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**Technology Acceptance in  
Two-Sided Platforms:  
The Adoption and Use of  
Contactless Proximity Payments by  
Consumers and Merchants**

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**DBA**

**2023**

**Technology Acceptance in  
Two-Sided Platforms:  
The Adoption and Use of  
Contactless Proximity Payments by  
Consumers and Merchants**

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*A thesis submitted in partial fulfilment of  
the requirements of the  
University of Northumbria at Newcastle  
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*Research undertaken in  
Newcastle Business School*

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## Abstract

Two-sided markets created by platform intermediaries emerge in many industries. Current research on two-sided platforms primarily focuses on strategy and pricing, whereas information systems research has only sparsely taken into account their specifics. This research bridges the gap by identifying factors that impact technology acceptance in two-sided platforms.

Drawing upon extant literature, this study identifies the factors impacting the adoption and use of contactless proximity payments by consumers and merchants, both sides of a two-sided platform. An explorative qualitative study with 20 experts in UK payment services identified 43 factors, and allowed to create a multi-levelled conceptual framework.

Subsequently, a conceptual model is created by overlaying the enhanced second unified theory of acceptance and use of technology (UTAUT2E) and the expectation-confirmation model (ECM). The model is validated through a quantitative study among 400 UK consumers and merchants, using partial least squares structural equation modelling (PLS-SEM). The results confirm that network externalities, the defining characteristic of multi-sided platforms, are a prevalent factor in the acceptance of technology in two-sided platforms. They do not only directly impact usage behaviour and intent, but are also instrumental in developing technology usage habits.

As technology is increasingly transforming traditional linear markets into multi-sided platforms, this study significantly contributes to theory and practice. It will encourage researchers in the field of information systems to take into account the specifics of multi-sided platforms. The insights can inspire platform businesses to kickstart a virtuous circle by leveraging the network externalities between constituent groups to develop habits and thrive on the induced continuance behaviour.

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## List of Abbreviations

ABS	UK Chartered Association of Business Schools
AVE	Average variance extracted
CAGR	Compound annual growth rate
CBDC	Central bank digital currency
DOI	Diffusion of innovations
ECM	Expectation-confirmation model
GDPR	General data protection regulation
IDT	Innovation diffusion theory
IS	Information systems
ISO	International organisation for standardisation
ISSM	Information systems success model
MGA	Multi-group analysis
MM	Motivation model
MPCU	Model of PC utilisation
MSP	Multi-sided platform
NFC	Near-field communication
PCR	Principal component regression
PIN	Personal identification number
PLS	Partial least squares
POS	Point of sale
QR	Quick response
RFID	Radio-frequency identification
SCT	Social cognitive theory
SEM	Structural equation modelling
SME	Small and medium-sized enterprises
SRMR	Standardised root mean squared residual
TAM	Technology acceptance model
TPB	Theory of planned behaviour
TRA	Theory of reasoned action
TTF	Task-technology fit
UTAUT	Unified theory of acceptance and use of technology
VHS	Video home system
VIF	Variance inflation factors

## List of Publications

Carpreau, B., Abdelrahman, M., & Masri, F. (under review). Technology Acceptance in Two-Sided Platforms: Exploring the Adoption and Use of Contactless Proximity Payments by UK Consumers and Merchants. *Journal of Business Research*.

Carpreau, B., Abdelrahman, M., & Masri, F. (under review). Technology Acceptance in Two-Sided Platforms: Adoption and Use of Contactless Proximity Payments by UK Consumers and Merchants. A Quantitative Approach. *Information Technology & People*.



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## Declaration

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my own work. I also confirm that this work fully acknowledges opinions, ideas and contributions from the work of others.

Any ethical clearance for the research presented in this commentary has been approved. Approval has been sought and granted through the Researcher's submission to Northumbria University's Ethics Online System (reference no. 28301) on April 21<sup>st</sup> 2021.

I declare that the Word Count of this Thesis is 55546 words.

Name: Bruno Carpreau

Signature:

Date: 2 July 2023

# Chapter 1: Introduction

This chapter presents an outline of the thesis. The background and research significance is explained. The research question is formulated and the research objectives are developed. The theoretical, methodological and managerial contributions of the research are summarised.

## 1.1 Research Background

Technology is revolutionising the way individuals interact. Not the least, economic interactions between people have been transformed profoundly by the boundless possibilities offered by new technologies. More specifically, communication technologies and artificial intelligence have enabled the rise of two-sided platforms, a new business model that is taking markets by storm and fundamentally reshaping the economic tissue of the global economy (Hinz, Otter, & Skiera, 2020).

Two-sided markets created by platform intermediaries emerge in many industries, induced by the existence of network externalities, where the platform's value to any given participant from one group largely depends on the number of participants from the other group (Eisenmann, Parker, & Van Alstyne, 2006; Hagiu & Wright, 2015; McIntyre & Srinivasan, 2017; Parker, Van Alstyne, & Choudary, 2016). Parker et al. (2016) state boldly that 'network effects are creating the giants of the twenty-first century'.

The core idea of a platform business model is not new. Since ancient times, buyers and sellers have been meeting at given times and places in order to exchange goods and services. The importance, and hence value, of a market is heavily driven by the number of participants, whether buyers or sellers (Casson & Lee, 2011). Even according to definitions of modern scholars, these public markets can be considered as the first emanations of a two-sided market (Parker et al., 2016). A two-sided platform is a specific type of market, using technology to

enable economic exchanges between two distinct groups of platform participants (McIntyre & Srinivasan, 2017).

An archetypical example of a two-sided platform is the payment services industry, where payment providers provide a platform connecting two distinct groups of participants, consumers (payers) and merchants (payees). The success of the two-sided platform business model in the payment services industry hinges upon the acceptance of a common technology between these two groups of platform participants.

An example of technological innovation in the payment services industry are contactless payments. These enable consumers to tap a contactless card or an NFC-enabled mobile phone on a specifically enabled contactless reader at the point of sale, allowing to exchange payment credentials and perform a payment transaction nearly instantly (Bounie & Camara, 2020). It is clear that both sides of the payment platform (consumers and merchants) need to adopt the technology in order to enable contactless payments at the point of sale.

The total revenues of the payment services industry are estimated at \$2 trillion, roughly 40% of total worldwide banking revenues (McKinsey & Company, 2020). In Western market economies, overall social costs of payments are estimated between 1% and 3% of GDP (Humphrey, Willeson, Bergendahl, & Lindblom, 2006; Schmiedel, Kostova, & Ruttenberg, 2012). As social costs of electronic payments are one-third to one-half of paper-based equivalents or cash (Humphrey et al., 2006) while also improving the safety and convenience of retail payments (Bolt & Chakravorti, 2008), moving towards electronic payments can represent a significant financial and societal gain. Recent research has indicated that the adoption of contactless payments by both consumers and merchants has the ability to significantly shift cash payments towards card-based electronic payments (Bounie & Camara, 2020).

Technology acceptance research tends to consider users as fully autonomous agents, whether as a consumer or as an organisational user (Venkatesh, Thong, & Xu, 2012). Indirect network externalities between groups of users within a network have sporadically been included in technology acceptance models (J. Wang & Lai, 2020), although findings suggest they should be emphasised as a major predictor of technology acceptance (Kumar, Nim, & Agarwal, 2020; Mallat, 2007; Qasim & Abu-Shanab, 2016).

## 1.2 Research Gap

Existing literature has not comprehensively clarified the role of network externalities as a factor influencing technology adoption in the context of a two-sided market. Further research is needed to fully understand the impact of indirect network externalities on explaining adoption and use of new technologies.

A systematic literature review identified a strong body of research on the adoption of new technologies in the payment services industry. However, our review indicates a lack of consideration for indirect network externalities as an influencing factor on adoption intent and behaviour.

