BigTech Mobile Payment Adoption in the Netherlands: Performance over Trust?

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Acknowledgements

"Study hard what interests you the most, in the most undisciplined, irreverent, and original manner possible" -Richard P. Feynman

These last two years at the TU Delft have been particularly eye-opening. I realized that my interests extend beyond the puzzling realm of physics. I found that there are countless puzzles hidden in plain sight of which the solution space consists not only of theoretical solutions, but practical strategic solutions as well. I have become infatuated with the all-encompassing game of chess played by corporations and governmental authorities alike, and I believe that I have found my career path in the study and practice of becoming a better player. As such, being able to write my thesis about even the smallest of skirmishes of such revered players as the BigTechs has been an extraordinary journey.

That said, not a single letter of this report would have come into existence if it hadn't been for my dear graduation committee. I am exceedingly grateful that they gave me the chance to dive into this particular topic. Especially since, after weeks of considering various alternatives, I had concluded that no other topic would be able to continuously hold my interest and attention to the point where I could burn through the literature driven mainly by curiosity instead of sheer performance pressure. As such, I want to thank Zenlin for her resourcefulness and her dedication to helping me research the topic of my choosing, I want to thank Victor whose incisive questions offered additional perspectives whenever I had unknowingly gotten stuck on just my own, and I want to thank Aleksandrina for her seemingly endless patience with me and her unwavering resilience in helping me set realistic and achievable goals for this thesis.

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I hereby finally present my master's thesis. May you gain something from reading it.

Sincerely yours,

Levi Pieter
Rotterdam, December 2022

Executive Summary

The broad goal of this thesis is to explore what is currently motivating consumers to adopt BigTech mobile payment services in the Netherlands. The term BigTech refers to a collection of the largest and most dominant companies in the IT industry, including Google, Apple, Meta, and Amazon, among others. The BigTechs have been leveraging their core competencies in order to enter the financial industry by offering contactless mobile payment services, such as Apple Pay and Google Pay. Further involvement of BigTechs in the financial industry could lead to increased systemic risk, as well as power concentration risks due to their already large influential market power. The Dutch central bank (DNB) and the Dutch competitive authority (ACM) have released reports in which they acknowledge these risks. They state that the competitive balance between BigTech and the financial incumbents will moreover depend on the relative distrust the consumer currently has towards the BigTechs as provider of financial services compared to incumbent financial institutions. Both authorities indicate that the direction which this competitive balance is taking remains unclear, yet the adoption of contactless mobile payment services in the Netherlands, the majority of which is provided by BigTechs Apple and Google, has seen increasing growth. Therefore, this thesis aims to evaluate whether this distrust still wields this influential balancing power in the Netherlands, or if there are other motives that are more strongly influencing this trend instead. Consequently, the main question that guides this thesis is:

What are the strongest motives for consumers' adoption of BigTech mobile payment services in the Netherlands?

Reviewing the relevant past literature found moderating and mediating effects between constructs examined in mobile payment studies to often be excluded from analysis. As a result, this thesis also aims to address this research gap. A suitable starting research framework was selected after reviewing eleven prominent research models and a conceptual model was designed based on these reviews. Data was subsequently collected using an online survey questionnaire. The 217 collected responses were subjected to data analysis of which the results indicate that the Dutch consumer is mainly driven by three functional motives regarding respectively: how well the technology is expected to perform, how well the technology is perceivably supported, and to which extent the consumer has habits that are similar to using mobile payment services.

Perceptions of involved risk and feelings of distrust towards providers of mobile payment services only reduced the incentive to adopt the technology among respondents within the age group of 25-34, and solely weakened the performance-based motive. It was furthermore found that the habit-based motive reduced both risk perception and distrust of the users. No motivational differences were found between users of BigTech services or those offered by financial incumbents, or between users and non-users.

The Dutch relevant authorities and central bank may induce from this research that the competitive balance in the Dutch financial sector is likely tipping in favour of BigTech as consumers are driven mainly by utilitarian needs to which BigTech can more easily cater than financial incumbents. Dutch financial incumbents may therefore require additional support to reduce the potential for harmful levels of competitive pressure in the financial sector and limit the sector's exposure to concentration risk, which the involvement of BigTech can bring about.

Dutch financial incumbents may induce from this research that the contemporary Dutch consumer mainly prefers improved functional capabilities. According to the results, performance, wide-spread support, and fit with consumers' existing habits, should serve as key focus areas for improvement in order to compete efficiently.

The theoretical contribution that this research made regards the discovered mediating and moderating effects of the evaluated constructs in mobile payment adoption research. The obtained results thereby implore future research in this field to similarly evaluate such effects in order to increase the explanatory power of the employed research model and potentially derive additional and crucial insights.

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1. Introduction

The coronavirus pandemic has increased the rates of both digitalisation and digitisation across the globe (Amankwah-Amoah et al., 2021). To decrease the speed at which the virus spread in the Netherlands the Dutch government recommended that its citizens switch to contactless payment methods. Both developments can be represented by mobile payment services. These are services which allow consumers to make contactless Near-Field Communication (NFC) payments solely using their smartphone or a wearable. The most popular examples of mobile payment services are Apple Pay and Google Pay. This is because the market for mobile operating systems is dominated almost exclusively by Apple Inc. and Alphabet Inc., Google's holding company (Statista, 2022). These companies are referred to as 'BigTechs' due to their status as some of the largest and most dominant companies in the information technology (IT) industry.

The prospect of increased involvement of BigTechs in the financial system in general has been a topic of controversy and concern as the ensuing increased competitive pressure on financial incumbents could increase systemic risk (Abidi & Miquel-flores, 2022; Bains et al., 2022; Beck et al., 2022; Gorjón, 2021; Zamil & Lawson, 2022). Furthermore, BigTechs already wield a considerable amount of market power and allowing them further expansion may lead to concentration risks (AFM, 2022; ESA, 2022). Therefore, it is important that developments in BigTech activity in the financial industry are closely monitored. As BigTechs are often found to use the payments market as beachhead for their expansion into the financial industry (BIS, 2019), studying how BigTech payment services are received by consumers and what drives or deters them from adopting or using them may lead to valuable insights regarding their stance on BigTechs' financial involvement.

The evaluation of the motives behind mobile payment adoption in a specific country has been carried out by scholars all over the world, however only a few have focussed on European countries (Abdullah & Naved Khan, 2021). Due to recent developments, the Netherlands has become a particularly interesting case to study (BigTech) mobile payment adoption. Likely partially driven by the aforementioned advice of the Dutch government, contactless mobile payments have recently seen an impressive uptake from only making up 13.5% of all non-cash payments in 2020, to constituting 34% of such payments in September 2022 (Dutch Payments Association, 2022). Moreover, the Dutch central bank (DNB, 2021a) and the Dutch competitive authority (ACM, 2020) have both released reports admitting the substantial risks involved with increasing BigTech activity in the Dutch financial sector. Both claim the future of the Dutch financial sector to be strongly dependent on the degree to which the Dutch financial consumers distrust BigTechs relative to Dutch financial incumbents, as is currently the case. The singular published study evaluating the preferences of the Dutch consumers regarding mobile payment services found trust and safety to indeed constitute influential factors, next to perceived usefulness and perceived ease-of-use (Hasan et al., 2021). However, a more recent study by researchers Fu and Mishra (2022) involving a globally representative sample found that the more trustworthy traditional incumbents and their digital services saw an initially large update but were eventually outperformed by more innovative companies such as the BigTechs as the coronavirus pandemic lingered on. According to them this may be indicative of a shift in consumer preferences away from trustworthy providers if that leads towards innovative providers instead.

This thesis thus first attempts to evaluate the contemporary preferences of the consumers in the Netherlands regarding mobile payment services in order to then examine whether this crucial shift in preferences in favour of BigTechs may already be taking place. The results will aim to serve as indicators to inspire further research and consideration by the DNB, the ACM, and the Dutch financial incumbents, so that they may respond accordingly in light of the risks that may accompany an increased involvement of BigTechs in the financial sector. The research question that is formulated to this effect is as follows:

RQ: What are the strongest motives for consumers' adoption of BigTech mobile payment services in the Netherlands?

In order to answer this research question, two sub-questions must be answered:

SQ1: Which motives for adopting mobile payment services are prevalent in the Netherlands?

SQ2: Do the motivations of BigTech consumers differ from incumbents' consumers?

These questions are to be answered by conducting an online survey questionnaire among inhabitants of the Netherlands that have a Dutch bank account. This approach was chosen as it allows for relatively rapid data collection unhindered by geographical distance and combined with exclusively closed-ended categorical items it allowed for complete anonymity and an instant quantification of the responses. It is important that the responses are quantified because the statistical analyses that can verify potential relationships of causality and correlation within the data of a large sample require quantitative data. As such, it is the most used approach in mobile payment studies where the focus lies on understanding the aggregate rather than the individual, as is the case with this thesis (Abdullah & Naved Khan, 2021). To this effect, qualitative and/or longitudinal data collection methods, such as interviews or panel studies, were moreover discarded to prioritize the limited allocated time to increasing the sample size.

The items of the survey were based on the constructs that composed a research model inspired through reviewing past literature on technology adoption models. The survey furthermore contained demographic items to identify the respondents' age group, whether they were already using mobile payment services or not, and whether their mobile payments were (or could be) provided by either a BigTech or a financial incumbent. The complete list of survey items can be found in Appendix C. The survey furthermore contained short pre-written passages aimed at explaining the terminology used in the survey and helping respondents identify their mobile payment service provider so that each respondent was sufficiently informed before starting the survey.

This thesis also aims to contribute to the academic literature regarding mobile payment adoption studies. A literature review on this topic was carried out which discovered that existing technology adoption frameworks are often extended to include additional constructs. Most commonly are extensions aimed at including a measure of trust and perceived risk. However, the frameworks are rarely extended to include additional mediating or moderating effects between the constructs. Included moderating effects are hereby almost exclusively limited to demographic control variables such as age or gender. Nonetheless, the existence of several mediating and/or moderating relationships could be logically substantiated in this research. Therefore, this thesis contributes to existing literature by extending the research framework it uses with new mediating and moderating relationships and verifying whether such extensions can also offer additional valuable insights in mobile payment studies, similarly to the more common extensions based on the inclusion of additional constructs.

Hypotheses were subsequently formed regarding the constructs and their influence on the adoption of mobile payment services, as well as any moderating and mediating effects that could be logically substantiated or were inspired by the literature review. As such, the research takes on an exploratory form, testing many new proposed interactions as well as altering existing constructs to better fit the research setting. The emergent research model was then subjected to Partial Least Squares Structural Equation Modelling (PLS-SEM) in order to verify the hypotheses and extract the path coefficients which are indicative of the relative importance of the constructs. Multigroup analyses was carried out to discover the difference between groups that vary in age and the difference between groups that have different mobile payment service providers.

This thesis report is built up in the following manner. The chapter immediately following the introduction, chapter two, further explains the setting of this research and its motivation. Chapter three regards the theoretical background containing a literature review on past mobile payment adoption studies and a comprehensive review of some of the most notable technology adoption models. The literature review demonstrates the research gap that this thesis aims to contribute to. The comprehensive review serves to explain the reasoning behind this thesis' choice of research model by assessing the

suitability of each of the included research models for this particular study. The fourth chapter subsequently contains the hypothesis development and displays the resulting conceptual research model. Chapter five describes the research methodology employed after which chapter six lists the results from this thesis. These results are further discussed in chapter seven, including the practical and theoretical implications from this thesis' results. The final conclusions are drawn in chapter eight after which comes the list of references and table of legislation. Finally, the appendices respectively contain an explanation of the business models of Apple Pay and Google Pay, a list of the query settings used for the literature review in chapter three, an overview of the items included in the questionnaire, and a summarized overview of the models and the corresponding considerations from the comprehensive review of chapter three.

2. Research Setting

The following sections serve to explain the relevance of the research setting. It describes the uniquely sensitive character of the financial industry when it comes to innovation, explains why BigTech pose an additional risk, highlights the important role played by the payments industry, and lastly describes why the Netherlands is a particularly interesting setting for this research.

2.1. The Unique Sensitivity of Financial Innovation

Whilst innovation tends to positively influence society in the long run, new innovations tend to be accompanied by an increase in competitive pressure in the respective industry. Some competition is desirable as it allows consumers to exert influence on the market and obtain increased benefits as companies continuously aim to better suit their needs. However, when a new innovation is so innovative that it can displace the incumbent market leaders it becomes known as a 'disruptive innovation'. Once more, this effect is not in and of itself a negative phenomenon. The innovative power struggle between companies of all kinds and in all industries cause some companies to grow and others to shrink. A few new companies enter the market, and some older companies depart it. The average consumer is largely left unscathed by this cycle as consumers are generally serviced by a diverse and individual mixture of companies.

However, all of these companies and their consumers are embedded in the vastly interconnected web of the financial system operated by the incumbents of the financial industry, such as large banks. Whereas a competitive shock incurred by the local convenience store will only extend to its direct customers, competitive shocks incurred in the financial industry are capable of traversing the entire network potentially affecting millions of people. As a result of this potential for widespread risks, competition in the financial industry must be handled with great care and responsibility. This is furthermore because increased competition may reduce the profitability of incumbents which may respond by taking excessive risks in order to counteract that effect (OECD, 2020). Finding the appropriate ad-hoc regulatory response is difficult. Toughening the prudential regulations enforced upon banks to prevent this will raise incentives to bypass regulation and increase unregulated nonbank financial activity (so-called *Shadow Banking*) which then raises systemic economic risk as the checks and balances that keep risk at bay are circumvented (OECD, 2020). Relaxing the prudential regulations and allowing additional risk-taking instead would be synonymous with raising systemic risk directly.

2.2. FinTech and BigTech

The rise of FinTech[1] in 2015 was accordingly met with a risk-averse suspicion (Romanova & Kudinska, 2016). The Renewed Payment Service Directive 2 (PSD2, Directive (EU) 2015/2366) allowed customers to share their financial data with third parties which dented the financial data monopoly large banks previously had. Although large banks did enjoy a far greater existing customer base and had access to much larger amounts of funding compared to the smaller FinTech companies, their striking disadvantage in innovative power became a cause for concern. Fortunately, these differences allowed for a mutually beneficial synergy (Bömer & Maxin, 2018; Harasim, 2021). FinTech start-ups could potentially gain a large and stable investor with a large customer base, and the financial incumbents in turn could outsource innovation to the more flexible and tech savvy FinTech. Moreover, due to their relatively small size, the Financial Stability Board (FSB, 2019b) eventually ruled the risk of FinTech companies exerting enough competitive pressure to negatively influence financial stability was eventually considered to be small.

BigTechs are a different story entirely. BigTechs share the same competitive advantages of FinTech companies over the financial incumbents, but do not suffer any of the traditional FinTech companies'

[1]FinTech is defined by the Financial Stability Board (FSB) (2019, p. 1) as "technology-enabled innovation in financial services that could result in new business models, applications, processes or products with an associated material effect on the provision of financial services"

disadvantages (FSB, 2019a). On the contrary, BigTechs already have global customer bases and their higher credit rating allow them to secure funds cheaper than some of the largest global banks (FSB, 2019a). Their potential for disruption should they decide to fully enter the financial industry has accordingly caused concern among many international bodies including the FSB, the European Banking Authority (EBA), the Bank for International Settlements (BIS), and the European Supervisory Authority (ESA) (BIS, 2019; Crisanto, Ehrentraud, & Fabian, 2021; EBA, 2019; ESA, 2022; FSB, 2022).

2.3. Payments: BigTechs' Entry Point

Well-versed in handling large volumes of transactional data as part of their core business, BigTechs are perfectly positioned to enter the payments industry and have been doing so to gain a foothold in the financial industry (BIS, 2019). Apple and Google most notably respectively launched their Apple Pay and Google Pay which have been growing in popularity. In august 2022, these forms of payment were found to account for almost 20% of Visa's point-of-sale transactions in the United States where 90% of the retailers already accept Apple Pay (Cohen, 2022). As the BigTechs are therefore actively working on their growth in payments, it is an interesting industry to study in order to learn more about how BigTechs can leverage their strengths in the financial industry and how consumers and financial incumbents react to their developments.

Payments play a vital role for banks. Although they only make up a portion of total banking activity, they contribute to the financing of the banks through their provision of customer interaction, customer data, and brand awareness (ACM, 2020). Dilution of these provisions by outsourcing them to BigTechs therefore not only hurts the incumbents' financing, but also supplies a potential competitor with their lost benefits. Moreover, since BigTechs don't charge the banks' customers for the usage of their services, the incumbents even end up paying the bill for the additional service such as is the case with Apple Pay. A more detailed explanation on the business models of Google Pay and Apple Pay, two of the largest BigTech mobile payment services, can be found in Appendix A.

2.4. The Netherlands

During the coronavirus pandemic the Dutch government implored its citizens to switch to contactless payments. The Dutch central bank (DNB) has stated that it expects this change of habit to stay (DNB, 2022). Accordingly, contactless mobile payments have seen rapid growth the last two years. In 2020 contactless mobile payments comprised 13.5% of all non-cash payments in the Netherlands, this number grew to 20% in 2021 and by September 2022 this number had grown to a staggering 34% according to the Dutch Payments Association (2022). To understand the significance of this growth in terms of BigTech developments in mobile payments it is important to know who the incumbents in the Dutch financial system are and which ones provide mobile payment services.

In the Netherlands, 'the Big Three', consisting of ING, Rabobank, and ABN-AMRO, together hold 82% of the market share in the Dutch banking industry with the smallest of the three, ABN AMRO, still being roughly four times the size of the fourth largest retail bank, the Volksbank (Banken.nl, 2022). Each of these three banks offer mobile payment services to their customers, however ING is the only one that offers a *proprietary* mobile payment service, and it does so only to customers that own a mobile phone that runs on the Android operating system. At any of the other banks, Android users have to use Google Pay. Additionally, all Apple users have to resort to Apple Pay for mobile payment services regardless of which bank they are a customer at. If we combine this with the fact that Android and iOS (Apple's operating system) together hold 99.5% of the mobile operating system market share in the Netherlands, we can roughly state that five out of every six contactless mobile payment transactions carried out by customers of the Big Three are actually BigTech mobile payments (statcounter, 2022). This means that the growth in contactless mobile payment usage in the Netherlands from 13.5% of all non-cash payments in 2020 to 34% in 2022 almost directly translates to a growth in BigTech mobile payments (Dutch Payments Association, 2022). In short, the BigTechs are winning territory in the Netherlands.

Another perhaps more direct indication of the BigTechs' success in the Netherlands are the way some banks have reacted to the coming of BigTech mobile payment services. Notably, two of the Big Three, Rabobank and ABN-AMRO, used to have their own proprietary mobile payment services, but decided to discontinue them and instead replace them with Google Pay for Android users, and Apple Pay for Apple users (ACM, 2020; Rabobank, 2022).

These developments have not gone unnoticed by the Dutch central bank (DNB) or the Dutch competitive authority (ACM). Both have published a report explicitly discussing these topics which each conclude that the competitive balance in the Dutch financial system is dependent on consumer trust and BigTechs' strategy, but that the direction in which the balance is headed remains unclear (ACM, 2020; DNB, 2021a). The fact that BigTechs' strategy is by itself a determinant of the competitive balance already to some degree indicates that BigTechs are in control of the situation. Nevertheless, according to both reports, consumer trust is also a strong influential factor which lies outside of the control of the BigTechs. In essence, if consumers continue to relatively distrust the BigTechs compared to the banks as they are currently doing according to the report by the DNB (2021a), then the banks may be able to retain their position as primary point of contact for the customers. If the reverse holds true, then the banks will fall to the background and instead serve to provide the services and infrastructure necessary for the BigTechs to conduct their contact with the customers as well as bear the risks of some of these financial services (ACM, 2020).

However, underlying these predictions lies the assumption that the contemporary Dutch consumer is effectively deterred from BigTechs' financial services due to their distrust in them. If so, then what is mainly driving the aforementioned uptake in BigTech mobile payment services in the Netherlands? And is this growth at all inhibited by a distrust towards the BigTech providers? Researchers Fu and Mishra (2022) recently discovered that the digitalisation accelerated by the coronavirus pandemic has caused innovative capabilities to take precedence over perceived trustworthiness when it comes to financial applications. Therefore, it is crucial that the assumption that consumers' distrust plays an important role in the adoption or use of BigTech (mobile payment) services in the Netherlands is tested in order to provide clarity regarding the direction of the competitive balance in the Dutch financial system so that the Dutch regulators and financial incumbents may respond timely and accordingly. Additionally, evaluating the overall drivers for mobile payment adoption may allow for a more detailed characterisation of the Dutch financial customer and lead to valuable additional insights.

3. Literature Review

The following two sections each contain a literature review. The first section regards past mobile payment adoption studies. This review led to the discovery of the research gap that served as the focus of this thesis' theoretical contribution. The second section contains a review of eleven technology adoption models that were considered and serves to explain why some models were deemed less suitable than others for this research.

3.1. Research on the adoption of mobile payment services

In this study, the term 'mobile payment service' refers to a service that enables point-of-sale contactless Near-Field Communication (NFC) payments using a mobile phone or a wearable technology. This definition thereby excludes mobile payment service technologies that primarily operate on a peer-to-peer basis or utilize QR codes, owing to the fact that the BigTech mobile payment services active in the Netherlands do not support such use. Scopus was used to source the necessary literature, employing the keywords ("mobile payment" OR "m-payment") AND ("use" OR "acceptance" OR "adoption" OR "intention") AND ("nfc" OR "near-field communication" OR "near field communication"). As Google Wallet, the first version of the technology as described, was launched in September 2011, search results were filtered to only include sources published in or after 2011 (Forbes, 2011). Subsequently, multiple additional filters were applied resulting in a total of 135 results of which 51 were accessible. The complete list of settings and filters applied to the search query in Scopus can be found in Appendix B.

Understanding what motivates or discourages the adoption of mobile payment services has been the topic of multiple studies carried out all over the world with most studies originating in Asia (Abdullah & Naved Khan, 2021; Liu et al., 2019). The relevance of repeating similar studies in different countries lies in the differences in results that arise due to country-bound factors such as culture and regulations that can have a moderating effect on the adoption factors (Chung & Holdsworth, 2012; Liu et al., 2019; Shaw et al., 2022). For example, the South Korean study conducted by Lee et al. (2019) found Social Influence to be a particularly strong motive for the adoption of mobile payment systems, however a similar study carried out in India by Gupta and Arora (2020) found it to be a rather weak predictor instead. This demonstrates the relevance of studying the adoption motives locally and merits a case-by-case approach to research model design.

The methodology with which the adoption motives are studied varies relatively little between the reviewed studies. Scholars tend to design their research models based on the Technology Acceptance Model (TAM) or the Unified Theory of Acceptance and Use of Technology (UTAUT) discussed in section 3.2 and extend it with other factors they deem influential or of particular relevance to their research (Apanasevic et al., 2018; Chen et al., 2019; Hasan et al., 2021; Lew et al., 2020; Phan et al., 2020). Other studies design a proprietary model basing the selection of constructs on past technology adoption research and employ SEM to verify the hypothesized relationships (Abdullah & Naved Khan, 2021; Ramos-de-Luna et al., 2016). Due to the popularity and proven effectiveness of the TAM and the UTAUT this often leads to several of their components becoming integrated in the research model besides the newly proposed extensions.

A recurrence discovered in the reviewed literature is the influential effect of extending existing research models to include a measure of consumer trust. Each of the reviewed studies that explicitly incorporated Trust in their research model has found it to be of significant influence (Gilitwala & Nag, 2020; Hasan et al., 2021; Jin & Lim, 2021; Leong et al., 2013; Lian & Li, 2021; Liébana-Cabanillas et al., 2021; Liu et al., 2019; Patil et al., 2020; Sembiring et al., 2022; Shao et al., 2019; Singh, 2020; Talwar et al., 2020). It is important to note that these studies were carried out in different countries which indicates trust to be a universal influential factor. This is in line with the results of the systematic literature review by Al-Saedi et al. (2019).

However, trust is mostly interpreted as the degree to which customers believe that the service providing company will be able to deliver the service or the reliability of the mobile payment system itself (Al-Saedi et al., 2020; Gilitwala & Nag, 2020; Liu et al., 2019; Sembiring et al., 2022). With BigTech involved there is bound to be a greater dimensionality to trust than the ability of providers to deliver their service and due to BigTech's large size and popularity this particular interpretation of trust is likely to produce positive scores when tested. After all, BigTech would not have attained their status if their services were substantially lacking. Lian and Li (2021) found trust to be composed of three validated dimensions: trust in mobile devices, trust in merchants, and trust in mobile payment service providers. What sets BigTech mobile payment services apart from those offered by incumbent financial institutions with respect to trust is bound to be the last dimension. The potential decisive impact this dimension can have when customers can choose between services offered by BigTech and those offered by incumbent financial institutions appears not to have been studied yet. Yet this dimension of trust is of vital importance when studying BigTech mobile payment service adoption in the Netherlands as the Dutch central bank and the Dutch competitive authority have both highlighted this form of trust to be a particular decisive factor in the competitive balance in the Dutch financial sector regarding BigTech vis-à-vis the Dutch financial incumbents (ACM, 2020; DNB, 2021a). Hasan et al. (2021) studied mobile payment adoption in the Netherlands and found trust to be influential, but the dimensionality of trust and the influence of BigTech were not accounted for. Although the reviewed literature does oftentimes mention BigTech mobile payment services in their research as examples, the implications of the involvement of BigTech is not examined.

Apart from trust, risk has also shown similar universal characteristics as influential extension of existing research models (Al-Qudah et al., 2022; Chen et al., 2019; Liébana-Cabanillas et al., 2020, 2021; Liu et al., 2019; Ramos-de-Luna et al., 2016; Schmidthuber et al., 2020). However, its influence seems slightly more susceptible to variance. Abegao Neto and Figueiredo (2022) found Brazilian customers to be less influenced by Perceived Risk and Jung et al. (2020) could similarly not support its impact when studying U.S. customers. Jung et al. thereby notably suggest trust to possibly influence the relationship between risk and the intention to use mobile payment systems. As the bibliometric analysis by Abdullah and Naved Khan (2021) suggested that research regarding the moderating effects affecting mobile payment adoption is scarce, studying effects such as the proposed relationship between trust and risk could further add to the academic literature.

All-in-all, it is relevant to evaluate the motives driving mobile payment adoption on a local basis as results between countries vary. As such, only a single study was found to study mobile payment adoption in the Netherlands. Furthermore, there appears to be a research gap regarding the influence of moderating effects caused by the studied independent variables on the relationships between the other independent variables and the adoption of mobile payments. Lastly, no literature was found which addresses the consumers' motives from a perspective that highlights the role of the different providers of mobile payments, the crucial importance of which was discussed in chapter three.

This thesis therefore aims to contribute to the existing theory by evaluating any potential moderating and mediating effects that the constructs may have on each other. Doing so in the Netherlands with a model constructed with the influences of BigTech in mind will serve as subsidiary addition to the literature due to the difference in results between studies conducted in different countries and the contemporary relevance of the competition between BigTech providers and traditional incumbents in the financial industry.

3.2. Research Models for the Adoption of Technology

It is important that the characteristics of new technologies that motivate their adoption are encapsulated by a set of representative and testable constructs. However, the activity of defining which constructs can be considered relevant is highly prone to subjectivity, which is why several adoption models were created to offer a framework for new research. The following subsections review some of the most prominent technology adoption models including the TAM and the UTAUT which are often used in mobile payment adoption studies (Leong et al., 2013; Liu et al., 2019).

Each model was examined with respect to their applicability for studying the factors that stimulate the adoption of BigTech mobile payment services in the Netherlands. The ideal model is exhaustive yet parsimonious, comprises readily operationalizable constructs, and provides actionable insights regarding the influence of adjustable aspects of the technology. These constraints are based on the objective of this thesis to understand consumer preferences to a degree that describes needs that could be catered to by BigTechs or financial incumbents in order to uncover insights regarding their competition. Appendix D contains a table summarizing the key characteristics, advantages, and disadvantages of the models addressed in this review. In the end, the UTAUT2 model was considered most suitable due to its unmatched explanatory power, relatively exhaustive set of readily operationalizable constructs, and proven general applicability.

3.2.1. The Theory of Reasoned Action (TRA)

The Theory of Reasoned Action (TRA) is one of the oldest theories used to predict the adoption of technology. Originally proposed by Fishbein and Ajzen (1975), the TRA dictates that an individuals' behaviour can be predicted by evaluating the individual's 'behavioural intention' to perform the specified behaviour. This behavioural intention is in turn determined by the constructs of Attitude and Subjective Norm. Attitude operationalizes the inside-out judgement individuals pass onto the behaviour itself and others displaying the behaviour. Subjective Norm in turn operationalizes the outside-in judgement that the individual in question believes others will pass onto them when displaying the specified behaviour. A schematic of the TRA can be seen in Figure 1.

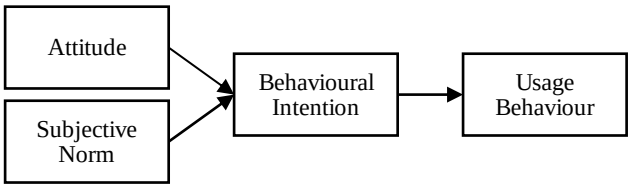

Figure 1: A schematic of the Theory of Reasoned Action (TRA) model by Fishbein and Ajzen (1975).

The TRA served as the inspiration for many other adoption models, including the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (A. Khan & Qudrat-Ullah, 2021; Venkatesh et al., 2003). Nevertheless, the TRA itself is unfit for this study regarding the motives influencing mobile payment adoption in the Netherlands. This is mainly because of two specific limitations. Firstly, the model is a tad too slender. The model does not examine what the underlying causes of a specific attitude or subjective norm are. Although these underlying causes may not be relevant for the prediction of technology adoption in the future, this paper requires a more in-depth approach as it aims to understand the current trend of mobile payment adoption in the Netherlands more deeply than an aggregate measure of attitude towards technology adoption can provide. Secondly, in order to derive actionable insights, it is important that the research model also includes constructs more closely related to the technology besides the psychosocial constructs that the TRA provides. To give an example, say there exists a negative influence due to a subjective norm. It may fully explain an individual's choice not to adopt modern technology, but due to its broad definition it will be difficult to pinpoint what exactly constitutes this subjective norm and how this is reflective of consumer preferences in order to keep track of the market trends.

3.2.2. The Theory of Planned Behaviour (TPB) Model

The Theory of Planned Behaviour (TPB) was created by Ajzen (1991) as an extension of the TRA model and is depicted in Figure 2.

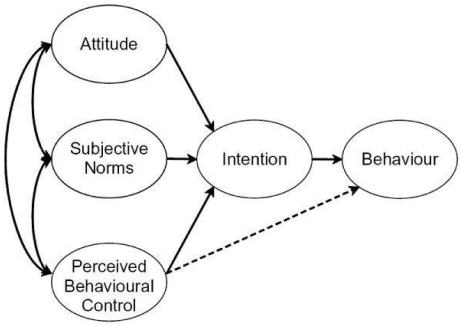

Figure 2: The Theory of Planned Behaviour Model by Icek Ajzen (1991, p. 182)

The TPB's added construct of Perceived Behavioural Control particularly addresses the limitation of the TRA when it comes to situations where individuals may be limited in their 'behavioural control', defined as "if the person can decide at will to perform or not perform the behavior" (Ajzen, 1991, p. 182). The construct is meant to catch any non-motivational barriers preventing the behaviour, such as required skills or money. Whilst this extension constitutes a more insightful model for the study of mobile payment adoption motives in the Netherlands when compared to the TRA, it is still too general to be readily applicable for this study. Behavioural control can be influenced by a tremendous number of factors of varying kinds. Researching which of these factors influence Perceived Behavioural Control in order to operationalize the construct in light of the adoption of BigTech mobile payment services in the Netherlands would likely justify an entire qualitative study on its own, as would operationalizing the remaining TPB constructs. Following the same line of reasoning as was applied to the TRA's applicability for this study, the TPB is considered too broad to uncover the various motives for BigTech mobile payment adoption in the Netherlands.