Related to this observation, existing research also tends to focus solely on adoption by consumers, making abstraction of the adoption by the other group of platform participants, merchants.

The literature review also confirms the observation that mobile payments garner significant more attention than other forms of payment, although they represent less than 5% of all payment transactions made at the point of sale in Europe (Global Payments Report, 2020).

Even though Europe is the second largest market for payment services in the world, accounting for more than 31% of all non-cash transactions (Capgemini Research Institute, 2022) and the

UK is Europe's largest card payments market, accounting for 28.5% of all card payments made in Europe (European Central Bank, 2019), only 2 of the 40 research papers in our systematic literature review of technology adoption for payments focuses on the UK.

This research will specifically assess if and how indirect network externalities affect the adoption and use of new technologies in a representative example of a two-sided platform. The hypotheses will be developed, applied and tested in the setting of retail payments in the UK between consumers and small to medium-sized retailers.

### 1.3 Research Question and Objectives

The overall purpose of this research is to identify the key factors that drive the acceptance of new technologies in two-sided platforms. More specifically, it will be applied to the adoption and use of contactless proximity payment technology by consumers and merchants in the United Kingdom. To this end, four research objectives have been formulated in order to address the research question.

#### 1.3.1 Research Question

What are the factors that affect the acceptance and use of contactless proximity payments by consumers (payers) and by merchants (payees) and to what extent does the behaviour of each group influence the other?

#### 1.3.2 Research Objectives

To identify factors that determine the acceptance of contactless proximity payments within both groups (consumers and merchants) based on literature review

To develop a framework based on exploratory research the factors identified within both groups to theorised latent constructs

To develop a conceptual model of the relationships between the latent constructs to determine technology acceptance within both groups as well as between groups (indirect network externalities) based on literature review

To create the conceptual model and to test its validity and reliability

#### 1.4 Research Scope

The technology that will be assessed is contactless proximity payment technology. This technology, enabling users to initiate payments by simply tapping a payment device on a point-of-sale reader, is one of the most recent major shifts in in-person retail payments, paving the way to expand from card-based into mobile and digital payments at the point of sale in retail environments (Karjaluo, Shaikh, Leppäniemi, & Luomala, 2019). The fact that this technology has been widely adopted in the UK market by consumers and merchants makes that most users can reflect ex-post on their own adoption behaviour of this particular technology, increasing the validity and reliability of the findings.

The subjects of this study will be consumers and owners and operators of small- and medium-sized enterprises (SME). Although the latter can be considered as institutional users, the fact that SME owners and operators often act as decision makers and users concurrently, makes that they share more similarities with consumers as compared to users in larger organisations. This will contribute to the comparability of findings across both groups, payers and payees.

The geographical delimitation of this research is the UK market. The UK is a leading European market for payment services, valued at £1.13 trillion in 2022 and is expected to achieve a CAGR of more than 5% during 2022-2026 (GlobalData, 2023). The UK is at the forefront of developing new payment technologies and systems, not limited to contactless payments, but more recently with faster payments, which allows for instant bank transfers, and the open

banking initiative, which enables third-party providers to access bank data to create new payment services. In parallel, the UK knows a well-established regulatory framework for the financial services industry, which helps to ensure the safety and security of payment transactions. The Financial Conduct Authority (FCA) and the Bank of England oversee the regulation of payment services in the UK. Although the UK can be considered an open and diverse society, the existence of a shared culture among stakeholders will also help in minimising the impact of cultural differences, which has been confirmed to exert an influence on technology adoption (see: Jadil, Rana, and Dwivedi (2021); Lee, Trimi, and Kim (2013)).

### 1.5 Research Process

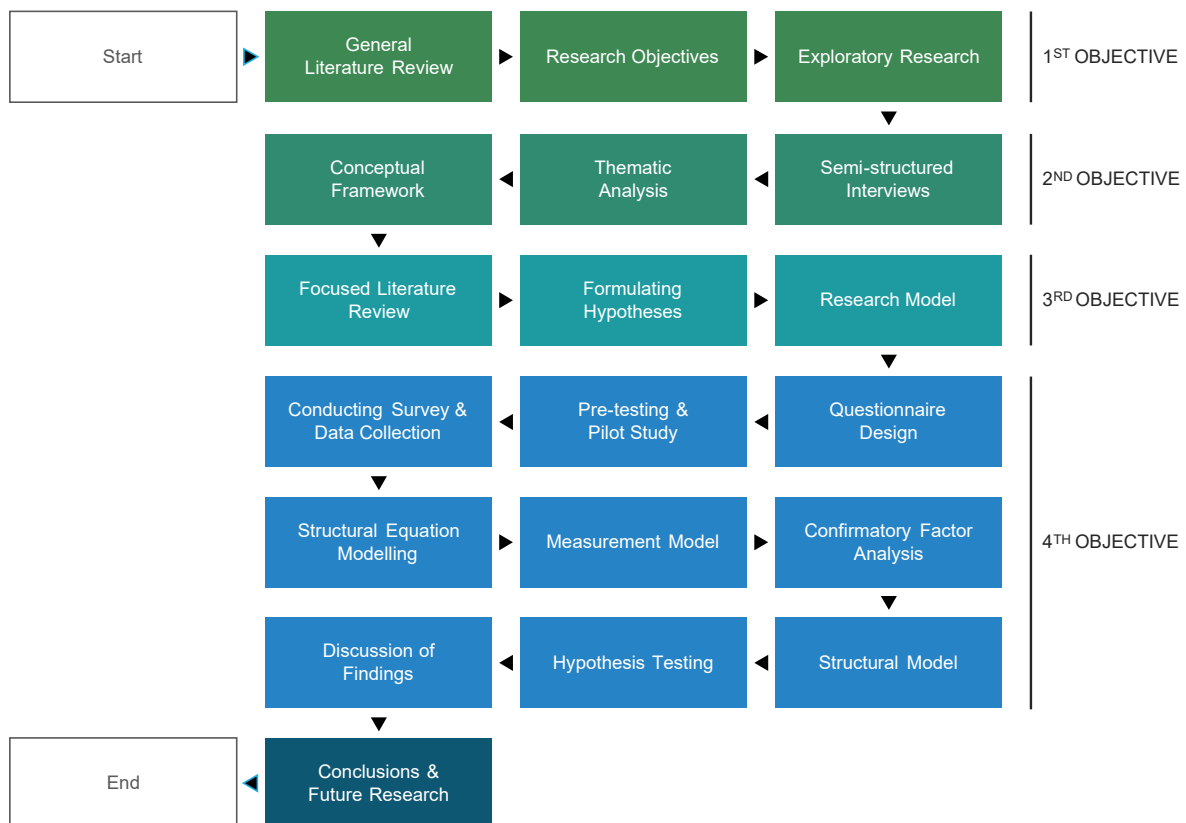


Figure 1-1: Overview of proposed research plan. Source: author

To address the research question and objectives, a general literature review is presented. Exploratory research with thematic analysis based on semi-structured interviews devises a



conceptual framework. Further focused literature review contributes to formulating hypotheses to develop a research model. An online questionnaire, subject to pre-testing and a pilot study, has been developed to collect quantitative data in order to validate the research model. Using structural equation modelling, a measurement model using confirmatory factor analysis ties the observed variables to latent constructs, and a theorised structural model between the latter has been fitted in order to test the formulated hypotheses. Theoretical and managerial implications of the findings are discussed and suggestions for further research are formulated. The subsequent steps are illustrated in Figure 1-1.

## 1.6 Research Contribution and Future Research

This research connects two topics in academic research that have recently attracted significant interest: two-sided markets created by platform intermediaries and individual acceptance and use of new technologies. It applies concepts as introduced in the literature around two-sided markets intermediated by platform operators to expand on technology adoption models developed in information systems research.

The main focus of the study is the payment behaviour of UK consumers and small & medium-sized enterprises active in UK retail sales.