3.2.3. The Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), created in 1989 by Fred Davis, is a popular model used in numerous academic papers to investigate technology adoption. Closely related to the TRA, the TAM suggests that the adoption of a technology by individuals is subject to two main determinants but has traded Attitude and Subjective Norm for *perceived usefulness* and *perceived ease of use.* These two determinants influence the intention to use a technology, which ultimately provokes actual usage behaviour (Davis, 1989). As such, a 2021 study regarding user trust levels and the adoption of mobile payment systems in China used the TAM in order to delineate which factors most encouraged customers to use mobile payment platforms (Sleiman et al., 2021). Figure 3 shows a schematic interpretation of the original TAM model as interpreted by Alwahaishi & Snasel (2013).

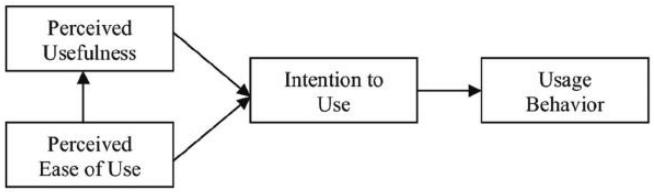

Figure 3: Schematic interpretation of Davis' original TAM model (Alwahaishi & Snasel, 2013).

The TAM's two determinant system is often criticised for its over-simplicity (A. Khan & Qudrat-Ullah, 2021; Malatji et al., 2020). Although studies have demonstrated its ability to explain a decent proportion (roughly 40%) of the variance in Intention to Use and Usage Behaviour, the simplicity of the model makes it less suited for studies that are interested in examining a more exhaustive list of factors that influence the adoption of technology (Venkatesh & Davis, 2000). This is why the original TAM is less suitable for studying the motives for BigTech mobile payment adoption in the Netherlands.

3.2.4. The extended TAM (TAM2)

The TAM was extended by Venkatesh and Davis (2000) to understand the determinants behind Perceived Usefulness in such a way that organizational interventions may be designed to boost acceptance and usage of new systems. This extended version is known as the TAM2 and is displayed in Figure 4.

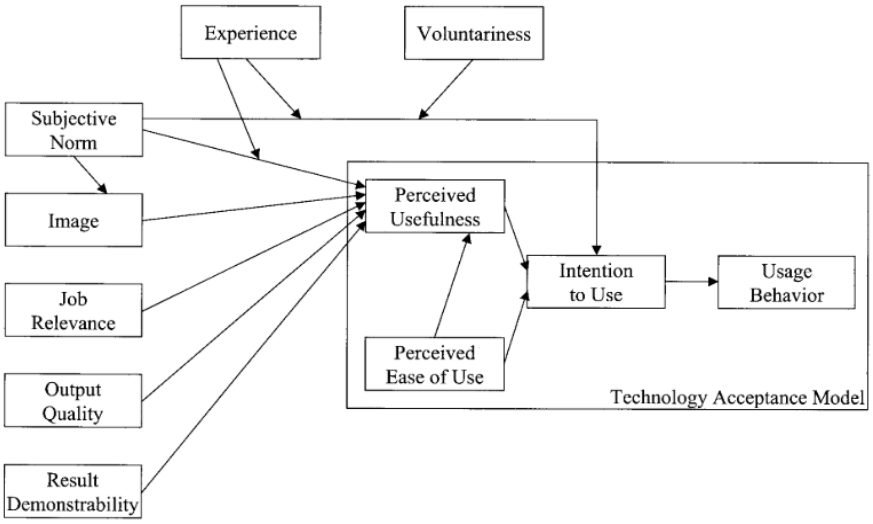

Figure 4: The TAM2 as designed by Venkatesh & Davis (2000)

The extensions of the TAM2 can be grouped into two sets of constructs: Social Influence processes (Subjective Norm, Voluntariness, and Image) and Cognitive Instrumental processes (job relevance, Output Quality, and Result Demonstrability). In a set of four longitudinal field studies discussed in the paper by Venkatesh and Davis (2000), the TAM2 demonstrated to be a useful extension of the original TAM as it was able to explain up to 60% of the variance in the construct of Perceived Usefulness. The extension introduced a social aspect to the TAM which makes the model more inclusive.

However, the added constructs have a clear intraorganizational focus. The factor of Job Relevance is not generalizable to technology adoption outside of organizations, including the personal adoption of mobile payment services, and what defines quality in the factor of *Output Quality* is less straightforward outside of the work environment. In the case of mobile payment services, "quality" can have multiple subjective interpretations depending on personal preference. Some may regard a high transaction speed to be the main indicator of the quality of a mobile payment service, others may define a high-quality mobile payment service to be the one which is most secure.

Lastly, Subjective Norm is still too broadly defined to be of use for this mobile payment adoption study. Carrying the original meaning from the TRA, a key inspiration for the development of the TAM, Subjective Norm is to be interpreted as "a person's perception that most people who are important to him think he should or should not perform the behaviour in question" (Hill et al., 1977). Whilst the influence of the subjective norm is undoubtedly of relevance when predicting technology adoption, it may be more insightful to evaluate aspects of the technology that may have led to the existence of this subjective norm when also trying to understand technology adoption in contemporary form. For example, Unnikrishnan and Jagannathan (2018) discovered that trust is the most significant predictor of

mobile payment adoption in India when compared to other related variables such as Perceived Privacy Risk and Perceived Security Risk. Although all effects can be measured through the construct of Subjective Norm, knowing which aspects shaping the subjective norm carry the most weight will allow a technology developer to undertake more accurate measures to improve. Moreover, due to the high involvement of BigTech in the provision of mobile payment services in the Netherlands and existing controversy regarding BigTechs, privacy and trust, this study requires a more composite approach to Subjective Norm than the TAM2 provides.

3.2.5. The extended TAM2 (TAM3)

The final extension of the TAM, the TAM3, was developed by Venkatesh and Bala (2008) and extends the TAM2 by also exploring the determinants of Perceived Ease of Use. The TAM3 is depicted in Figure 5.

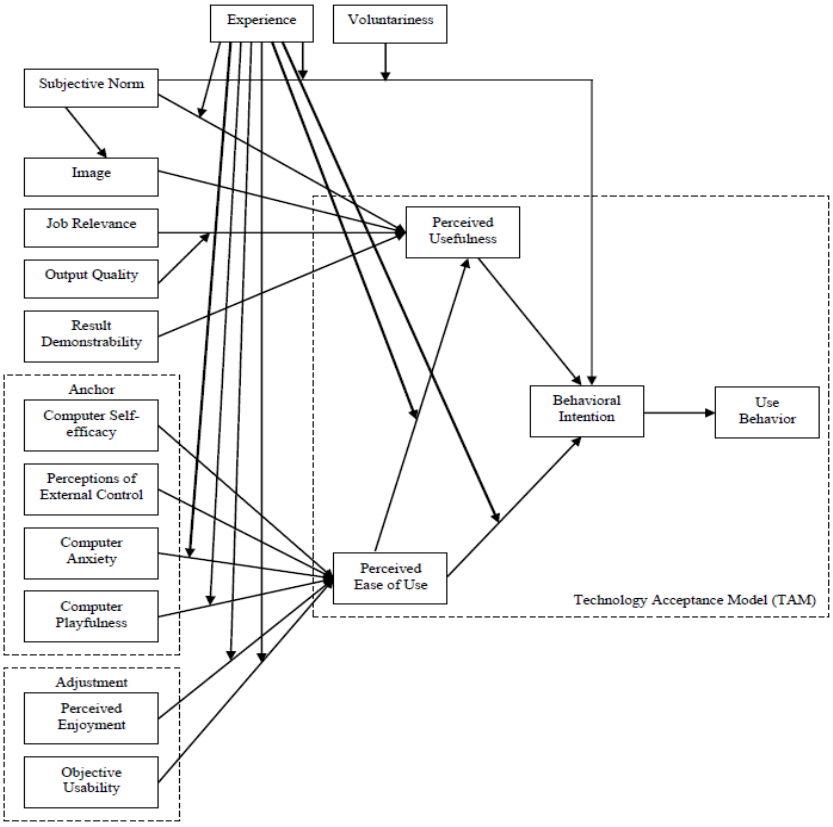

Figure 5: The Technology Acceptance Model 3 (TAM3) (Venkatesh & Bala, 2008, p.10)

Unfortunately, the extensions of the TAM3 do not resolve the issues of the TAM2 when applied to a nationwide study of the adoption of BigTech mobile payment services. In fact, its increased focus on individual endogenous influential constructs makes the TAM3 less parsimonious and less applicable to this study, as these constructs are rather to be controlled for when studying a diverse and large population instead of leading to actionable insights. For example, a high level of Computer Anxiety within a company may spur management to supply employees with extra computer training, but it cannot be expected that a company will start supplying an entire nation with computer training solely to increase the adoption of an auxiliary service, such as mobile payments, when it discovers high Computer Anxiety to be a nationwide problem.

To conclude, the TAM models' specific focus on the organizational setting and individual attributes renders them unfit for studying the specific contemporary motives for the adoption of BigTech mobile payment services in the Netherlands.

3.2.6. Model of PC Utilisation (MPCU)

Shortly after the TRA was proposed by Azjen and Fishbein in 1975, Triandis (1979) proposed an extension of the theory to include more influential factors. He specifically emphasized how human behaviour is furthermore influenced by habits, perceived consequences of the behaviour, and the presence of conditions that facilitate or hinder the behaviour. The resulting theory is known as the Theory of Interpersonal Behaviour and is depicted in Figure 6.

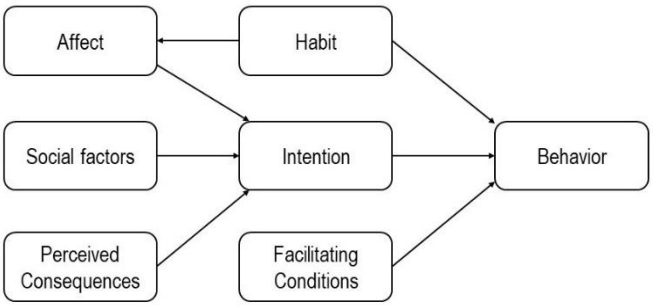

Figure 6: Theoretical model of the Theory of Interpersonal Behaviour by Triandis (1979)

In similar fashion to how the TAM was developed built upon the TRA, Thompson et al. (1991) used Triandis' TIB to create the Model of PC Utilisation (MPCU) in order to study and understand which factors influence the use of personal computers in a more inclusive manner than provided by Azjen's and Fishbein's TRA. The MPCU counts six core constructs each formulated with a focus on PC use. A more generic interpretation of the model where each construct is stripped of its direct reference to PC use is depicted in Figure 7.

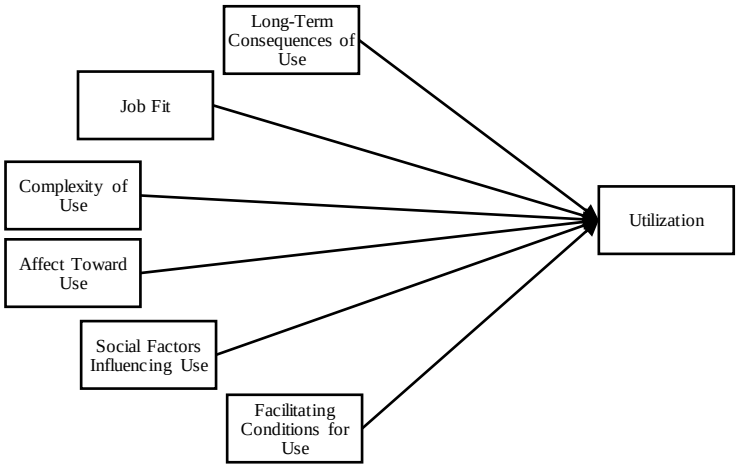

Figure 7: A generic interpretation of the Model of PC Utilization by Thompson et al. (1991)

In the MPCU, *Job Fit* is defined by Thompson (1991) as "the extent to which an individual believes that using a PC can enhance the performance of his or her job" (p. 129) and *Affect* as representative of "the feelings . . . associated by an individual with a particular act" (p. 127).

Regardless of its original focus on PC utilization, the model has shown to be suited for the prediction of the acceptance and use of technology in a variety of IT domains (A. Khan & Qudrat-Ullah, 2021; Venkatesh et al., 2003). Appearing more inclusive than the original TAM and more actionable than the TAM's extensions, the MPCU is a promising candidate for the study of BigTech mobile payment adoption in the Netherlands.

A few modifications would still be required to suit the needs of this study. Firstly, the construct of *Affect* would have to be dismantled. The feelings associated with an act that combine to form the Affect construct must stem from other associations made by the perceiving individual. Obtaining information about those specific associations is of greater value to this study as it may provide more actionable insights. To give an example, someone may associate a feeling of disgust with Apple Pay due to its association with Apple as a BigTech, which they don't trust due to recent investigations regarding anticompetitive practices (Crisanto, Ehrentraud, Lawson, et al., 2021). The cause of the influential feeling, distrust in this case, may tell Apple to improve its image with respect to trustworthiness, the knowledge pertaining to the existence of the influential feeling itself will still require additional research to determine the source before action can be undertaken. Secondly, the construct of *Long-Term Consequences* would also have to be modified and redefined to scope the various consequences people believe are associated with BigTech mobile payment usage, but more importantly, these beliefs would also have to be retraced to their roots in order to identify the various associations that BigTech mobile payments instigate. Both modifications appear to require a slightly more collectively exhaustive set of motives influencing the adoption of BigTech mobile payment services than the MPCU provides by itself. Finding these additional factors may require additional qualitative exploratory research before the model can be effectively used in this research, which is beyond the scope of this thesis.

3.2.7. The Diffusion of Innovations (DOI) Theory

Diffusion of Innovations (DOI) is a theory popularized by Everett Rogers in his book *Diffusion of Innovations* (1995) which aims to describe how and why innovations diffuse among people. When it comes to the adoption of new technologies, DOI postulates five driving factors (Rogers, 1995, pp. 240–251). The first factor regards *Relative Advantages* and pertains to the added benefits of using the new technology compared to the old. The second factor, *Complexity*, describes the difficulty in using or understanding the new technology. *Trialability* is a measure for how much interested parties are able to test the new technology before deciding whether to adopt it. The social aspect of adopting a new technology is captured in the factor of *Observability*, which relates to how visible the adoption and usage of the technology is to other people and considering potential judgement. Lastly, *Compatibility* regards the ease with which the adoption and usage of a new technology could be incorporated in personal existing habits. Figure 8 displays the DOI's adoption model.

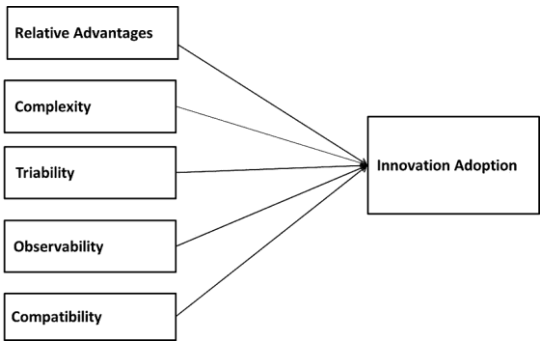

Figure 8: Depiction of the Diffusion of Innovation's adoption model

The first factor of *Relative Advantages* by itself can be expected to be highly influential, as when considering humans as efficient and rational actors they are expected to strive to obtain that which increases their personal interests. However, the construct of *Relative Advantages* is bound to within itself produce a list of attributes that vary in weight on an individual subjective basis. This would then require a deeper analysis to establish which of these advantageous attributes appears to be driving the adoption of the technology. As this study is mainly focussed on this last analysis, the precursory qualitative scoping of advantages required for the first analysis is largely synonymous with this study. This by itself complicates the proper implementation of the DOI for this study. The reason one cannot merely list the objective advantages of the innovation over its predecessor is because humans can be

expected to be influenced by their subjective idea of what constitutes an important improvement. Although instrumental rationality is in fact largely assumed in this thesis as well, such an objective interpretation would be counterproductive as it eliminates the subjective individual perception of a technology that this study is interested in. On the other hand, if interpreted on a purely subjective individual basis it could facilitate cross-correlations between the measured factors due to differences in interpretation and subjective valuation which is undesired in this particular study. An example would be if the increased observability of an innovation would be considered a relative advantage by an extraverted individual, whilst at the same time a relative disadvantage by an introverted individual. Lastly, the DOI factors of *Trialability* and *Observability* are not expected to add many insights as they do not significantly vary between mobile payment services. All-in-all, implementing the DOI in this study would require significant adaptations to the point where perhaps using a different framework would be more efficient.

3.2.8. The Social Cognitive Theory (SCT) Model

An influential theory that was adopted from social psychology to explain technology adoption in similar fashion as the TRA and the MPCU's TIB, is the Social Cognitive Theory (SCT) by Bandura (1986). The theory proposes a triadic relationship between individual factors, environmental factors, and behaviour. Figure 9 presents the SCT model.

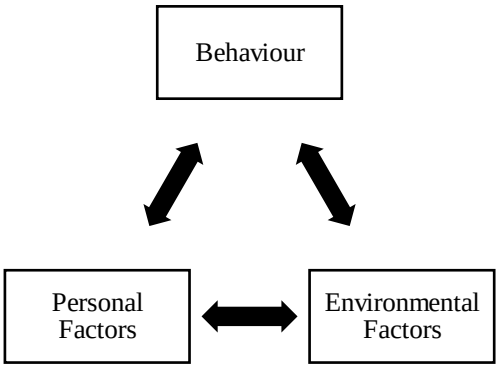

Figure 9: The model of Social Cognitive Theory

What sets the SCT apart from other models such as the TAM, TPB, and DOI, is that the relationships in SCT are all reciprocal. This approach therefore accounts for how individuals are not merely subject to the will of their environment, but actively interact with it and change it. The theory proved to be effective and valid in various fields of research and began helping researchers understand the adoption of IT systems in the 90s when Compeau and Higgins (1995) applied it to understand the behaviour and performance of individuals receiving computer training (K. D. Carillo, 2010). In a longitudinal follow-up study, Compeau and Higgins further found that specifically *self-efficacy*, referring to the individual beliefs regarding one's ability to enact specific behaviour, and *outcome expectations*, each influence technology adoption behaviour as prominent elements of SCT.

In his literature review, Carillo (2010) criticized how the subsequent focus on self-efficacy in SCT-grounded information systems use and adoption studies has prevented the theory from being used at its full potential. In response, he developed a meta-framework that more clearly and equally addresses its components. This meta-framework is depicted in Figure 10.

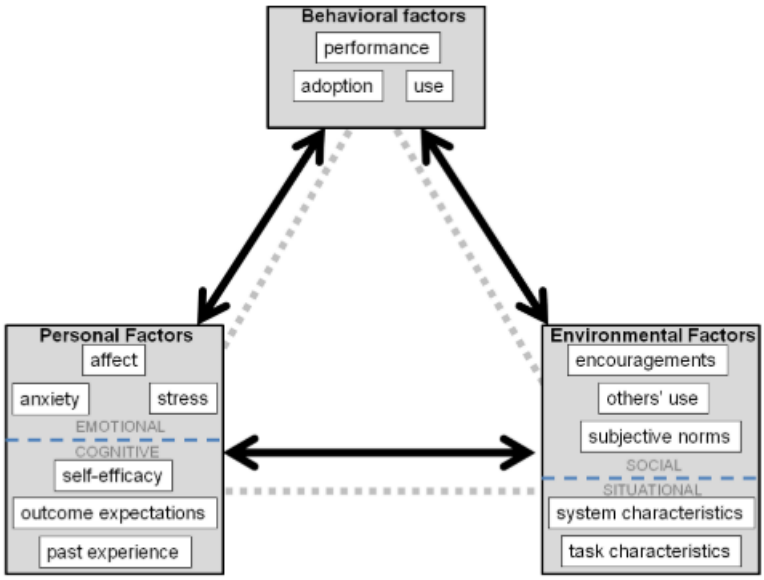

Figure 10: SCT meta-framework created by Carillo (2010, p. 10) to support information systems research

Whilst the meta-framework provides more detail regarding the factors that influence adoption and use of a technology compared to the original SCT model, not all its components are easily operationalized. The environmental factors of system and task characteristics are surely expected to influence the behavioural factors, but it is left to the researcher to discern which of these characteristics are most likely to do so. As this study on BigTech mobile payment adoption in the Netherlands is itself aimed at discovering these influential characteristics, the SCT is not well suited as research model to this end, even with the aid of the meta-framework.

An additional complication less specific to this particular study but inherent in the use of the SCT arises from the reciprocal relationships between the factors. As each individual factor influences the remaining factors, SCT in essence does not provide an isolated dependent variable that can be studied through unidirectional relationships such as is the case with the TAM for instance. The resulting model appears too dynamic to be properly applied in a cross-sectional study as the factors require periodic, if not constant, observation so that the effects of one changing factor on the remaining factors can be controlled and accounted for. Considering the cross-sectional nature of this study and the speed at which trending innovations such as mobile payment services diffuse, a justified application of the SCT model is deemed too time-intensive for the study of BigTech mobile payment adoption in the Netherlands.

Nevertheless, the SCT and its proven effectiveness in other studies does provide valuable insights regarding what constitutes an all-inclusive research model. As such, another study by Carillo (2012) applied SCT as a meta-level framework in which other technology adoption models can be mapped. Several models of the models discussed in this paper were also included in his analysis, such as the TAM and the TPB. The limitations of the TAM previously discussed become instantly evident when viewed through the lens that the SCT meta-level framework provides. This is because the TAM only addresses personal and behavioural factors but neglects the environmental influences posited by the SCT. Therefore, the SCT still finds its use as meta-level heuristic that can aid in the creation of a specific conceptual research model for this study. The heuristic being that the research model must take into

account all three factors posited by SCT in attempt to make the model more inclusive in its determination of influential motives driving the adoption of BigTech mobile payment services in the Netherlands.

3.2.9. The Unified Theory of Acceptance and Use of Technology (UTAUT)

The increasing abundance of theoretical models for technology adoption research led Venkatesh et al. (Venkatesh et al., 2003) to design a more integrated model comprised out of eight commonly used technology adoption models (including the TAM, TAM2, TRA, TPB, SCT, MPCU, and DOI) in order to combine their strengths, and called it the *Unified Theory of Acceptance and Use of Technology* (UTAUT). The crucial added value of employing the UTAUT instead of its comprising components lies in its integration of the other models which results in a more well-rounded model that has shown to be able to account for 70 percent of the variance of the dependent variable, the Behavioural Intention to use the technology. This is a substantial improvement over the highest scoring individual model, an upgraded version of the TAM, which was able to explain 53 percent of the variance (Venkatesh et al., 2003). Another important feature of the UTAUT models is the broad set of general constructs. Although this does increase the complexity of a research model, the incorporation of both social-psychological factors as well as more direct factors related to perceived performance allows researchers to pinpoint how a technology is being perceived by the public and which aspects of the technology drive them to adopt or reject it. Lastly, this same focus on the perception of the technology rather than the individual endogenous factors that may bring about this perception allows for more actionable advice to be deduced from the UTAUT models' results. This is because the perception of the technology is bound to be easier for the technology's developers to influence compared to individual endogenous factors such as the Computer Anxiety factor from the TAM3.

The largely independent constructs that the UTAUT model considers are: *Facilitating Conditions (FC)*, *Performance Expectancy (PE)*, *Effort Expectancy (EE)*, and *Social Influence (SI)*, and furthermore considers the moderating effects of the constructs of *Gender*, *Age*, *Experience* and *Voluntariness of use* (Venkatesh et al., 2003). These constructs in turn influence the construct of *Behavioural Intention (BI)*, which serves as a predictor of actual adoption and use behaviour. Figure 11 shows the UTAUT model as depicted in the original paper by Venkatesh et al. (2003).

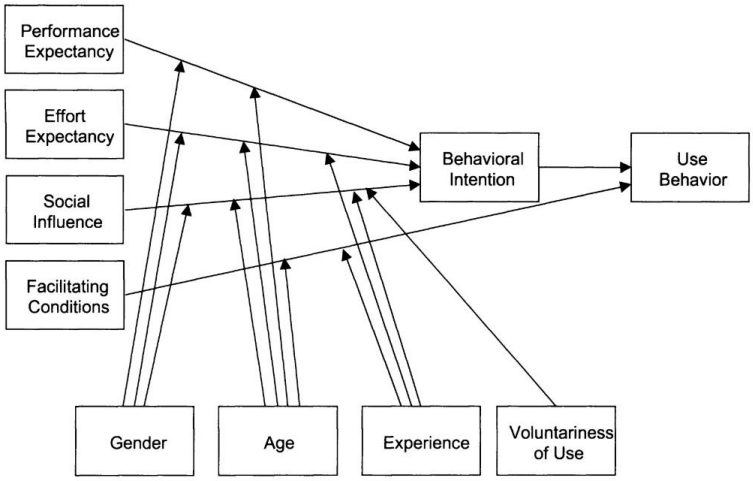

Figure 11: Schematic of the Unified Theory of Acceptance and Use of Technology (UTAUT) model by Venkatesh et al. (2003, p. 447)

Although praised for its applicability, generalisability, and validity, the UTAUT still has several limitations (A. Khan & Qudrat-Ullah, 2021; Al-Tarawneh, 2019). The UTAUT was designed in an organizational context and therefore lacks several factors focussed on consumer adoption specifically (A. Khan & Qudrat-Ullah, 2021; Koenig-Lewis et al., 2015). A common critique that is also of particular relevance to this study is that the UTAUT does not include factors related to trust or risk, which have shown to be influential factors in previous mobile payment adoption studies, including the mobile

payment adoption study carried out in the Netherlands by Hasan et al. (2021) (Gilitwala & Nag, 2020; Hasan et al., 2021; Jin & Lim, 2021; Leong et al., 2013; Lian & Li, 2021; Liébana-Cabanillas et al., 2021; Liu et al., 2019; Patil et al., 2020; Sembiring et al., 2022; Shao et al., 2019; Singh, 2020; Talwar et al., 2020). Moreover, recalling the application of the SCT as meta-framework to increase inclusiveness, the UTAUT model does not seem to account for the relationship between personal and environmental factors. For example, Social Influence could logically lead to an increased Performance Expectancy as the recommendation of the technology by a friend of the individual examined may serve as a premature proof of concept.

3.2.10. The extended UTAUT (UTAUT2)

To overcome the UTUAT's limitations as model derived from an organizational context, Venkatesh et al. (2012) proposed an extension of the UTAUT, the UTAUT2 (Patil et al., 2020). The constructs of *price value*, *hedonic motivation*, and *habit* were added and the moderating factor of *Voluntariness of use* was dropped accordingly. Although the additions increased the complexity of the model, the UTAUT2 has demonstrated to be an improvement over the traditional UTAUT model in general, but also specifically when it comes to the interpretation of the motives behind the adoption of mobile payment technologies (Gupta & Arora, 2020; Malarvizhi et al., 2022).

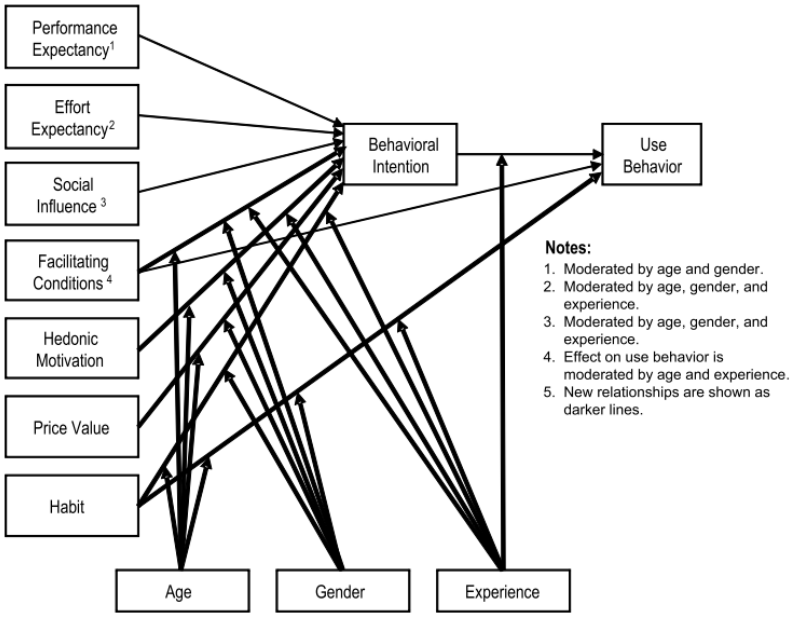

Figure 12: Schematic of the Unified Theory of Acceptance and Use of Technology 2 taken from the original paper by Venkatesth et al. (2012, p. 160).

Nevertheless, the UTAUT2 still lacked constructs relating to trust and risk. Furthermore, the seven main independent variables of the UTAUT2 are posited not to influence each other as would be dictated by the SCTs meta-framework. To this extent, Patil et al. (2020) interestingly found this not always to be the case as their research demonstrated Effort Expectancy to be significantly influenced by Facilitating Conditions. Their conclusion is strongly aligned with the results of the literature analysis by Abdullah and Naved Khan (2021) which highlighted the need for more mobile payment adoption studies investigating the influence constructs may have on each other.

3.2.11. The Integrated Model on Mobile Payment Acceptance (IMMPA)

By combining elements from the TRA, TAM, DOI, and UTAUT, Di Pietro et al. (2015) developed a research model specifically for studying the adoption of mobile payments in public transport. It contained the traditional constructs of Attitude (TRA), Ease of Use (TAM), Usefulness (TAM), Intention to Use (UTAUT), Behavioural Intention (UTAUT), and Compatibility (DOI), and Security as additional construct. The resulting model can be seen in Figure 13.

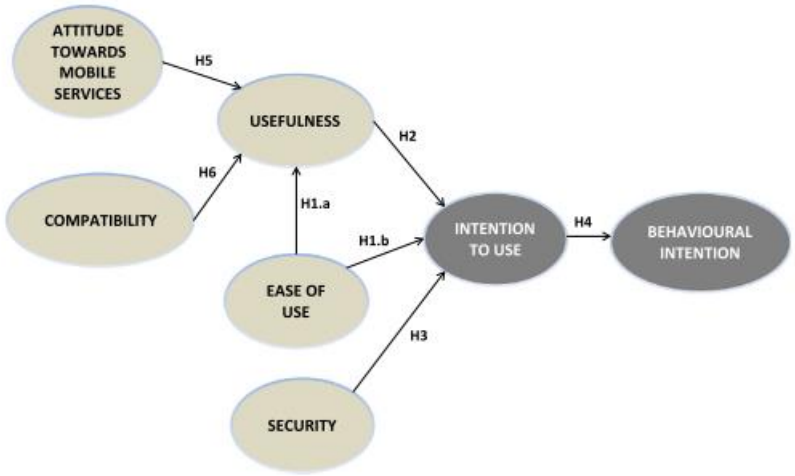

Figure 13: The IMMPA model by Di Pietro et al. (2015, p.470)

Although the IMMPA's specific focus on mobile payment adoption appears promising, the model was designed for prediction which makes it less descriptive than desired when trying to understand contemporary driving factors. This effect is notably prevalent through the Attitude construct of which the limitations were already highlighted in the review of the TRA (section 3.2.1). Interestingly the model did retain the mediating effect of Usefulness between the constructs of Ease of Use on Intention to Use from the TAM. Most of the previously discussed models do not include such effects therefore supposing that only linear relationships exist between the independent variables and the dependent variable. Future research exploring similar non-linear relationships in the adoption of mobile payment services could perhaps deliver additional insights. Furthermore, evaluating additional moderating constructs such as age and gender is recommended, and since the model is still very new compared to the other models it still needs to be tested in other contexts to verify its reliability in sectors other than public transport (di Pietro et al., 2015). It appears that the tested and more widely applied and descriptive UTAUT2 offers a more suitable alternative as a starting framework for this study.