A first theoretical contribution of this research is the application of existing technology acceptance models to the adoption of technology in two-sided markets intermediated by platform operators. In the traditional linear value creation model, value is added to the product or service as it moves through the different steps of the supply chain. This implies that the product characteristics determine the value creation of the product proposition, whether instrumental (contributing to the achievement of goals) or hedonic (enjoyment of using the technology)(Davis, Bagozzi, & Warshaw, 1992). Although a number of researchers have recently suggested that network externalities could be an important and determining factor to

predict technology adoption and usage among users (Kumar et al., 2020; Mallat, 2007; Qasim & Abu-Shanab, 2016), there have been very few studies to attempt to quantify the impact of network externalities on technology adoption. This study aims at incorporating network externalities as a underlying construct for technology adoption, and evaluating its impact on the behavioural intent and behaviour of both consumers and merchants.

Secondly, this research contributes to existing knowledge by concurrently applying a technology acceptance model across different types of users. Most technology acceptance models only take into account one type of users, whether consumers or institutional users (Venkatesh et al., 2012). Scant research has focused on the acceptance of the same technology by different groups of users, each with different roles, objectives and characteristics. This research addresses this gap by concurrently modelling usage intention and usage behaviour within two distinct groups of users – merchants and consumers.

Thirdly, this research focuses on all types of contactless proximity payments, encompassing both cards and mobile devices. An impressive body of research has been dedicated to modelling the acceptance of mobile payments. These studies focused on the mobile phone as a consumer device, making abstraction of the technology used, amalgamating proximity payments (using NFC/RFID, QR or Bluetooth technologies, all requiring different technologies at the merchant side) with online payments, although it has been demonstrated that usage and adoption can differ significantly (De Luna, Liébana-Cabanillas, Sánchez-Fernández, & Muñoz-Leiva, 2019)

A fourth contribution of this research is the focus on merchants, and more particularly small and medium-sized UK retailers. Research focusing on the merchant side of payment technology adoption has been rather exiguous (Bounie & Camara, 2020; Dahlberg, Guo, & Ondrus, 2015; Dahlberg, Mallat, Ondrus, & Zmijewska, 2008).

A systematic literature review reveals the lack of research on the merchant side of payment technology acceptance. Out of 40 articles identified, only 2 present results on payment technology adoption by merchants, and only 1 presents research on the interrelationship between consumers and merchants. As the successful introduction of new technologies in the payment industry hinges upon the adoption by both groups, consumers as well as merchants, this research will attempt to re-balance the consumer-side bias in extant literature.

As a final contribution to theory, this research explores the adoption of contactless payments in the United Kingdom. Although Europe is the second largest regional payment market in the world, representing over 30% of global non-cash transactions in 2019 (Capgemini Research Institute, 2022), and within Europe, the UK is by far the most important card payments market, representing 28.5% of the total number of card payments carried out in the EU (including the UK) in 2019 (European Central Bank 2019), only 2 out of the 40 research papers in our systematic literature review of technology adoption for payments reflected UK-focused research.

This research will also contribute to managerial decision-making. For product managers in the payment industry, the insights of this research may help to identify the product attributes that matter most to users, both consumers and merchants. Marketers will be able to design advertising and communication strategies around themes that are most likely to resonate among target audiences. Analysts and strategic planners can develop and refine business models by focusing on target audiences and market opportunities not currently addressed by incumbent parties.

Beyond the payment industry, general themes, constructs and conclusions of this study may also be applied to other two-sided markets intermediated by platform operators. Examples

include products and services as diverse as movie streaming services, e-book readers, internet search engines, food delivery services, electric car charger networks or car-sharing services.

## 1.7 Outline of the Thesis

This thesis contains 8 different chapters, each of which briefly summarised below:

Chapter 1 introduces the background and significance of this thesis, outlines the research question and objectives, and details the research process.

Chapter 2 provides a comprehensive overview and critical appraisal of the extant literature on two-sided platforms, on contactless proximity payments and on technology acceptance models. The results of a systematic literature review of recent empirical research in the field of technology adoption for payments are presented. Based on this evaluation, the selection of the underlying research model is justified. The research gaps are identified, the originality of the research is demonstrated and the contribution of the research to theory and practice is presented.

Chapter 3 describes the research methodology. It starts by stating the philosophical paradigm driving the research. It outlines how the philosophic assumptions have shaped the methodology and methods used for the research. This research has opted for mixed methods as an approach. Reflective of a research paradigm described as pragmatism, a mixed methods methodology will be adopted, combining quantitative and qualitative techniques that complement each other, and can help to triangulate the outcomes of the research project.

Chapter 4 presents the qualitative analysis of this research. It details the exploratory research carried out in preparation of the data collection. It explains the use of semi-structured interviews as method for collecting qualitative data, followed by the description of the sampling frame and methods. The next sections explicit the interview process and the thematic

analysis. As an outcome of the analysis, the conceptual framework is developed. The chapter concludes with the quality checks of the analysis and the conclusions of this part of the research.

Chapter 5 starts from the conceptual framework presented in the previous chapter. Based on a focused literature review, it elaborates and interprets the outcomes of the qualitative study as to answer the research question and achieve the research objectives. It describes how the theoretical research framework is developed, and how the variables of the hypothesised model have been operationalised.

Chapter 6 describes quantitative analysis, based on structural equation modelling. It describes the estimation of the measurement model specifying how measured variables relate to the unobservable latent constructs. Subsequently, it describes the fitting of the structural model, representing how latent constructs interrelate between each other. Relevant descriptive statistics are defined, justified and discussed.

Chapter 7 summarises and discusses the findings of the quantitative and qualitative steps of the mixed methods approach and relates them to previous research as presented in the literature review. The structural model and the hypotheses underlying the relationships between the constructs are discussed.

Chapter 8 summarises the research and the findings, it formulates an answer to the research question and illustrates how the research objectives have been achieved. It discusses theoretical, methodological and managerial contributions of the research. The limitations of the research are discussed in detail and areas for future research are put forward.

## Chapter 2: Literature Review

### 2.1 Introduction

This chapter provides a comprehensive overview and critical appraisal of the extant literature on two-sided platforms, on contactless proximity payments and on technology acceptance models. The results of a systematic literature review of recent empirical research in the field of technology adoption for payments are presented. Based on this evaluation, the selection of the underlying research model is justified. The research gaps are identified, the originality of the research is demonstrated and the contribution of the research to theory and practice is presented.

### 2.2 Two-sided Platforms

Over the last two decades, the emergence of internet connectivity and the rapid development of digital technology has given a boost to the creation of two-sided platforms (e.g. Parker et al., 2016). This has triggered the emergence of research on multi-sided platforms, in a number of adjacent disciplines (Poniatowski, Lüttenberg, Beverungen, & Kundisch, 2021).

Platforms have been looked at from an information systems research perspective, mainly focusing on the technological and socio-economical aspects of digital platforms, including their design, evolution and governance. There has been a lot of focus on digital platforms because of their impact in institutions, markets and technologies (see De Reuver, Sørensen, & Basole, 2018) and on socio-technical systems (see Kapoor et al., 2021).

As opposed to IS research, economics research on multi-sided platforms explores both platforms that are underpinned by digital technologies as well as other types of platforms (see Rochet & Tirole, 2006), and focuses on market mechanisms and dynamics, (see Jullien, Pavan, & Rysman, 2021).

Finally, management research focuses on the practical aspects of managing platforms, encompassing products proposed on platforms (see Jia, Cusumano, & Chen, 2019), technology systems (see McIntyre & Srinivasan, 2017), transactions (see Jiang, Zhan, & Shu, 2017) and platform ecosystems (see Gawer & Cusumano, 2014).