4. Hypothesis Development

To answer the research questions a research model is designed with hypotheses based largely on the UTAUT2 model together with extensions thereof inspired by existing mobile payment adoption studies and the research gap uncovered in the literature review regarding the influence of service providers and the moderating and mediating effects of the constructs on each other.

Performance Expectancy

Performance Expectancy is one of the constructs that also belonged to the original UTAUT model (Venkatesh et al., 2003). Venkatesh et al. (2003, p.447) describe Performance Expectancy as the strongest predictor of intention, defining it as the individual belief that the system will help them in achieving gains in performance. Studies particular to the adoption of mobile payment services have found similar support for the significance of Performance Expectancy (Gupta & Arora, 2020; Malarvizhi et al., 2022). The relevance of Performance Expectancy is furthermore expected as consumers can be modelled as striving to achieve instrumental rationality, thereby seeking the most effective means to achieve their particular ends (Weber, 1978). Once more considering the accelerated digitalization in the Netherlands during and after the coronavirus lockdown, the Dutch people will have likely gotten used to the adoption of new and improved digital products and services. Furthermore, with BigTech mobile payment services the new technology is being provided by very reputable companies. Together this could lead to an increased Performance Expectancy towards the offered mobile payment services and an increased influence on the adoption of those offered by BigTechs. The following hypothesis is therefore suggested:

H1: Performance Expectancy has a strong positive influence on the Behavioural Intention to adopt BigTech mobile payment services in the Netherlands.

Effort Expectancy

The concept of Effort Expectancy is another staple in the subject of technology adoption models. It was part of the original UTAUT model and is furthermore phrased as ‘Ease of Use’ in both the TAM and the DOI model (Rogers, 1995; Venkatesh et al., 2003). In the original UTAUT model, Venkatesh et al. (2003) describe Effort Expectancy as “the degree of ease associated with the use of the system”. It is important to distinguish that a higher Effort Expectancy therefore relates to greater ease of use, and not to greater expected effort. In line with the rationale behind the relevance of Performance Expectancy and the results from previous mobile payment adoption studies, this paper expects this construct to be of similar high relevance regarding the adoption of BigTech mobile payment services in the Netherlands (Al-Saedi et al., 2020; Gupta & Arora, 2020; Malarvizhi et al., 2022; Penney et al., 2021). The relevance in the specific case of BigTech mobile payment services is herein also present. Apple is especially famous for its focus on ease-of-use; therefore users can expect the adoption of Apple Pay to similarly be of low effort. The following hypothesis is suggested:

H2: Effort Expectancy has a strong positive influence on the Behavioural Intention to adopt BigTech mobile payment services in the Netherlands.

It could be argued that there exists an overlap between Effort Expectancy and a Performance Expectancy. Building forth on the concept of instrumental rationality, it can be rationalized that an instrument with a greater ease-of-use is considered an effective method similarly to a method that has a greater expected performance. Moreover, the concept of ease-of-use can be considered as implicit in the concept of performance. Therefore, to capture this effect in this research, the following hypothesis is suggested:

H2a: The positive effect of Effort Expectancy on Behavioural Intention is mediated by Performance Expectancy.

Facilitating Conditions

Venkatesh et al. (2003) describe Facilitating Conditions as being the degree to which individuals believe that there exists an infrastructure that supports the use of the technology or system. Their findings suggested that the impact of this belief is largely already captured in the construct of Effort Expectancy and therefore does not significantly contribute to the adoption of a technology. However, studies specifically looking into the adoption of mobile payment services have contrastingly found that the construct of Facilitating Conditions is in fact of significance in that regard (Koenig-Lewis et al., 2015; Lin et al., 2020; Malarvizhi et al., 2022). Koenig-Lewis et al. (2015) explain this effect through the required knowledge for the usage of mobile payment services as an extension of the normal usage of a smartphone. Furthermore, contactless payment has seen a staggering growth in preference in the Netherlands, making up 68% of total payments in the Netherlands in 2021. The knowledge that contactless mobile payments are therefore also widely supported could be a decisive factor explaining both the adoption and actual use of the technology. Lastly, the lockdowns resulting from the Dutch coronavirus countermeasures has led to an acceleration in digitalization, which may have expanded itself into the adoption of mobile payment services (AFM, 2021).

The study by Hasan et al. (2021) found penetration of these services in the Netherlands to be low at the time of their research, however this could potentially be explained by the factor that the bars, restaurants, and entertainment locations had remained closed during the time in which their research was carried out. As these locations all count as supporting infrastructure of the technology, it could be argued that there has been a significant increase in Facilitating Conditions since the countermeasures in the Netherlands were lifted. In lockstep with the already rapidly growing popularity of payments made by smartphones and wearables as witnessed by the Dutch Payments Association and the DNB, this paper hypothesizes that the increase in Facilitating Conditions is playing a pertinent role in this trend (DNB, 2021c). As a result, the following hypotheses are suggested:

H3: Facilitating Conditions have a strong positive influence on the Behavioural Intention to adopt BigTech mobile payment services in the Netherlands**.**

As the presence of facilitating conditions facilitate the usage of a technology, it can be hypothesized that they have a positive influence on the effort expectancy, leading to the following hypothesis further inspired by Venkatesh et al. (2003):

H3a: The positive influence of Facilitating Conditions on Behavioural Intention is mediated by Effort Expectancy.

Moreover, individuals that perceive there to be Facilitating Conditions may from that induce that the technology must perform well. Otherwise, at face value, it would not make sense to invest in the creation of those conditions. The following hypothesis is suggested:

H3b: The positive influence of Facilitating Conditions on Behavioural Intention is mediated by Performance Expectancy.

Social Influence

The Social Influence construct is defined by Venkatesh et al (2003, p.451) as the degree to which individuals feel that others that are important to them believe that they should make use of the new technology or system. A recommendation by a friend to use the system would already fall under this construct. However, this definition only considers an active social influence, whereas it can have a passive component too when an individual sees the technology being used or adoption by other people in their environment. This passive component is captured by the Observability construct of the DOI. Aiming to capture all aspects of social influence, it is defined in this study as the degree to which individuals feel that others actively or passively recommend the use of the technology. Previous studies have found Social Influence to be of positive influence on consumer's behavioural intention to use mobile payments (Koenig-Lewis et al., 2015; Lin et al., 2020; Morosan & DeFranco, 2016).

Furthermore, the existing study into mobile payment drives in the Netherlands by Hasan et al. (2021) had not yet included Social Influence. It can be argued that their research could not have been meaningfully extended with the Social Influence construct during the timeframe in which they collected their results as this was during a time of low social interaction due to the coronavirus countermeasures and lockdowns demanding social distancing (De Rijksoverheid, n.d.). This makes it valuable to test the construct of Social Influence and build upon the research carried out by Hasan et al. (2021). Nevertheless, several studies also found the impact of Social Influence to only be mildly positive (Gupta & Arora, 2020; Patil et al., 2020). Considering the individualistic and subjective perception of Social Influence, the above discussion leads to the suggestion of the following hypothesis:

H4: Social Influence has a mildly positive influence on the Behavioural Intention to adopt BigTech mobile payment services in the Netherlands.

As Social Influence can be expected to influence expectations, the following hypotheses are also evaluated:

H4a: The positive effect of Social Influence on Behavioural Intention is mediated by Performance Expectancy.

H4b: The positive effect of Social Influence on Behavioural Intention is mediated by Effort Expectancy.

Furthermore, Koening-Lewis et al. (2015) found empirical evidence that Social Influence negatively influenced their construct of Perceived Risk. This is understandable as it is reasonable that people trust the recommendations of their peers not to put them at risk. In order to test this effect, the following hypothesis is suggested:

H4c: Social Influence moderates the relationship between Perceived Risk and Behavioural Intention.

A similar case can be made for the effect Social Influence might have on Perceived Distrust:

H4d: Social Influence moderates the relationship between Perceived Distrust and Behavioural Intention.

Hedonic Motivation

Hedonic Motivation refers to the pleasure that is derived from the use of a system or technology (Venkatesh et al., 2012, p. 161). Whereas the specific use-case of this paper is not at all developed with the intention of stimulating such hedonic responses, studies particular to the adoption of mobile payment services have found support for the strong influence of Hedonic Motivation on the adoption of mobile payment technology (Malarvizhi et al., 2022; Morosan & DeFranco, 2016). However, Malarvizhi et al. (2022) do admit that these results contradict the majority of studies that have been carried out regarding the adoption of mobile payment services (Gupta & Arora, 2020; Koenig-Lewis et al., 2015). It can be argued that the expected pleasure that could be derived from the use of a BigTech mobile payment service will already be captured by the ease-of-use construct Effort Expectancy. Hedonic Motivation could be a driving factor in the continued usage of a technology as has been demonstrated by several studies that found the relatively similar construct of satisfaction to be influential in predicting continued use (Franque et al., 2021; Gilitwala & Nag, 2020; Liébana-Cabanillas et al., 2019; Talwar et al., 2020). However, in order to retain a focus on identifying the aspects of the technology that drive adoption and subsequently bring about such subjective influences, Hedonic Motivation is excluded from the model as individual construct.

Price Value

Price Value was included in the original UTAUT2 model to capture the impact of the cost of a technology with respect to its created value and any discrepancies between them (Venkatesh et al., 2012, p. 172). The contactless payment services that are currently active the Netherlands are all free for the direct users of the technology, including those offered by BigTechs (ACM, 2020). As such, there is no

reason to believe that Price Value is influencing the use of BigTech mobile payment services in this context.

Habit

The construct of Habit is an operationalization of the strong predicting effect of prior use of a technology on future use (Kim & Malhotra, 2005; Venkatesh et al., 2012, p. 162). However, habit can also be interpreted in a broader sense where it instead sees to the Habit of using mobiles phones for financial and payment related purposes in general, instead of only mobile payment services. The relevance of this interpretation lies in the fact that there are several mobile-focussed financial services which are immensely popular in the Netherlands. Prime examples are *Tikkie* by ABN-AMRO Group and *Betaalverzoek* by ING and Rabobank, each of which are payment request services supplied by Dutch banks (ACM, 2020). Furthermore, bunq, an officially licensed European FinTech bank, was founded in the Netherlands and operates almost entirely via its proprietary smartphone app (bunq, n.d.). This hints towards the existence of a strong affinity with the use of smartphones for financial services among the Dutch inhabitants. This could translate to a lower barrier to adopt BigTech mobile payment services. The following hypothesis is suggested as a result:

H5: The Habit of using smartphones for financial services has a strong positive influence on the Behavioural Intention to adopt BigTech mobile payment services in the Netherlands.

When individuals are used to using their smartphones for financial services, it can be argued that they will expect an additional financial service to be similarly easy for them to use in contrast to individual that are not used to such use. Therefore, the following additional hypothesis is suggested:

H5a: The positive effect of Habit on Behavioural Intention is mediated by Effort Expectancy.

Lastly, individuals are known to gradually become desensitized to potential hazards that may be involved in their habitual behaviour due to risk habituation. Therefore, the construct of Habit is expected to influence both constructs that represent hazards in this study: Perceived Risk and Perceived Distrust, which are introduced in the following section. The following hypotheses are suggested:

H5b: Habit negatively influences Perceived Risk.

H5c: Habit negatively influences Perceived Distrust.

Perceived Risk

Risk has demonstrated to be significant in past research studying the factors influencing the adoption of mobile payment services (Al-Qudah et al., 2022; Al-Saedi et al., 2019; Apanasevic et al., 2018; Chen et al., 2019; Hasan et al., 2021; Liu et al., 2019; Schmidthuber et al., 2020; Shaw et al., 2022). In this study, Perceived Risk refers to the risks perceived by users as a result of the direct usage of the technology due to threats posed by third parties (Malarvizhi et al., 2022). Moreover, the increase in digitalization in the Netherlands has also increased concerns by the DNB and the Dutch Authority for Financial Markets (AFM) regarding cybersecurity risks as communicated in their reports (AFM, 2021; DNB, 2021b). This may have influenced the degree of Perceived Risk associated with BigTech mobile payments in the Netherlands and potentially have increased the weight of Perceived Risk with respect to the adoption and use of BigTech mobile payments. The following hypothesis is accordingly suggested:

H6: Perceived Risk has a strong negative influence on the Behavioural Intention to adopt BigTech mobile payment services in the Netherlands.

Furthermore, a high Perceived Risk can be expected to deter people from adopting a technology even when other characteristics such as Performance Expectancy are favourable. This dampening effect is summarized in the following hypothesis:

H6a: Perceived Risk moderates the influence that the other factors have on Behavioural Intention.

Perceived Distrust

Together with Perceived Risk and in congruence with the literature review carried out in section 3.1, Al-Saedi et al. (2019) discovered that the factor of Perceived Trust is another popular influential factor with which scholars studying the adoption of mobile payment services have frequently extended their (UTAUT-based) research models. Aside from the frequent use of the constructs of trust and risk, their significance has also been confirmed by several mobile payment adoption studies (Chakiso, 2019; Hasan et al., 2021; Penney et al., 2021; Unnikrishnan & Jagannathan, 2018).

In similar fashion as the study by Penney et al. (2021), this paper defines Perceived Trust as the degree to which one party expects that another party with whom they interact will not take advantage of their reliance on them. This definition notably addresses only one of the four dimensions of mobile payment trust found by Lian and Li (2021), the trust in mobile payment service providers. This dimension is also the main interpretation of trust in the DNB's report (2021a) on the growing importance of BigTechs in the Dutch financial sector. The exclusion of the remaining dimensions of trust is justified as they denote trust relationships between the user and other involved entities that do not change when one switches between mobile payment service providers.

The aforementioned report by the DNB (2021a) study also demonstrated that consumers predominantly trust financial incumbents and distrust BigTechs. Therefore, *Distrust* is used instead of 'trust' to reflect this directionality of trust as it more clearly captures how consumers stick with the incumbent financial institutions due to their distrust of BigTechs (ACM, 2020; DNB, 2021a). Testing their conclusions post-lockdown leads to the suggestion of the following hypothesis:

H7: Perceived Distrust has a strong negative influence on the Behavioural Intention to adopt BigTech mobile payment services in the Netherlands post-lockdown.

Lastly, Jung et al. (2020) proposed that trust might influence the relationship between Perceived Risk and the Behavioural Intention to adopt mobile payment services. As it can be expected that a high Perceived Distrust similarly influences the other relationships of Behavioural Intention, the following hypothesis is suggested:

H7a: Perceived Distrust moderates the influence that the other factors have on Behavioural Intention.

Moderating UTAUT2 Constructs

The UTAUT2 includes the three moderating constructs of age, gender, and experience (Venkatesh et al., 2012). In the original paper, these three constructs moderate the influence of each of the seven key constructs.

As the use of mobile payment services has shown to inversely correlate with age in the Netherlands, it is expected that the moderating effect of age on the influence of the independent variables as postulated by the UTAUT2 will also be detectable in this study (DNB, 2021c). The UTAUT2 model proposed that all of the independent variables are affected by the moderating influence of age, the following hypothesis is suggested:

H8: Age has a moderating effect on the influence of the independent variables on the Behavioural Intention to adopt BigTech mobile payment services.

It is not expected that the moderating effect will be applied equally to each independent variable. The moderating effect of age will therefore be evaluated per independent variable.

Studies particular to the adoption and use of mobile payment services have determined that gender can have a significant moderating effect on the influence of one or more constructs (Lee et al., 2019; Lu & Wung, 2021). Its potential moderating influence is therefore not disregarded. The following hypothesis is suggested:

H9: Gender has a moderating effect on the influence of the independent variables on the Behavioural Intention to adopt BigTech mobile payment services.

The moderating effect of gender on the individual independent variables is evaluated similarly to the moderating effect of age.

Experience is originally formulated as "an opportunity to use a target technology . . . typically operationalized as the passage of time from the initial use of the technology by an individual" (Venkatesh et al., 2003, p. 161). The influence of having opportunities to use the technology is already accounted for in this study through the Facilitating Conditions construct. As point-of-sale payments are a frequent occurrence, it is expected that the usage of BigTech mobile payment services quickly become a habit. This is also because BigTech mobile payment services act as a perfect substitute of other offline payment methods, excluding cash payments, in the sense that no additional effort is required to use the service once it has been adopted for the first time as smartphones have become an indispensable part of everyday carry. A demonstrative example of this indispensable status of smartphones in the Netherlands is the fact that during the Covid pandemic negative test results and vaccination records were to be officially validated through the CoronaCheck app developed by the Dutch Ministry of Public Health, Welfare and Sport (2022). As a result, it is expected that the originally supposed moderating influence of experience is captured entirely by the constructs of facilitating conditions and habit, justifying the exclusion of an explicit experience construct.

4.1. Conceptual Research Model

A conceptual research model was created based on the developed hypotheses. This framework consists of ten variables of which two, age and gender, are categorical. The model is depicted in Figure 14.

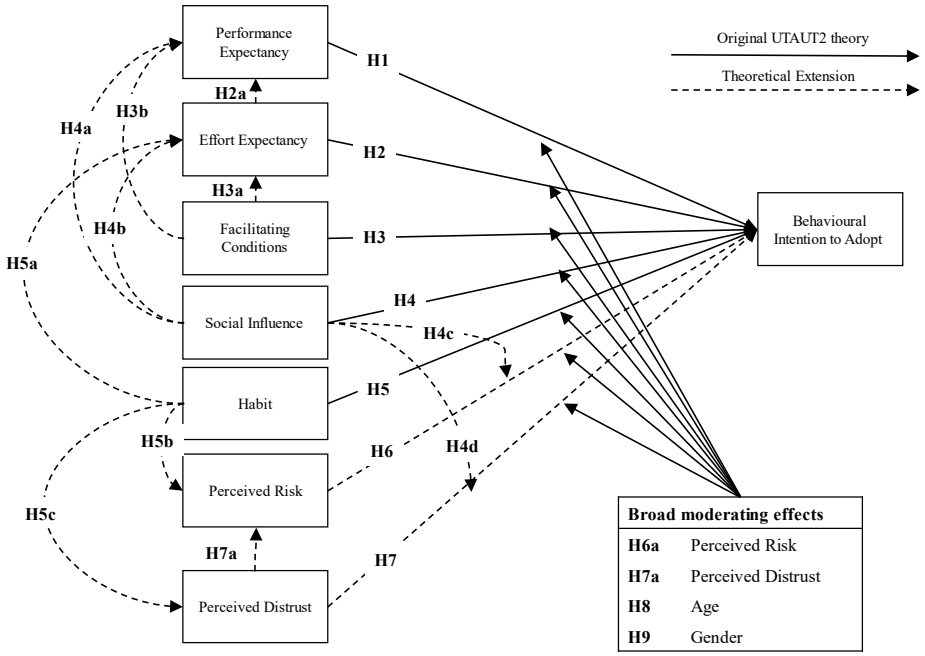

Figure 14: Conceptual research framework based on the UTAUT2 by Venkatesh et al. (2012) and extended using the factors of Perceived Risk and Perceived Distrust as inspired by Al-Saedi et al. (2019) and potential mediating and moderating effects. H1-H9 denote the hypotheses implied in the connections.

The complexity of the model is undeniable but due to the exploratory nature of this study it is important that all potentially interacting effects between the constructs are accounted for. This way the results may provide a thorough evaluation of the influential factors.

5. Research Methodology

5.1. Survey-based Analysis

As consistent with previous research carried out pertaining to the adoption of mobile payment services, the effects of the variables are measured using an anonymous online survey (Al-Saedi et al., 2019). Allowing participants to remain anonymous aims to reduce social-desirability bias and conducting the survey online allows for a much faster collection of data datapoints compared to physical or qualitative alternatives. Furthermore, this approach facilitates the quantification of data and outputs the data in a format that can be readily imported into the statistical programs that can discover relationships and test hypotheses such as SPSS and SmartPLS.

The items that make up the survey will each be designed to test one of the hypotheses H1-H9 outlined in section 4. The moderating effects of H8 and H9 will be determined through moderation analysis after interdependence and regression analyses have been performed on the other hypotheses. The constructs put forward in this paper will be operationalized based on the verified operationalizations as utilized by existing literature studying the adoption of mobile payment services such as Vinerean et al. (2022), Penney et al. (2021), and Al-Saedi (2020) amongst others. The items will mostly consist of Likert scales to facilitate the assignment of quantitative values to the responses. Each of the hypotheses H1-H9 will be tested by multiple items to increase construct validity through the concepts of convergent and discriminant validity (Sekaran & Bougie, 2016). A detailed overview of the items can be found in Appendix C.

The survey itself was hosted on Qualtrics. The opening page was displayed which contained the opening statement as well as the terms, conditions, and further information required to adhere to the standards imposed by the TU Delft's Human Research Ethics Committee (HREC). Once the participant agrees with the opening page and gives their informed consent, they continue to the next part of the survey which collects required demographical data including age, gender, whether they own a Dutch bank account, and whether their (potential) mobile payment service provider is a BigTech or a bank. Due to this study's focus on adoption within the Netherlands, participants without a Dutch bank account are prevented from further participating. Qualtrics' reCAPTCHA v3 integration was used in order to screen responses for suspicious activity so that responses that were likely submitted by internet bots could be removed.

Data regarding income and education are excluded from the demographic data collection. Although demographic research by the DNB demonstrated that their lowest defined income bracket (annual income < €23,400) is 9 percentage points less likely to use contactless payments, this seems to contradict their findings regarding age group usage (DNB, 2021c). According to the same report, the age group of 19-24 is the largest and fastest growing user of contactless payments. However, their average annual income in the same year is far below the boundary of the age bracket at €17,340 (CBS, 2022; DNB, 2021c). As the moderating effect of age on the intention to adopt technology is already supported within UTAUT theory, age was selected instead of income. Furthermore, as the mobile payment services discussed in this research are used free of charge, differences in income are not expected to directly influence the behavioural intention to adopt mobile payment services (Alphabet Inc., 2020; Andriotis, 2021; Venkatesh et al., 2012). Any indirect effects are expected to be captured by the remaining variables in the research model. Education is similarly not expected to directly influence the behavioural intention to adopt technology by itself. From a logical perspective, no specific level of education can be expected to directly advocate the adoption of a specific mobile payment service. Variance in education may however cause a variance in respondents' scores regarding the independent variables (e.g. Perceived Risk), but this thesis mainly concerns the relationships between these variables and the behavioural intention to adopt. Moreover, none of the existing studies reviewed have demonstrated education to have a moderating effect on the influence of these independent variables of the UTAUT models on the Behavioural Intention to adopt a technology. Consequently, demographic data collection

is limited to the aforementioned four items in line with the GDPR's minimisation principle regarding the processing of personal data (GDPR, Regulation (EU) 2016/679).

The final section is responsible for the research data collection and firstly contains three sets of seven Likert scale items aimed at discovering the individual participant's motivations for adopting or rejecting (BigTech) mobile payment services within the conceptual research framework previously depicted in Figure 14. The item order is automatically randomized per participant to counter question order bias and some statements are reversed to verify the participant's consistency.

5.2. Sampling

Students will be the predominant focus of sample targeting as their age group (19-24) makes the most use of contactless payments of which mobile payment services are a subset (DNB, 2021c). Furthermore, their age groups' usage of these payments had also increased the most between 2020 and 2021 (DNB, 2021c). With this approach this study hopes to get more survey respondents that know of the technology and have formulated an opinion about it. Although this does potentially create a bias towards adopters of the technology, understanding what motivated their adoption is key to understanding what is causing the growing adoption of mobile payments in the Netherlands.

Sampling will mainly be carried out in two ways. Convenience sampling will be digitally utilized by spreading links to the online survey through social media channels such as WhatsApp, Instagram, Facebook, and LinkedIn. This approach will carry a snowball sampling element in the sense that respondents are encouraged to spread the survey link within their own networks as well to increase the number of respondents. In line with the existing literature regarding the adoption of mobile payment services, a target sample size of 300 was chosen (Hasan et al., 2021; Qasim & Abu-Shanab, 2016). This sample size furthermore adheres to the propositions outlined by Roscoe (1975) regarding multivariate research.

5.3. Data Analysis Approach

The Kaiser-Meyer-Olkin (KMO) test will be applied in conjunction with Bartlett's test of sphericity to evaluate the appropriateness of subjecting the data to factor analysis (IBM, 2021). If the data passes both the KMO test and Bartlett's test of sphericity, Confirmatory Composite Analysis (CCA) will be carried out to evaluate the measurement model. This moreover verifies discriminant validity through the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio, composite reliability (CR), average variance extracted (AVE) and multicollinearity (Hair et al., 2020).

The structural research model is subsequently tested using Partial Least Squares Structural Equation Modelling (PLS-SEM). The results of this method will then be used to verify the hypotheses posited in this thesis.

6. Results

6.1. Descriptive Statistics

A total of 347 responses were recorded. After filtering out unfinished responses and responses that were flagged as potentially being created by bots, the remaining sample size was 217. Responses were flagged as generated by bots when the reCAPTCHA v3 score for that response was lower than .5 which is the default threshold (Google, 2022). The sample details and descriptive statistics can be found in Table 1. Respondents were differentiated based on gender, age and user type. A list of the questionnaire items can be found in Appendix C.

Table 1: Descriptive sample details

Item	Details	Number	Percentage
Gender	Male	130	59.9%
	Female	87	40.1%
	Non-Binary	0	0%
Age	16-18	16	7.4%
	19-24	102	47.0%
	25-34	79	36.4%
	35-44	6	2.8%
	45+	14	6.5%
Type of user	BigTech	92	42.4%
	Financial Incumbent	74	34.1%
	Non-user	51	23.5%
Total		217	100%

6.2. Measurement Model

The data was subjected to Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity to verify the sampling adequacy and to test the data's suitability for factor analysis. The KMO indicates the degree to which variance in the tested variables might be due to underlying factors and Bartlett's test assesses whether the correlation matrix of the variables forms an identity matrix, in which case the variables would be unrelated (IBM, 2021). The KMO statistic returned a value of .851, which is above the cut-off value of .6 (Kaiser & Rice, 1974). Bartlett's test returned a significant result (p <.001), which means the variables are indeed related. The data is deemed suitable for factor analysis.

6.2.1. Reliability and Validity

Item PD2 was removed due to their Factor Loading being below the .5 threshold set moreover by Hair et al. (2018), which indicates that the item correlated too weakly with the corresponding Perceived Distrust construct. The reliability of the constructs was verified through Composite Reliability (CR) and the convergent validity through the Average Variance Extracted (AVE) as dictated by Confirmatory Composite Analysis (Hair et al., 2018).

All items and constructs met the CR and AVE criteria. As the construct of Facilitating Conditions was modelled formatively, CR and AVE are not appropriate measures to verify the construct and a test of multicollinearity through the Variance Inflation Factor (VIF) is more appropriate instead (Hair et al., 2020). No items displayed problematic VIF values (>3.0). These results can be found in Table 2 along with the corresponding constructs and survey items; a detailed overview of which can be found in Appendix C. All results were statistically significant (P<.001).

Table 2: The results for reliability and validity of the constructs and the items of the survey along with their recommended values

		Recommended Values[a]			
		> .5	> .7	> .5	< 3.0
Construct	**Item label**	**FL**	**CR**	**AVE**	**VIF**
Behavioural Intention	BI1	.930	.893	.807	1.631
	BI2	.866			1.631
Effort Expectancy	EE1	.786	.833	.626	1.467
	EE2	.876			1.472
	EE3	.703			1.278
Facilitating Conditions	FC1	.628			1.028
	FC2	.872			1.028
Performance Expectancy	PE1	.830	.880	.709	1.583
	PE2	.857			1.764
	PE3	.840			1.754
Habit	H1	.796	.822	.698	1.192
	H2	.873			1.192
Social Influence	SI1	.758	.835	.627	1.611
	SI2	.813			1.733
	SI3	.804			1.223
Perceived Risk	PR1	.772	.801	.668	1.132
	PR2	.861			1.132
Perceived Distrust	PD1	.887	.787	.651	1.111
	PD3	.718			1.111

[a](Hair et al., 2018, 2020)

Collectively the results displayed in Table 2 respectively indicate sufficient correlation between the items and their corresponding constructs, satisfactory internal consistency of the constructs, satisfactory convergent validity of the constructs, and sufficiently low multicollinearity between the constructs.

Discriminant validity of the reflective constructs was assessed through the HTMT ratio and the Fornell-Larcker criterion (Fornell & Larcker, 1981; Henseler et al., 2015). The HTMT results can be found in Table 3. None of the constructs exceeded the threshold of .90 implying discriminant validity. Perceived Risk and Perceived Distrust did come close to the threshold at a HTMT-ratio of .872, but this could be attributed to their conceptual similarity due to their shared strong ties with data privacy.

Table 3: The HTMT ratios of the constructs. Discriminant validity is established when none of the ratios exceed the threshold of .90 (Henseler et al., 2015).

	BI	**EE**	**H**	**PD**	**PR**	**PE**	**SI**
BI							
EE	.614						
H	.717	.636					
PD	.728	.527	.589				
PR	.566	.419	.407	.872			
PE	.852	.764	.707	.611	.533		
SI	.341	.312	.475	.257	.239	.260	

Abbreviations: BI = Behavioural Intention; EE = Effort Expectancy; H = Habit; PD = Perceived Distrust; PR = Perceived Risk; PE = Performance Expectancy; SI = Social Influence.

The constructs also met the Fornell-Larcker criterion further establishing discriminant validity. This criterion dictates that correlations between the constructs should be lower than the square root of the AVE of the construct as this indicates that the construct does not explain the variance of other constructs better than its own (Hair et al., 2018). These results can be found in Table 4 which displays the constructs' AVE values which act as threshold values on the diagonal and the inter-construct correlations on the off-diagonal entries.

Table 4: The results of the Fornell-Larcker test. The elements on the diagonal display the square root of the AVE value, which according to the criterion should be higher than the inter-construct correlations which are depicted on the off-diagonal entries (Fornell & Larcker, 1981).

	BI	**EE**	**H**	**PD**	**PR**	**PE**	**SI**
BI	**.899**						
EE	.487	**.791**					
H	.487	.440	**.836**				
PD	-.464	-.340	-.313	**.807**			
PR	-.361	-.268	-.228	.459	**.818**		
PE	.675	.587	.479	-.395	-.347	**.842**	
SI	.273	.243	.321	-.145	-.083	.209	**.792**

Abbreviations: BI = Behavioural Intention; EE = Effort Expectancy; H = Habit; PD = Perceived Distrust; PR = Perceived Risk; PE = Performance Expectancy; SI = Social Influence.