Research in these three academic disciplines intersects, resulting in shared domains of research but also raising the risk of friction resulting from differing aspects, perspectives and terminologies (Poniatowski et al., 2021), as illustrated in Table 2-1. Shared topics between management and economics disciplines include competition, market effects and dynamics and price and revenue sharing mechanisms, where economic research focuses more on meta-effects, whereas management research focuses on processes and practice. Shared between management and IS research are strategy topics on technical design, strategy and governance. Research on competitive strategies and network effects are shared between the disciplines of economics and IS, whereas behavioural aspects are shared between the three disciplines. The research question, as it is focusing on behavioural aspects and on network effects, is positioned on the intersection between management, economics and information systems disciplines.

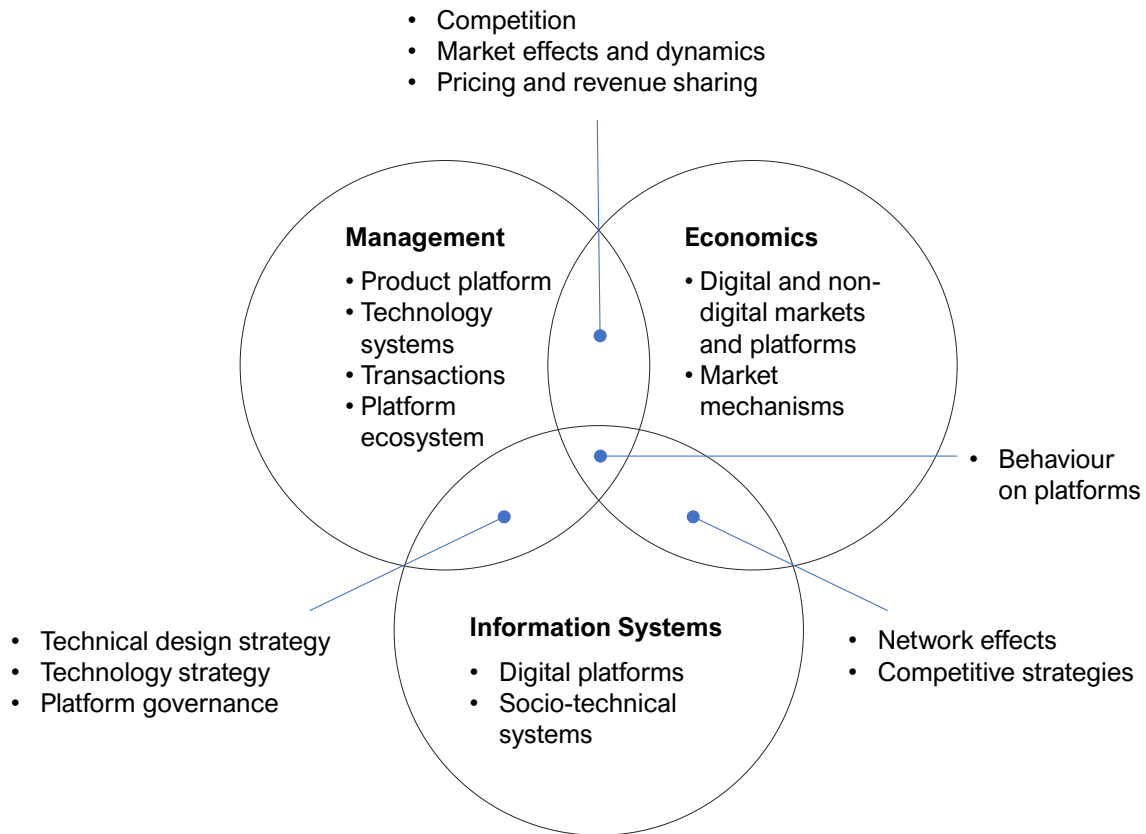


Table 2-1: Foci in research on multi-sided platforms in management, economics, and information systems. Source: adapted from Poniatowski et al. (2021)

There is no unequivocal agreement in the academic community on the definition of a platform (Hagiu & Wright, 2015), but most scholars tend to include one or more elements from these three characteristics: interaction between participants, indirect network effects and non-neutrality of prices. These will be discussed more in detail below.

Technology plays a key role in the emergence and development of platformed business models (Rysman, 2009). In the majority of examples of two-sided platforms quoted in the seminal article by Rochet and Tirole (2003), technology plays a pivotal role: video games, streaming media, browsers, operating systems, text processing, internet portals, payment systems.

The prominent role of technology in two-sided platforms is twofold. Firstly, technology is used to create and maintain switching costs, to discourage current platform participants to switch to competing platforms (Lam, 2017). At the other hand, the value for every participant to the



platform increases with every new participant joining the platform, an effect known as network externalities. If a platform is able to attract more participants thanks to the attractiveness of the technology features it offers, it increases the value to all participants through the effect of network externalities (Katz & Shapiro, 1986).

A well-documented case study of the role of technology within two-sided platforms is referred to as the ‘format wars’ (Jakobs, 2013). In the 1980s, competing consumer electronics companies introduced a number of home video standards, including the VHS system from Matsushita and JVC, the Betamax system from Sony and the Video 2000 system from Philips and Grundig. Although differences in terms of performance, features and price were relatively minor, Sony’s Betamax was generally seen as superior to the other offerings (Blankart & Knieps, 1993; Cusumano, Mylonadis, & Rosenbloom, 1992). In the early phases of the technology adoption lifecycle, Betamax was able to capture more market share than competitive technologies. At the other hand, the VHS standard has been licensed extensively to other manufacturers, resulting in wider consumer and market coverage, as opposed to both other standards. Subsequently, the adoption rate of VHS has taken off, increasingly widening the gap with other standards, to the point that the other systems were eventually forced out of the market. Philips stopped producing the Video 2000 system in 1984 and Sony adopted the VHS standard for its consumer offerings in 1988. This famous case in the literature has been used as an illustration of a company failing to capture its ‘first-mover advantage’ (D. S. Evans & Schmalensee, 2016; Park, 2004). The concept of first-mover advantage has been related to markets characterised by direct network effects (Lieberman & Montgomery, 1988; Ohashi, 2003). In this case, as more consumers opted for video recorders using the VHS standard, sales of a complementary product, VHS video tapes, soared. Thanks to economies of scale, retail prices of VHS tapes dropped, whereas the competing systems suffered from increasing costs of video tapes produced at a small scale (Blankart & Knieps, 1993). This dynamic is self-

enforcing, eventually leading to the convergence of the market towards the most successful technology. Authors have argued that this theoretical underpinning has supported the ‘dot-com bubble’ of the early 2000s, as the common belief implied that entrepreneurs should ‘Get Big Fast’ in order to realise first-mover advantages (Goldfarb, Kirsch, & Miller, 2007). As a result, investors have prioritised growth over profitability, which post-factum raised doubts whether this constituted an optimal business strategy (Hendershott, 2004). This was a challenge to the universal applicability of first-mover advantages in platform businesses, and called for a refinement of the concept (D. S. Evans & Schmalensee, 2016).

Two decades after the VHS/Betamax case, a similar ‘format war’ broke out for home video systems, this time between the HD-DVD format and the Blu-ray consortium (Jakobs, 2017). This time the dynamics played out differently. Possibly inspired by theorised first-mover advantages as described in the VHS/Betamax case, the backers of the HD-DVD format, including Toshiba and Microsoft, from the outset focused their strategy on shipping larger numbers of devices (D. S. Evans & Schmalensee, 2016). However, the consortium behind Blu-ray, with Sony and Apple among others, pursued a different strategy. They focused their attention to building content to be made available on Blu-ray discs, notably by vertically integrating with content providers. As such, Sony acquired film studios such as Columbia and TriStar, and made contents from these studios available exclusively on Blu-ray discs. Over time, as content available on Blu-ray exceeded that on HD-DVD, the adoption among consumers of the latter started to fall behind (D. S. Evans & Schmalensee, 2016). This is an illustration of indirect network externalities, where the value of the platform to one group is impacted by the number of platform participants from a different group, in this case consumers and providers of content, respectively.

One of the most influential research contributions of the 2014 laureate of the Nobel Prize in Economic Science, Jean Tirole, is the ground-breaking analysis of two-sided markets mediated by platform intermediaries (Schmalensee, 2014). With Jean-Charles Rochet, he wrote the 2003 paper ‘Platform Competition in Two-Sided Markets’, which has since been cited extensively in the academic literature, especially in the areas of strategy (Eisenmann et al., 2006; Hinz et al., 2020; J. Wang & Lai, 2020; Zhu & Iansiti, 2012) and pricing (Armstrong, 2006; Li, McAndrews, & Wang, 2020; Rochet & Tirole, 2003, 2006). The paper defined and operationalised the business model underlying two-sided platforms. They identified several key factors that influence the pricing and design of two-sided platforms, including the degree of network externalities (as discussed below), the degree of differentiation between the two sides of the market, and the degree of price sensitivity among users. They also explored the implications of their analysis for antitrust policy, arguing that traditional antitrust analysis may not be sufficient to address the unique challenges posed by two-sided markets. In particular, they suggested that regulators should be wary of intervening in pricing decisions made by two-sided platforms, as such interventions could have unintended consequences for the platform's ability to serve both sides of the market (Rochet & Tirole, 2003).

While the work of Tirole and Rochet on two-sided platforms has been highly influential and widely recognised, there have been some criticisms on their approach as well.

One criticism is that their model may not fully capture the complexity and heterogeneity of two-sided markets. Some researchers have argued that the traditional two-sided market model developed by Tirole and Rochet assumes that the two sides of the market are symmetric and homogeneous, which may not always be the case in real-world settings (Armstrong & Wright, 2007). Another criticism is that their model may not account for the dynamic feedback between the two sides of the market. Some researchers have argued the model as proposed by Tirole

and Rochet is static in nature, and hence may not fully capture how the behaviour of one side of the market can affect the behaviour of the other side, and how this feedback loop can lead to complex and unpredictable outcomes (Chen & Tse, 2008; Jullien et al., 2021). Finally, some researchers have suggested that the traditional two-sided market model developed by Tirole and Rochet may not fully capture how competition and innovation can drive the evolution of two-sided markets over time, and how this evolution can have important implications for economic welfare (Boudreau, 2007; Rysman, 2009).

### 2.2.1 Interaction between Participants

D. S. Evans (2003) focuses on the interdependence of participants in his definition of a platform as a tool to ‘connect or coordinate the activities of multiple groups of customers’. These multiple groups can be perceived because they differ enduringly, such as consumers and merchants, or because of their role in a given transaction, such as buyers and sellers on a second-hand sales platform. Another condition is that both groups are connected by a third intermediary. This intermediary can be a commercial entity, but also an institution or another authority. Essentially, the role of the intermediary is to determine and enforce the rules of interaction between participants, required to realise the network externalities. Another task of the intermediary is to get and keep the participants on board, balanced between the different groups of participants (D. S. Evans, 2003).

Rochet and Tirole (2003) therefore distinguish between a two-sided market and a multiproduct market. There are a number of similarities between both. Both use technology to create externalities between offerings. In a multiproduct market, the externalities are absorbed by the same party, whereas in two-sided platforms the externalities are allocated between two distinct groups of platform participants. A textbook example of a multiproduct market is the market for disposable razors and razor blades. Since both products are complements, a price shift from the

one to the other will not result in a reallocation of value, as the end user will purchase both the disposable razor as the compatible razor blades. This allows the seller to subsidise one product (the razor) in order to lock-in the end-user with a given technology, and charge a premium on the razor blades, typically more than offsetting the subsidised part of the razors.

## 2.2.2 Network Externalities

In a platform business model, value is not only created when products and services move through the different stages of the value chain, but also by network externalities occurring between participants to the platform.

When the first broadcasting networks emerged in the early 20<sup>th</sup> century, it has been stated that the overall value of a broadcasting network  $V$  is proportional to the size of the audience  $n$ . This has been referred to as ‘Sarnoff’s Law’ (Swann, 2002):

$$V \propto n$$

This law has been formulated based on a network in which one broadcaster serves a multitude of viewers, with the value created expressed relative to the broadcaster. This type of network is also referred to as a one-way or unidirectional network, as there is only one content provider, and the rest of the network consists of content consumers, so that communication within the network is inherently unidirectional.

For a two-way or bidirectional network, in which every participant can interact with every other participant, the dynamics play out differently. Extending Sarnoff’s Law, the network’s value to one user (or ‘node’ as in the original postulation) is proportional to the number of other users ( $n-1$ ). Multiplying this value by the total number of users  $n$  within the network results in a total value of  $n(n-1)$ , approximated as  $n^2$ . Thus, it can be stated that the value of a bidirectional

network  $V$  goes up by the square of the number of users  $n$ , whereas the cost  $C$  goes up linearly (Metcalf, 2013). This can be expressed as:

$$V \propto n^2$$

$$C \propto n$$

This implies that with increasing  $n$ , at one point the value of the network will exceed its total costs, and the gap is widening exponentially. Metcalfe (2013) called this the ‘critical mass crossover’. Firstly formulated as a rule of thumb, Metcalfe’s Law has been validated by a number of studies, including by Metcalfe himself (Alabi, 2017; Metcalfe, 2013; Van Hove, 2014; X.-Z. Zhang, Liu, & Xu, 2015).

Metcalf’s Law has been extended by distinguishing sub-networks within an overarching network, exemplified by chat rooms or internet communities. The aggregate value of the network is theorised to be proportional to the number of groups that can be distinguished within the network. In a network with  $n$  users, a total of  $2^n - n - 1$  non-trivial groups can be discerned. With  $n$  sufficiently large, this can be characterised as (Swann, 2002):

$$V \propto 2^n$$

This asserts that the value of a network grows exponentially with the number of participants, or that adding one person to an existing network will effectively double its value (Briscoe, Odlyzko, & Tilly, 2006).

These laws have been critically evaluated by other authors. One of the drawbacks of the various frameworks is that they do not describe the absolute value of networks to the participants, they only characterise growth in the network’s value (Briscoe et al., 2006). Another critical comment on these laws is that all connections within a network are assumed to be equally

valuable, although the case can be made that the incremental value of every new participant to a network follows a decreasing curve (Briscoe et al., 2006; Van Hove, 2014).

At the individual level, the concept of network effects or network externalities has been introduced by Rohlfs (1974). Katz and Shapiro (1985) have defined it as positive external consumption benefits, which can be categorised as either direct or indirect, the latter referring to an outside catalyst required for inducing the network effect, such as the presence of complementary products or services.

Hinz et al. (2020) distinguish 4 types of network effects within a two-sided platform, i.e. same-side and cross-side effects, each within both sides of the two-sided platform. Same-side effects refer to the impact of other participants on the same side of a multi-sided platform. Cross-side effects refer to the direct impact of the growth of one side of the platform on the growth of another side (Chu & Manchanda, 2016).

The more participants to a given platform, the stronger the effect of network externalities, the more value that is created by the platform for the participants (Armstrong, 2006; Caillaud & Jullien, 2003; Rochet & Tirole, 2003). The value-creation capabilities of a platform increase with the number of participants to it. This means one additional participant can increase the value of the platform for existing participants (De Reuver et al., 2018; Eisenmann et al., 2006; D. S. Evans, 2003). However, this incremental value to the existing participants is not necessarily distributed uniformly (Belleflamme & Peitz, 2019).