6.3. Structural Model

The conceptual research model was able to explain 59 percent of the variance in the behavioural intention to use mobile payment services (adjusted R^2). Bootstrapping was performed with five thousand samples in order to obtain the p-values. Multigroup analysis (MGA) was also performed to study the differences between respondents that use BigTech mobile payment services and respondents that use services offered by financial incumbents. The analysis found no statistically significant differences between the two groups with regards to the factors influencing the behavioural intention to adopt or use mobile payment services.

The structural model was subsequently analysed using PLS-SEM. Behavioural Intention, the key dependent variable of this research, was found to be directly influenced only be Facilitating Conditions, Performance Expectancy, and Habit, with Performance Expectancy having the largest path coefficient. Other notable findings were that Perceived Risk appeared to be relatively strongly influenced by Perceived Distrust which, in line with their HTMT-ratio, shows that these individual concepts are related to a certain degree. Interestingly, Perceived Distrust was found to be reduced by Habit which captures the effects of habituation and familiarisation. Performance Expectancy was found to be influenced by Effort Expectancy, Facilitating Conditions, and Habit revealing how perceptions of performance are shaped by perceived ease-of-use, perceived support for the technology, and having similar habits. Lastly, Effort Expectancy appeared to be influenced by both Facilitating Conditions and Habit. This result was expected as the purpose of Facilitating Conditions is to make the technology easier to use and more accessible. Furthermore, in the process of developing similar habits people are likely to obtain similar knowledge and skills to those required for the use of mobile payment services. This may then subsequently lower their Effort Expectancy.

These results are displayed in Table 5 where the path coefficient β and its p-value are listed respectively denoting the strength and statistical significance of the influence exerted by the corresponding influencing variable on the listed dependent variable.

Table 5: Overview of the direct effects evaluated by the research model.

Dependent Variable	Influencing Variable	β	p-value
Behavioural Intention Adj. R^2 = .587	FC	.277	.006**
	PE	.303	.010*
	EE	-.086	.440
	SI	.063	.515
	H	.193	.043*
	PR	-.158	.152
	PD	-.162	.129
Perceived Risk	PD	.430	***
Perceived Distrust	H	-.313	***
Performance Expectancy	EE	.372	***
	FC	.265	***
	H	.210	.002**
Effort Expectancy	FC	.370	***
	H	.263	.003**

Statistical significance: *** = p < .001; ** = p < .01; * = p < .05.
Abbreviations: FC = Facilitating Conditions; PE = Performance Expectancy; EE = Effort Expectancy; SI = Social Influence; H = Habit; PR = Perceived Risk; PD = Perceived Distrust.

Besides the direct effects, the hypothesized mediating effects were also analysed. All statistically significant (p < .05) mediating effects that were found are displayed in Table 6. This table once again displays the coefficient β, this time denoting the strength of the mediating path, and its p-value. Furthermore it lists which dependent variable was influenced by which influencing variable, and through which mediating variable this influence was carried.

Table 6: Overview of the discovered mediating effects between the constructs.

Dependent Variable	Influencing Variable	Mediating Variable	β	p-value
Behavioural Intention	EE	PE	.141	.016*
	H		.082	.033*
	FC	EE→PE	.052	.036*
Performance Expectancy	H	EE	.123	.010*
	FC		.171	***
Perceived Risk	H	PD	-.134	***

Statistical significance: *** = p < .001; ** = p < .01; * = p < .05.
Abbreviations: FC = Facilitating Conditions; PE = Performance Expectancy; EE = Effort Expectancy; SI = Social Influence; H = Habit; PR = Perceived Risk; PD = Perceived Distrust.

The results of the mediation analysis showed that the influences of Habit and Effort Expectancy on Behavioural Intention were both mediated through Performance Expectancy. The influence of Facilitating Conditions on Behavioural Intention was found to be mediated through both Effort Expectancy and Performance Expectancy. In line with the findings pertaining to the direct effects, it appears that Facilitating Conditions, Habit, and Effort Expectancy all contribute to what the Dutch consumer interprets as being a well performing mobile payment service.

Besides the direct influences of Habit and Facilitating Conditions on Performance Expectancy, their influence also appeared to be mediated through Effort Expectancy. As such, Effort Expectancy seems to play an important role for Performance Expectancy as both mediator and direct influencer. This may very well be indicative of how performance and ease-of-use are closely intertwined concepts when it

comes to mobile payments. Lastly, it was found that the suppressive influence of Habit on Perceived Distrust, as was shown in Table 5, extends beyond the latter to also affect Perceived Risk.

Permutation multigroup analysis was subsequently performed to evaluate the moderating effects of age and gender. The age analysis could only be carried out using age groups 19-24 and 25-35 as the other groups did not contain sufficient responses for analysis. Gender was not found to have a significant moderating effect but age seemed to be a strong determinant of moderating influence of Perceived Risk on the relationship between Performance Expectancy and Behavioural Intention. The result found that in the younger age group, Perceived Risk had no significant effect (p-value > .05) on the attractive power of Performance Expectancy when it comes to the use of mobile payment services. Contrastingly, in the older age group Perceived Risk had a statistically significant (p-value < .05) and moderately strong negative moderating effect ($\beta = -.403$) on this relationship. This indicates that although the Behavioural Intention is not directly affected by Perceived Risk in either group, the older group will more likely refrain from using high performing mobile payment services when they perceive there to be a risk involved. The younger group appears unaffected by perceived risks when intending to use mobile payment services that they expect to perform well.

Permutation multigroup analysis was repeated to evaluate differences between users of BigTech mobile payment services and users of mobile payment services offered by financial incumbents. No statistically significant differences were found. Lastly, permutation multigroup analysis was carried out to evaluate the differences between users of mobile payment services and non-users, but no statistically significant differences were discovered there either.

Combined, all of these results form a structural model that displays the validated motives that influence the behavioural intention to use or adopt mobile payment services. This model is displayed in Figure 15.

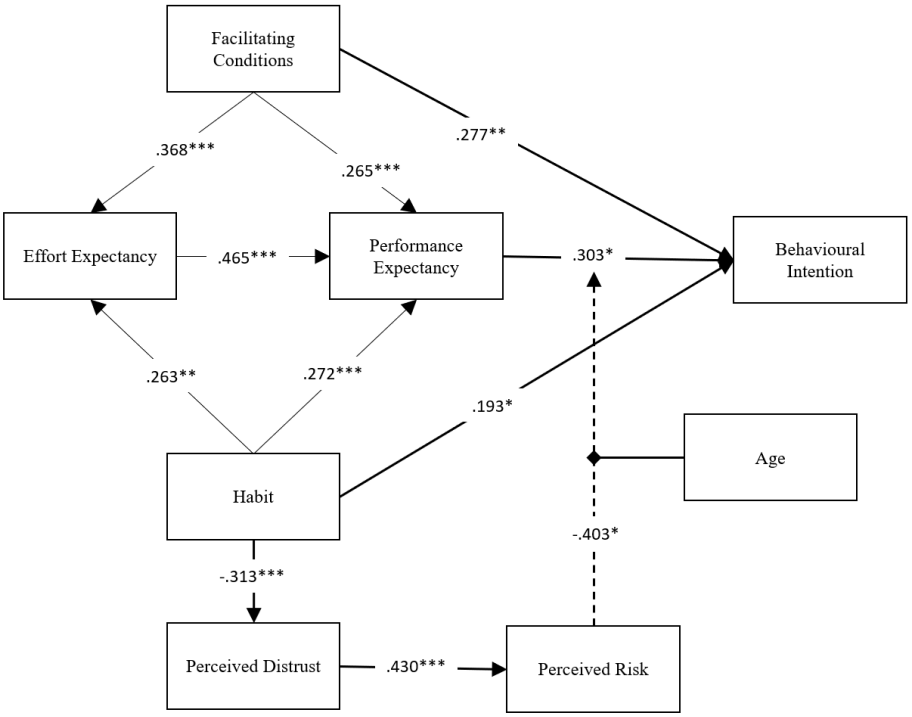

Figure 15: The resulting structural model displaying all of the relationships that are supported by the results. Statistical significance is denoted as follows: *** = p < .001; ** = p < .01; * = p < .05.

An overview of all the hypotheses that found support in these results is displayed in Table 7. It is noteworthy to mention that although Habit did have a positive influence on Behavioural Intention, H5 specifically hypothesized this influence to be strong which was not relatively found to be the case.

Table 7: All the hypotheses that were supported by the results

Label	Hypotheses
H1	Performance Expectancy has a strong positive influence on the Behavioural Intention to adopt BigTech mobile payment services in the Netherlands
H1a	The positive influence of Facilitating Conditions on Behavioural Intention is mediated by Effort Expectancy
H1b	The positive influence of Facilitating Conditions on Behavioural Intention is mediated by Performance Expectancy
H2	The positive effect of Effort Expectancy on Behavioural Intention is mediated by Performance Expectancy
H3	Facilitating Conditions have a strong positive influence on the behavioural intention to adopt BigTech mobile payment services in the Netherlands**.**
H3a	The positive influence of Facilitating Conditions on Behavioural Intention is mediated by Effort Expectancy.
H3b	The positive influence of Facilitating Conditions on Behavioural Intention is mediated by Performance Expectancy.
H5a	The positive effect of Habit on Behavioural Intention is mediated by Effort Expectancy
H5b	Habit negatively influences Perceived Risk
H5c	Habit negatively influences Perceived Distrust
H6a	Perceived Risk moderates the influence that the other factors have on Behavioural Intention.
H8	Age has a moderating effect on the influence of the independent variables on the Behavioural Intention to adopt BigTech mobile payment services

7. Discussion

This thesis aimed to establish the strongest motives for BigTech mobile payment service adoption in the Netherlands. Data was collected through an online survey and PLS-SEM was performed to test the conceptual research model and the hypothesized relationships between the constructs. The following sections will serve to discuss the key findings, the theoretical and practical implications, the limitations of this thesis, and suggestions for future research.

7.1. Key Findings

This thesis employed an extended UTAUT2 model to investigate consumers' motives driving BigTech mobile payment adoption in the Netherlands. The model entailed nine exogenous constructs (i.e., Facilitating Conditions, Performance Expectancy, Effort Expectancy, Social Influence, Habit, Perceived Risk, Perceived Distrust, Age, and Gender) which together formed 19 path relationships. The model was able to explain 59% of the variance in the behavioural intention to adopt mobile payment services, which is comparable to the UTAUT2's explained variance of technology use (52%) (Venkatesh et al., 2012).

In accordance with many previous mobile payment adoption studies, Performance Expectancy was found to be the strongest motivator of behavioural intention to adopt (Al-Saedi et al., 2020; Gupta & Arora, 2020; Manrai & Gupta, 2020; Patil et al., 2020; Purohit et al., 2022). It demonstrated to be positive influenced through Habit and Facilitating Conditions.

Facilitating Conditions was found to be the second strongest motive. This indicates that Dutch consumers are more likely to adopt a technology when they perceive it to be widely supported. Acceptance of mobile payment services has been growing in the Netherlands and was likely accelerated when the Dutch government urged its citizens to pay using contactless methods, such as contactless (BigTech) mobile payments. Facilitating Conditions was furthermore shown to have a positive effect on Performance Expectancy. This effect is likely since widespread visible support for a technology may act as a proof-of-concept for its performance. Lastly, Facilitating Conditions was also found to influence Effort Expectancy which confirms the findings of Patil et al. (2020).

The third and last influential motive that was discovered was Habit. Habit referred to the familiarity with which consumers use their smartphone for financial purposes in general and how well the usage of mobile payment services integrates with consumers' existing behaviour. Habit has long been established as a good predictor of (similar) future behaviour and it appears that mobile payment services are no exception to the rule (Venkatesh et al., 2012). Habit was also found to positively influence both Performance Expectancy and Effort Expectancy. The explanation for this relationship is straightforward as individuals that habitually use a technology can logically expect it to keep on performing well. Moreover, their past experiences will likely have provided them with the relevant knowledge and skills to perform the behaviour more effortlessly when compared to their non-habitual peers. It is important to mention here that the respondents that stated not to use mobile payment services had a similar distribution in their response to the items measuring habit compared to those that use BigTech or incumbents' services.

Although affected by both Habit and Facilitating Conditions, Effort Expectancy did not by itself demonstrate a positive influence on Behavioural Intention. It appears that its effects on Behavioural Intention were entirely mediated by Performance Expectancy. When comparing older methods of payment with contactless mobile payments, the most striking improvement that contactless mobile payments offer is the increased ease-of-use. Consumers that perceive contactless mobile payments to require less effort may accordingly conclude it to be a well-performing payment method. Discriminant validity between Performance Expectancy and Effort Expectancy was sufficiently established regardless.

Surprisingly, neither Perceived Distrust nor Perceived Risk demonstrated a significant direct effect on aggregate Behavioural Intention. However, Perceived Risk (and Perceived Distrust by mediation) appeared to have a significant negative moderating effect on the relationship between Performance Expectancy and Behavioural Intention amongst the age group 25-34. Perceived Risk was in turn found to be influenced by Perceived Distrust, which was itself negatively influenced by Habit. The accommodating effects of Habit on Perceived Distrust were slightly (-.134) mediated through to Perceived Risk as well. The age group of 19-24 seemed entirely unaffected by Perceived Distrust or Perceived Risk with regards to their Behavioural Intention. These findings contrasted the research by Hasan et al. (2021) where trust was found to be the largest influencer of mobile payment adoption.

Social Influence did not appear to affect any of the evaluated constructs or their relationships. This indicates that the Dutch consumers are more likely to formulate their own opinions regarding payment services and are less influenced by their immediate surroundings. This finding opposes the results of other mobile payment studies (Ibrahim et al., 2022; Patil et al., 2020; Ramos-de-Luna et al., 2016). However, at the same time this type of independence in decision-making and individualism is a typical characteristic of the Dutch culture (De Bony, 2005). Gender similarly did not demonstrate a statistically significant moderating effect on the evaluated constructs.

Evaluating sub-question one, '*Which motives for adopting mobile payment services are prevalent in the Netherlands'*, found the prevalent motives for the adoption of mobile payment services in the Netherlands to be Performance Expectancy, Facilitating Conditions, and Habit. Evaluating sub-question two, '*Do the motivations of BigTech consumers differ from incumbents' consumers?'*, found there to be no differences between BigTech consumers and incumbents' consumers. Resultingly, similar to sub-question one, the main research question found the strongest motives for consumers' adoption of BigTech mobile payment services in the Netherlands to be respectively Performance Expectancy, Facilitating Conditions, and Habit.

7.2. Theoretical Contributions

The main theoretical contribution of this thesis arises from the interactive treatment of the UTAUT2 inspired constructs. This thesis' results have demonstrated that the UTAUT2 constructs merit a more interactive treatment than the orthogonal approach that predominantly characterizes mobile payment adoption studies (Abdullah & Naved Khan, 2021). Not only have the constructs been found to influence each other, they have also demonstrated to influence the relationships between other constructs and to be susceptible to the influence of these other constructs. The potentially elusive character of these effects became evident in this thesis as per example the moderating effect of Perceived Risk on the relationship between Performance Expectancy and Behavioural Intention was itself moderated by age and did not show up in the initial analysis of the aggregate data.

Going forward this thesis stresses the importance of evaluating the mediating and moderating effects that the constructs examined in mobile payment adoption studies have on each other in order to improve the explanatory power of the research models and generate additional comprehensive practical insights.

7.3. Practical Implications

The results of this thesis indicate that, when it comes to mobile payment services, the Dutch consumer appears to be driven by a utilitarian and instrumental rationality. The main factor that motivates their choice to use mobile payment services, whether BigTech or otherwise, is how well they perceive the technology to perform. The age group of 25-34 did appear to be influenced by a degree of distrust and perceived risk when deciding to use or adopt mobile payment services, but this risk aversity was absent in the younger age group of 19-24.