### 2.2.3 Non-neutrality of Prices

In a traditional value chain, goods and services move linearly from one party to a following, each one performing activities to enhance the value to the ultimate buyer or consumer (Porter, 1998). Consequently, the value proposition to the end-user is a result of the activities of all upstream parties in the value chain. The number of participants to the value chain does not

influence the value created for any of the participants. This model is also increasingly being referred to as a pipeline business (Fung So, Wirtz, Mody, Chun, & Liu, 2020; Parker et al., 2016)

Rochet and Tirole argue that two-sided markets are fundamentally different from traditional markets because the platform operator must consider the demand and pricing decisions of both sides of the market when making its own pricing and design decisions. Conventional views on pricing and competitive behaviour do not apply in two-sided market platform environments, and the authors formulated a number of recommendations for policy-makers and regulators. For instance, pricing products below cost, or even at zero or negative prices would be considered predatory pricing in a conventional view. However, this can be a perfect rational and welfare-enhancing price structure in a two-sided platform, if the platform is able to generate enough revenues from the other group of platform participants.

### 2.3 The Market for Payment Services

Payments are an integral element of practically all economic exchanges. Every economic transaction is generally characterised as the delivery of goods or services in exchange of a compensation.

There are a number of costs inherently associated with this exchange. Coase (1937) introduced the notion of transaction costs in his seminal paper 'The Nature of the Firm', where he conceptually defined it as the cost of operating a price mechanism. Coase mentions the costs of negotiating and concluding a contractual agreement. He argues that transaction costs diminish the efficiency of markets, and that the mere existence of firms, or organisations aimed at producing goods and/or services, is due to the market inefficiencies caused by transaction costs. The costs of conducting payments can be considered a component of transaction costs



(Scott, 2015), and more specifically, the verification of credit- and trustworthiness is an example of the high transaction costs that used to prevent exchange (Parker et al., 2016).

A distinction is to be made between social costs and private costs for a specific payment method. Private costs are the costs that are exchanged between the parties involved in a payment transaction, i.e. the payee (seller) and the payer (buyer). Social costs at the other hand can be defined as the total costs incurred by all stakeholders for using a specific payment method. These stakeholders, besides payee and payer, can include banks, central banks, public services and the society as a whole. Social costs are the most relevant to take into account when looking at market efficiency, as private costs paid by one party to the other party cancel each other out.

As illustrated in Table 2-2, the retail payments sector is made up by a number of stakeholders, each performing a specific role in carrying out payment transactions.

*Table 2-2: Overview of the actors in the most prevalent retail payment systems in the UK, including examples. Source: author, partially based on Rambure and Nacamuli (2008)*

	PAYER			PAYEE	
	Account provider	Issuer	Payment System	Acquirer	Account provider
<b>Cash</b>	HSBC, Lloyds, Barclays, RBS, Standard Chartered	Bank of England, Royal Mint			HSBC, Lloyds, Barclays, RBS, Standard Chartered
<b>Cheques</b>		HSBC, Lloyds, Barclays, RBS, Standard Chartered	Cheque & Credit Clearing Company		
<b>Cards</b>		Barclaycard, RBS, MBNA, American Express	Visa, Mastercard, American Express	Worldpay, Elavon, Fiserv, American Express	
<b>Automated Clearing House</b>			Vocalink, BACS, Faster Payments, CHAPS		
<b>Crypto-currencies</b>	Binance, Coinbase Exchange, Kraken	Bitcoin, Ethereum, Tether, XRP, Litecoin	Blockchain		Binance, Coinbase Exchange, Kraken

Payment transactions are carried out using a financial instrument as an intermediary. Financial instruments have evolved over time, gradually losing their intrinsic value, while enhancing

convenience and security. Currently, the main financial instruments utilised for retail payments are cash, cheques, cards (and digitised variants) and account-to-account transfers (direct debits, automated clearing house) (Rambure & Nacamuli, 2008). Also cryptocurrencies exchanged using blockchain technology have recently emerged as retail payment instruments.

An account provider is a financial institution, also referred to as a custodian, which holds an account to which financial instruments can be credited or debited. In the framework of a financial transaction, both payers (consumers) as payees (merchants) hold accounts.

An issuer is an institution that issues a financial instrument to the payer, whether these are cash, cheques, cards, mobile wallets, digital currencies or any other instrument. In many cases – especially for cheques and debit cards - the issuer is the same as the consumer account provider (e.g. RBS), but also other institutions can issue payment instruments without holding accounts (e.g. American Express).

An acquirer is an institution that enables the acceptance and processing of financial instruments by the payee, typically a merchant. The acquirer can also be an issuer (e.g. HSBC), or a payment scheme provider (e.g. American Express)

The payment scheme connects the payer (through the issuer) and the payee (through the acquirer). It sets the operating rules and conditions, and ensures the payment transactions are carried out adequately. This typically involves the authorisation of a payment transaction, the clearing and the settlement.

Cash, also known as physical currency or fiat money, is typically issued by a central bank. In the UK, coins are issued by the Royal Mint, and notes by the Bank of England (England & Wales) as well as by other banks (Scotland & Northern Ireland). For cash payments, there is no central payment system or acquirer.

Cheques are typically issued by the financial institutions that also hold the payer's account. A central payment system provides clearing and settlement services for paper-based cheques, in the UK this is the Cheque & Credit Clearing Company. No acquirer is needed for payments settled with cheques.

Payment cards, whether using plastic cards or digitised forms of them, are issued by an issuer. For debit cards, in most cases this is the same financial institution as the payer's account provider. For pre-paid or credit cards, there also are specialised issuers, such as Revolut or American Express. Payments are authorised, cleared and settled by a central payment scheme, such as Visa, Mastercard or American Express. Card acquirers enable merchants to accept card-based payments by installing payment terminals at the point-of-sale and by connecting them to the central payment system. They also ensure that the funds are credited to the merchant account held at the account provider.

Financial institutions have set up systems that allow the direct transfer of funds from the account of the payer to the account of the payee. These transactions are carried out by an Automated Clearing House (ACH), such as Vocalink, BAC or CHAPS in the UK. Initially, direct transfers were predominantly used for payments between large organisations or between individuals and large organisations. With the emergence of smartphones and application programming interfaces (API), ACH is developing as a practical method for retail payments.

Finally, since 2009 a new type of payment system has emerged, using digital currencies as financial instrument to enable value exchanges between payer and payee without the need of centralised oversight. Typically an open-source software algorithm defines the workings of a peer-to-peer network using cryptographic techniques to avoid any party to modify, create or delete transactional information. As per their nature, blockchain-based cryptocurrencies do not require any trusted party to operate, as the initial algorithm warrants the adequate cooperation

of different parties in the absence of a legal framework or even mutual trust. Private cryptocurrencies use cryptographic techniques to ensure the privacy and security of transactions, making it difficult for third parties to trace them. Although the debate hasn't been settled whether cryptocurrencies can be considered a currency, a technology, or a transfer mechanism (White, Marinakis, Islam, & Walsh, 2020) – the reality has proven that cryptocurrencies can be considered a viable alternative to more established payment systems and can be used for a wide range of purposes, including illicit activities.

Next to private cryptocurrencies, since the introduction of the Sand Dollar project in the Bahamas in 2020, central banks and governments are increasingly using the technology, procedures and processes behind cryptocurrencies to create a digital form of legal tender, known as central bank digital currencies (CBDCs). Private cryptocurrencies are issued by private entities, individuals or groups, by anyone with the technology and knowledge necessary to create and distribute digital currencies. The lack of a central authority means that private cryptocurrencies are often decentralised and operate on a peer-to-peer network, and are not subject to formal centralised control, whereas CBDCs are defined and managed by the overseeing authority, who can regulate the supply, monitor transactions, and enforce regulations (Laboure, H.-P. Müller, Heinz, Singh, & Köhling, 2021). Furthermore, CBDCs are considered legal tender, meaning that they are recognised as a valid form of payment by law. This means that they can be used to settle debts, taxes, and other financial obligations. As opposed to the often volatile private cryptocurrencies, CBDCs are designed to be stable and have a fixed value, backed by central authorities ensuring their stability and reliability.

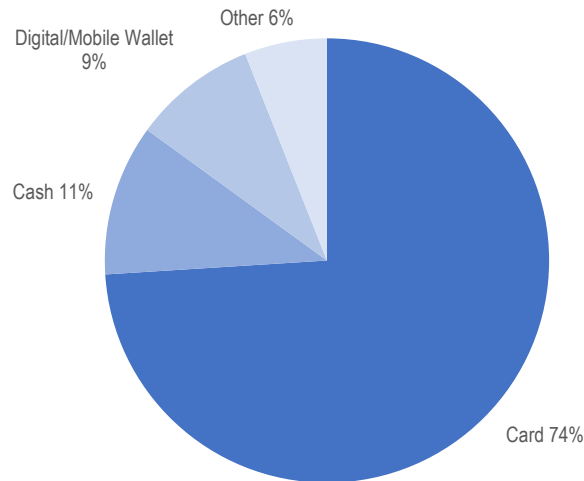


Figure 2-1: Payment methods at the point of sale in the UK. Source: Worldpay from FIS (2022)

As shown in Figure 2-1, in the UK, the annual turnover of in-person retail payments at the point of sale is £1121bn, of which 11% is done using cash and 6% is using other methods, including financing methods, and the remainder, nearly three quarters, is using card-based payment methods. Retail payments using cheques, bank transfers or cryptocurrencies currently account for less than 1% combined (Worldpay from FIS, 2022).

### 2.3.1 Payments as a Two-Sided Platform

The payment services industry is a prime example of a two-sided market intermediated by platforms (Kazan, Tan, Lim, Sørensen, & Damsgaard, 2018; Rochet & Tirole, 2003; Zhu & Iansiti, 2012), and has as such been adopted by the US Supreme Court as a foundational concept for a landmark ruling impacting an entire industry ("Ohio V. American Express Co.," 2018). This ruling is particularly important as it established a legal definition of a two-sided platform, and it asserted that the market of card-based payments operates as a two-sided platform. The ruling took the point of view that the dynamics of a two-sided platform are fundamentally different from a combination of two separate single markets (Wright & Yun, 2019).

The acceptance and use of new technologies in the payment industry is influenced by network externalities (Kumar et al., 2020; Mallat, 2007; Qasim & Abu-Shanab, 2016). One group's value of adopting the technology is dependent on the adoption by the other group (Armstrong, 2006).

### 2.3.2 Contactless Proximity Payment Services

Since Frank McNamara for the first time used his Diner's Club card at the Major's Cabin Grill restaurant in Manhattan, card payments have evolved from paper-based to plastic cards with embossed card numbers, to magnetic stripe, to chip cards (Soman, Cheema, & Chan, 2012). These technological innovations to payment cards mainly improved the security of retail payments.

In 1997, the American petroleum company Mobil introduced Speedpass, a keychain enabled with radio-frequency identification (RFID) technology which could be used for initiating payments at thousands of petrol stations worldwide, as well as in quick-serve restaurants and supermarkets. Subsequently, major payment service providers have been deploying contactless payment technologies including RFID and NFC technologies to improve the user experience of card payments, as well as allowing for the digitisation of physical cards into mobile consumer devices (Karjaluo et al., 2019). Of all card-based retail payments carried in the UK in December 2020, 68% were done using contactless technology (UK Finance, 2020).

Contactless payments using NFC or RFID are compliant with the ISO standard 14443, which uses the 13.56 Mhz radio band to enable contactless communications between electronic devices (Lacmanović, Radulović, & Lacmanović, 2010).

Radio-Frequency Identification (RFID) enables the communication between a (powered) reader and an (unpowered) card or tag. The reading distance is typically 4 cm ( $\approx 1.6$  in) or below. Using an antenna, the card harvests energy from the inductive electromagnetic field

emitted by the contactless reader. This energy is subsequently used to power an integrated circuit with data storage capabilities. RFID is typically used for one-directional data exchange, where the unpowered card or tag emits data, and the powered reader receives the emitted data. Aside from payment cards, RFID tags are extensively used in for the identification of individuals (such as machine-readable passports, identity cards, public transport tickets) and for the identification of individual items (such as in logistics or stock management)(Lacmanović et al., 2010).

Near Field Communication (NFC) is based on the same protocols for standards-based short-range wireless connectivity technology. The main difference with RFID is that it allows for bidirectional data exchange, with both interacting devices each capable of emitting and receiving data. For enabling payments, NFC is typically used to enable communication between a powered consumer device, such as a smartphone or a smartwatch, and a merchant acceptance device at the point of sale (Albattah, Alghofaili, & Elkhediri, 2020).

Contactless proximity payments require acceptance of compatible devices by both consumers (using an RFID-enabled card, an NFC-enabled phone or wearable device) and merchants (by implementing ISO 14443 contactless readers at their point-of-sale payment terminals).

This insight leads to the theorisation that the acceptance of contactless proximity payments will be influenced by network externalities characteristic for two-sided platforms, as the value of accepting the technology by one group is dependent on the acceptance by the other group - hence the formulation of the research objectives and the overall research question of this research.

## 2.4 Technology Acceptance Models

Modelling and predicting the acceptance and use of new technologies on the level of the individual user has received significant attention by IS scholars (Venkatesh, Davis, & Morris, 2007). As from the last quarter of the 20<sup>th</sup> century, different authors have theorised, tested and validated various models aimed at identifying the factors likely to influence the behavioural intention and the actual behaviour of technology users.

Based on an extensive bibliographic analysis of 11,706 peer-reviewed papers related to technology acceptance and its subfields, Xu, Ge, Wang, and Skare (2021) identify eight major technology acceptance models: TPB, TAM, IDT, MPU, TAM-TPB, SCT, TAM2, UTAUT. In this analysis, seven more models are included, as they have been identified as precursors or derivatives of one or more of these models, i.e. TRA, TAM3, MM, ECM, ISSM, UTAUT2 and UTAUT2E.

In bibliometric analysis, citation analysis as a method is utilised as a measure of academic influence. Importance is approximated by the number of citations in other peer-reviewed publications (Zupic & Čater, 2015). To illustrate the relative weight of the different technology acceptance models, we rely on the database of Google Scholar. Google Scholar provides the most extensive library of academic publications, as compared to other popular databases such as Microsoft Academic, Scopus, Dimensions, Web of Science, and OpenCitations (Martín-Martín, Thelwall, Orduna-Malea, & Delgado López-Cózar, 2021). For this citation analysis, citations of the original article in later scholarly publications were counted, as well as the number of citations since 2017. Furthermore, the average annual number of citations since the publication of the original article is provided. Each of these three citation measures has its own merits and restrictions, but taken together they can indicate the academic impact of the various models identified. Five models can be considered to be cited more extensively than the others,



i.e. TRA, TAM, UTAUT, TPB and TAM2. The most recent model, UTAUT2E, is too recent to be assessed using citation analysis.

The results are given in Table 2-3.