The critical insight here is that this younger age group is also the largest adopter of mobile payment services and the fastest growing adopter (DNB, 2021c). Accordingly, in the growing mobile payment services market, it is innovativeness, and not trust, that is the main influential factor. Striking is the comparison that can be made with the research by Fu and Mishra (2022), who found that when it comes to FinTech, innovative capabilities surpass perceived trustworthiness as a driver of FinTech adoption. Additionally, it was found that people that already have a habit of using their mobile phones for financial services are affected less by perceptions of risk or distrust regardless of whether they were users of mobile payment services offered by BigTech or incumbents, or whether they did not use mobile payment services at all.

This means that the competitive advantage that financial incumbents have based on consumer trust with respect to BigTechs within the mobile payments industry in the Netherlands is not as advantageous as the ACM (2020) and the DNB (2021a) posit. As the remaining deciders of the interaction between BigTechs and financial incumbents in the Netherlands are BigTech's chosen strategy and the innovativeness of the financial incumbents vis-à-vis BigTechs, it appears that the future course of action will likely be decided by BigTechs (DNB, 2021a).

The question then remains whether it is desirable to leave the future of the competitive landscape of a critical segment of the Dutch society such as the financial system in the hands of the already extremely dominant and influential international collective that BigTechs uniquely constitute. In any case, the findings of this thesis implore the DNB and the ACM to adjust their expectations regarding the developments in the competitive landscape of the financial industry to be less dependent on consumer trust and risk aversity.

As for the financial incumbents, the findings of this thesis advise them to focus their efforts to keep innovatively enhancing the performance of their services and to accordingly manage consumer expectations to strengthen their competitive positioning. Innovation has long been a daunting task as incumbents are often bogged down by legacy software and rigid hierarchical organizational structures (Harasim, 2021; Naimi-Sadigh et al., 2021; Stulz, 2019). Nevertheless, innovation is becoming increasingly paramount now that the competition stands to consist not only of smaller FinTechs that often lack the clientele to forcefully compete, but also of BigTechs which have more than enough competitive power to make a difference, if they remain unchecked (FSB, 2019b).

7.4. Limitations

As the main method of data collection was carried out through convenience sampling the foremost limitation of this research regards the generalizability of the findings due to the sample not being directly representative of the Dutch population. Most of the respondents were between 19-24 years old (47%) and most of the respondents were male (59.9%).

This research therefore serves to give an indication as to which factors are currently most importantly driving BigTech mobile payment adoption in the Netherlands. These findings could then motivate a larger and more thorough study to further confirm the findings but may by themselves call attention to the developments in the competitive relationship between BigTechs and Dutch financial incumbents and provoke debate regarding the desired future of this relationship. Furthermore, due to the cross-sectional character of this research its results are only indicative of the current situation.

Finally, some of the survey items were found not to significantly load on their respective constructs. As a result, some of the constructs were represented by only two indicators which, although still proven valid and reliable in this thesis, may lead to complications in terms of reliability (Hair et al., 2018).

7.5. Recommendations for Future Research

Future research is recommended to study a more representative sample to make the results more generalizable and to include more survey items per construct than was done in this thesis to create sufficient room for error during the operationalization of the constructs. The interactive and indirect relationships between each of the constructs is also highly recommended for future mobile payment studies as these may uncover influential relationships which can carry important practical implications. Furthermore, a longitudinal study would be able to elucidate the developments in consumer preferences in the Dutch mobile payments industry. The influence of trust (or distrust) and risk should thereby be the focus considering their societal relevance. Lastly, future research including broadly interpretable constructs such as notably risk, trust, and facilitating conditions could benefit from a more multidimensional approach following the example of Lian and Li (2021). Neglecting the multidimensional character of such constructs may lead to interpretative mismatches between researcher and subjects, as well as problems in comparing research results. As such, future research could also be directed towards addressing the multidimensionality of a construct in order to create a standardized approach that allows researchers to easily take this characteristic into account.

For example, a qualitative study regarding the concept of facilitating conditions could help address its multidimensionality by discerning the different forms that facilitating conditions can take. Doing so may additionally help capture the independent essence of the construct that does not stem from its overlap with the other constructs present in the UTAUT models. As this overlap is not accounted for in the original models, replacing the original construct with a more independent interpretation could potentially help improve the models' overall discriminant validity. Contrarily, if no independent essence is discovered, its effect on the other constructs could potentially be controlled for if the model is updated accordingly to account for the separate influences of its dimensions. This way a researcher could perhaps discern, for example, how much of a consumer's high performance expectancy was brought about by external stimuli such as facilitating conditions, rather than stimulated intuitively by the technology itself.

8. Conclusion

Serving as a beachhead market for BigTechs in their entrance to the financial industry, the mobile payment services industry is a valuable field to study developments in the interaction between financial incumbents and BigTechs. The Dutch central bank (DNB) and competitive authority (ACM) had released statements that indicated the future of this competitive landscape to depend on BigTechs' strategy and consumers' relative distrust in the BigTechs. Keeping in mind the potentially negative effects that may arise from increased competitive pressure in the financial system, as well as those associated with allowing BigTech to further increase their already unprecedented market power, it was important that the contemporary consumer preferences with regards to mobile payment services were evaluated so see whether trust still plays this vital role, and which other factors are influential.

In answer to the main research question, indications were found that Performance Expectancy is the strongest motives for the adoption of BigTech mobile payment services in the Netherlands, followed respectively by Facilitating Conditions and Habit. No statistically significant differences were found between the results of BigTech users or users of mobile payment services offered by financial incumbents and no other direct motives were prevalent. Effort Expectancy was however found to play an integral role through its influence of Performance Expectancy and as mediator of both the effects of Facilitating Conditions and Habit on Performance Expectancy. Evaluating the potential for interactive effects between the UTAUT2 constructs including both moderating and mediating effects as was performed in this thesis had not been done before to the best of the researchers' knowledge, yet it provided crucially valuable theoretical insights.

As such, age was found to be the decisive factor that regulated whether Perceived Risk or Perceived Distrust had a negative influence on the driving force of Performance Expectancy on the Behavioural Intention to use or adopt mobile payment services. Only the age group of 25-34 demonstrated this risk averse effect. Furthermore, this effect showed to be significantly weakened by the presence of an existing habit of using mobile phones for financial services. Gender and Social Influence were not found to have any statistically significant effect on the adoption of mobile payment services or on other constructs.

A confirmatory follow-up study using a larger representative sample may further support the practical implications of this thesis to the degree that may potentially constitute regulatory action. A longitudinal approach could thereby more clearly demonstrate trends in consumer preferences. Future research building on the theoretical contributions of this thesis could be carried out to study the interpretative multidimensionality of the constructs of risk and facilitating conditions to further improve the UTAUT2 and create a more objectively descriptive and universally applicable technology adoption model. Similarly, it would be valuable to study the interactions and moderating effects of the constructs included in this thesis in different settings and applications to potentially discover common interactions that may subsequently be accounted for in future technology usage and adoption studies.

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EU General Data Protection Regulation (GDPR): Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), OJ 2016 L 119/1.

Appendix A: Apple Pay and Google Pay

Apple Pay and Google Pay are very similar. Their value proposition revolves around increased consumer convenience (Apple, n.d.-a; Google, n.d.). They can both function as digital wallets, replacing your physical wallet by allowing you to pay by simply holding your smartphone or wearable close to a compatible card reader. Both are secured with multiple layers of security and do not disclose your actual bank information when making a purchase. Furthermore, both are technically more financial facilitating services than that they are completely new payment services, as they operate on the existing infrastructure of banks (ACM, 2020). The main difference lies in their business models.

Apple Pay is free for its direct users. Instead, Apple charges the Apple Pay users' banks 0.15% of each credit card purchase made through Apple Pay and charge a separate fee for debit-card purchases (Andriotis, 2021). Although Apple stresses that they do not store your original or personal data when using Apple Pay, the Apple Pay privacy policy states that anonymized Apple Pay data may be retained in order to improve Apple products and services (Apple, n.d.-a, 2022). Contrastingly, the privacy policy of Apple Wallet, the digital wallet which contains Apple Pay, states that data regarding your payment info may be collected and linked to your identity for advertising and marketing purposes (Apple, n.d.-b). This could be helping Apple to generate additional advertising revenues. Speculation aside, it is evident that the way in which Apple handles and potentially monetizes user data is not as transparent as they proclaim. Nevertheless, the fees that Apple charges the banks do form a clear revenue stream.

Google Pay, on the other hand, is entirely free of charge. Google does not charge users or their banks but instead, as Google is known to generate a significant portion of their revenues from advertising (Alphabet Inc., 2020). The Google Pay data they collect is therefore understandably used to improve their advertising services (Sang Un Chae & Hedman, 2015).

All-in-all, both Apple Pay and Google Pay provide users with a convenient way of making purchases. Users can simply leave their wallets at home and instead pay using their smartphones, which have become integral parts of the modern day-to-day life.

Appendix B: Literature Review Search

Keywords to be found in source title, abstract or key:

("Mobile payment*" OR "m-payment*")
AND ("Use" OR "acceptance" OR "adoption" OR "intention" OR "behaviour")
AND ("Nfc" OR "near-field communication" OR "near field communication")
AND NOT ("QR" OR "p2p" OR "peer-to-peer")

Subject areas excluded from the search were:

- Agricultural and Biological Sciences
- Arts and Humanities
- Biochemistry, Genetics, and Molecular Biology
- Chemical Engineering
- Chemistry
- Environmental Science
- Materials Science
- Mathematics
- Medicine
- Pharmacology, Toxicology and Pharmaceutics

Source keywords included in the preliminary results that the search was subsequently limited to due to their direct relevance to the main focus of this research:

- Adoption
- Behavioural Intention
- Behavioural Intention
- Behavioural Intentions
- Continuous Use Intention
- Intention
- Intention To Adopt
- Intention To Use
- Mobile Payment
- Mobile Payment Adoption
- Mobile Payment Service
- Mobile Payment Services
- Mobile Payment System
- Mobile Payment Systems
- Mobile Payments
- Mobile Services
- M-Payment
- M-Payments
- M-payments
- Near Field Communication
- NFC
- Technology Acceptance
- Technology Adoption
- The Near Field Communication (NFC)

Remaining source keywords included in the results that were subsequently excluded due to their incongruity with the main focus of this research:

- Artificial Neural Networks
- Authentication
- QR Code
- Scanning Electron Microscopy

Language was limited to English.

These settings produced 170 results in Scopus. Manually reviewing the list and removing any source not focussed on understanding the drivers behind the adoption of contactless NFC mobile payment services reduced the number of results to 135.

Appendix C: Questionnaire Items

Table 8 contains an overview of the questionnaire items used to operationalize the main constructs involved in the research model. The demographic items included in the questionnaire are displayed in Table 9

Table 8: Overview of all of the items used to operationalize the constructs involved

Construct	Item label	Item
Behavioural Intention	BI1	I am likely to use or keep using mobile payment services in the future
	BI2	I don't think I will use mobile payment services in the future
Facilitating Conditions	FC1	Most of the stores in the Netherlands support mobile payment services
	FC2	There are a lot of use-cases where I (would) prefer only taking my phone and leaving my wallet behind
	FC3	If I would have difficulties with using mobile payment services, I would easily be able to get help
Performance Expectancy	PE1	I believe mobile payment services save time
	PE2	Using mobile payment services is inefficient
	PE3	I don't believe mobile payment services are an improvement over traditional payment methods
Effort Expectancy	EE1	Using mobile payment services seems complex
	EE2	Using mobile payment services is easy
	EE3	It takes a lot of effort to switch to using mobile payment services
Social Influence	SI1	Many people that I know use mobile payment services
	SI2	I see a lot of people that use mobile payment services
	SI3	Friends have recommended the use of mobile payment services
Habit	H1	I often use my phone for financial activities (banking, payments, Tikkie, trading, etc.)
	H2	Mobile payment services integrate well with the technology I already use (mobile banking, smartwatch, Tikkie, etc.)
Perceived Risk	PR1	Using mobile payment services likely harms my privacy
	PR2	I believe mobile payment services are more secure than traditional methods
Perceived Distrust	PD1	I trust the company that provides me with mobile payment services
	PD2	Financial institutions such as banks are more trustworthy than BigTech (Google, Meta, Apple, Amazon, Microsoft)
	PD3	Out of the mobile payment service providers available I trust mine the most

Table 9: Overview of the demographic items included in the questionnaire

Construct	Item	Possible Answers
Age	Which age bracket do you belong to?	16-18; 19-24; 25-34; 35-44; 45+
Gender	What are your pronouns?	She/Her; They/Them; He/Him; Other than specified
User Type	Do you use any of the following mobile payment services?	Apple Pay or Google Pay; Mobiel Betalen by ING, ASN, or SNS; I don’t use any of the mentioned mobile payment services

Appendix D: Adoption Model Review Summary

Model	Key Characteristics	Advantages	Disadvantages
TRA	Derives Intention from Attitude and Subjective Norm	• Tried and tested model successfully applied in many different fields	• Core constructs too broadly defined and too focussed on psychosocial influences to easily derive actionable insights
TPB	Extended the TRA to control for varying degrees of voluntariness	• The extension created an improved TRA model whilst sharing its advantages	• The TRA's disadvantages were not resolved by the extension
TAM	Intention to Use is determined by Perceived Usefulness and Perceived Ease of Use	• Relatively high explanatory power • Simplistic • Intentionally built to study technology adoption	• Strictly utilitarian and therefore not sufficiently exhaustive as it neglects environmental and social influences
TAM2	Extended the TAM to account for social and intraorganizational factors that influence Perceived Usefulness	• More exhaustive than the TAM • Increased explanatory power • Intentionally built to study technology adoption	• Some of the added constructs strictly regard the workplace and cannot be generalized • Some constructs are too broadly defined to easily derive actionable insights
TAM3	Extended the TAM2 to account for individual factors that influence Perceived Ease of Use	• More descriptive than previous TAM models	• Added constructs too focussed on individual endogenous factors to derive actionable insights on a national level
MPCU	Design based on a more inclusive extension of the TRA to study PC utilization	• Successfully applied in a variety of IT use and adoption studies • Relatively exhaustive, including social, environmental, and utilitarian constructs	• Some constructs are broadly defined and would require additional qualitative research to derive actionable insights
DOI	Adoption of an innovation influenced by its relative advantages, complexity, trialability, observability, and compatibility	• Simplistic model • Relatively exhaustive, accounts for utilitarian, individual, and social influences	• Trialability and Observability are the same for all mobile payment services and as a result unlikely to generate insights in this study • Relative Advantages is too sensitive to subjective interpretation due to its broad formulation
SCT	Explains behaviour as being part of a triadic reciprocal relationship with personal and environmental factors	• Exhaustive, models behaviour as influenced by two mutually exclusive and collectively exhaustive factors • Simplistic • Innovatively accounts for the dynamic reciprocal nature of the relationships between factors	• Broadly formulated factors require additional research before they can be operationalized • Proper inclusion of reciprocal effects requires a longitudinal study

Model	Key Characteristics	Advantages	Disadvantages
UTAUT	Created to combine the strengths of the models mentioned above excluding the TAM3	• Easy to operationalize and to derive actionable insights from • Exhaustive, includes personal, environmental, and social factors, and controls for endogenous factors such as age • Inclusive, accounts for the subjectivity of individual perceptions • Far greater explanatory power than the models that inspired it	• Organizational focus calls for additional consumer-related constructs to make the model more applicable for studying consumers • Does not account for the relationship between personal and environmental factors • Moderating constructs make the model relatively complex
UTAUT2	Created to broaden the UTAUT's applicability to beyond the organizational context	• Same as UTAUT with an even greater explanatory power • Added constructs make it readily applicable in consumer-focussed studies	• The many interaction effects make the model relatively complex • Neglects potential interactions between the base constructs
IMMPA	Combination of the TRA, TAM, DOI, and UTAUT designed specifically for a mobile payment adoption study in public transport	• Intentionally focussed on studying mobile payment adoption • Includes some interaction between the constructs	• Relatively new and therefore not yet sufficiently validated in contexts other than public transport • Broad formulation of some constructs would require additional research to derive actionable insights