Table 2-3: Citation analysis of popular technology acceptance models. Source: author

Model	First instance	Citations (total)	Citations (since 2017)	Citations (annual average)
TRA	Theory of Reasoned Action	73100	22500	1555
TAM	Technology Adoption Model	64218	27700	1736
UTAUT	Unified Theory of Acceptance and Use of Technology	36309	16200	1100
TPB	Theory of Planned Behaviour	27465	11300	1248
TAM2	Technology Adoption Model 2	23799	10400	1700
ISSM	Information Systems Success Model	15481	4350	573
IDT	Innovation Diffusion Theory	11856	3740	382
TAM-TPB	Combined TAM-TPB	11502	3790	426
UTAUT2	Unified Theory of Acceptance and Use of Technology 2	9222	7110	342
SCT	Social Cognitive Theory	8306	2530	277
MM	Motivation Model	8174	3270	389
ECM	Expectation-Confirmation Model	8099	3740	270
TAM3	Technology Adoption Model 3	6836	4190	360
MPU	Model of PC Utilisation	5025	1860	503
UTAUT3	Unified Theory of Acceptance and Use of Technology 3	5	5	

### 2.4.1 Theory of Reasoned Action (TRA)

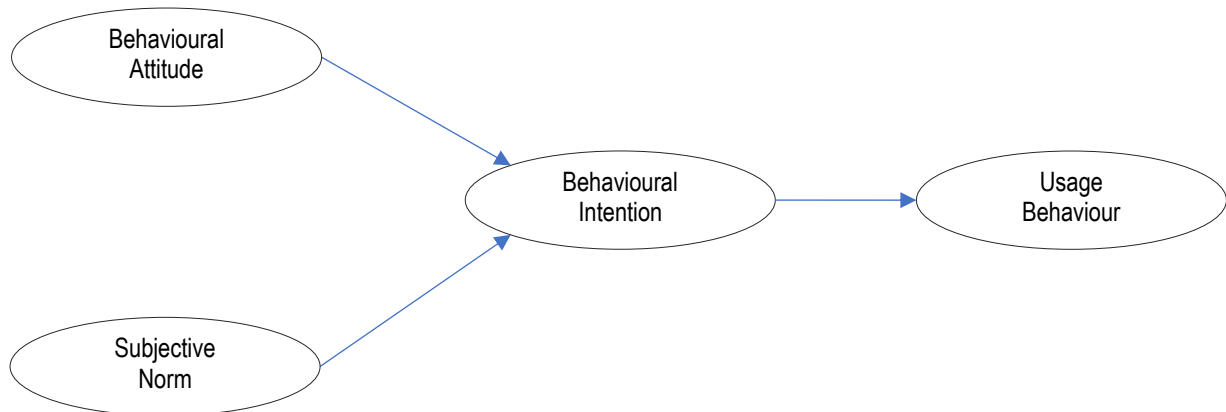


Figure 2-2: Theory of Reasoned Action (Fishbein & Ajzen, 1975)

What is generally considered the first technology acceptance model, Fishbein and Ajzen (1975) introduced the Theory of Reasoned Action (TRA), drawing on theories from social psychology. The TRA posits that the stated intention to adopt a certain behaviour is the best predictor to that behaviour. The intent is driven by two main factors, the individual's attitude towards the

behaviour, and the subjective norm, the attitude of others who are considered relevant by the individual.

An individual's attitude toward a behaviour is the product of the probability of a certain outcome and the evaluation of the outcome, whether the outcome is deemed positive or not by the individual.

The subjective norm is the product of a normative belief, the extent to which referent groups consider the outcome of the action as positive, and the motivation of the individual to comply with the perceived normative beliefs of the referent groups.

The model intends to explain behaviour, as exemplified by the fact that the name of the model includes the term 'action'. However, the conclusion that behavioural intention is a strong predictor of behaviour, has led to the development of models predicting behavioural intention, rather than behaviour itself (Salahshour Rad, Nilashi, & Mohamed Dahlan, 2018). Subsequent research has confirmed the hypothesis that intention is the best predictor for behaviour, although the gap between both remains non-negligible (Sheeran, 2002). Another point of interest is the distinction between actual and reported usage, with the bulk of research with TAM as a framework using some form of self-reported usage, which in itself can induce bias in the findings (Walldén, Mäkinen, & Raisamo, 2016).

Figure 2-2 is a visual representation of the Theory of Reasoned Action.

## 2.4.2 Theory of Planned Behaviour (TPB)

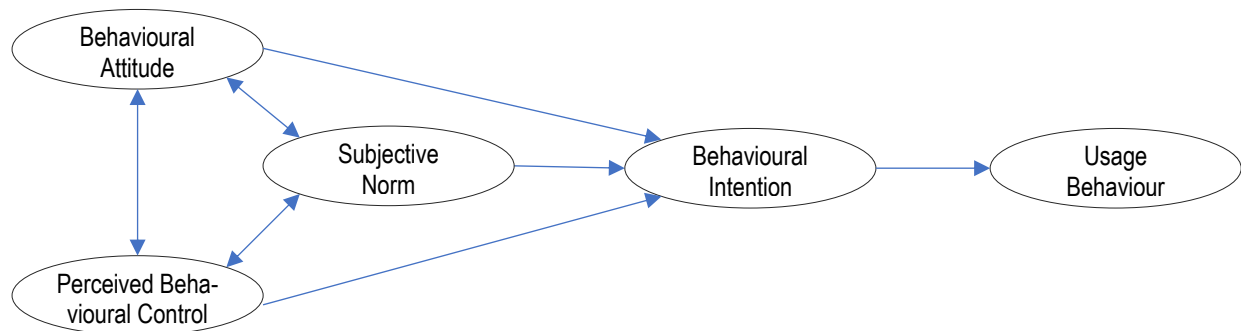


Figure 2-3: Theory of Planned Behaviour (Ajzen, 1985)

Ajzen, one of the original authors of the TRA, extended the model to make it more relevant in situations where the use of the technology would not be voluntary, but driven by factors outside of the individual's will (Ajzen, 1985). The Theory of Planned Behaviour (TPB) expanded on the TRA by adding constructs relating to Perceived Behavioural Control, reflecting individual perceptions of behavioural constraints, both internal and external (Taylor & Todd, 1995a).

This extension is particularly useful in organisational contexts, such as public services or commercial enterprises, where individuals might not have full control on the decision whether or not to adopt a new technology.

The TPB is often used to understand and predict behaviours such as smoking, exercise, diet, recycling, and purchasing behaviour. By understanding the factors that influence behaviour, researchers and practitioners can design interventions that are more effective in promoting behaviour change.

While the TPB has been widely used and has shown to be a useful tool for understanding and predicting behaviour, it does have some limitations. For example, the theory assumes that individuals have complete control over their behaviour and may not account for external factors that may influence behaviour. Additionally, the TPB does not account for emotional and affective factors that may influence behaviour (Sniehotta, Presseau, & Araújo-Soares, 2014).

Despite these limitations, the TPB remains a valuable tool for understanding and predicting behaviour in a variety of settings.

The Theory of Planned Behaviour is presented in

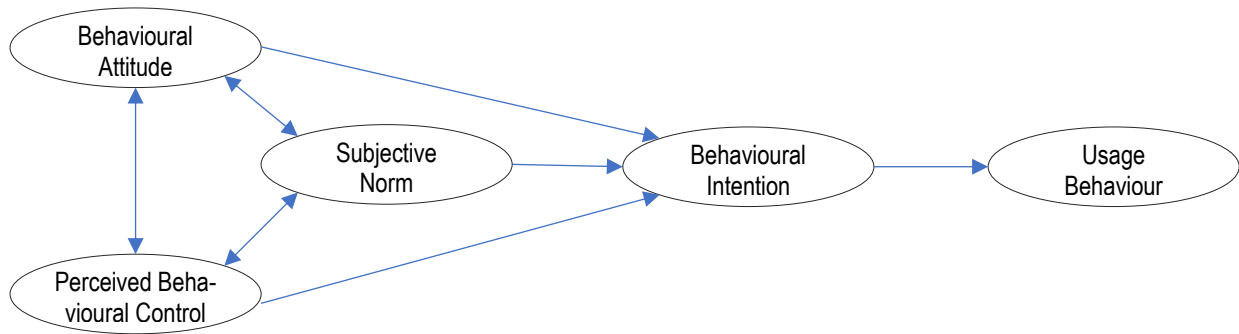


Figure 2-3.

### 2.4.3 Technology Acceptance Model (TAM)

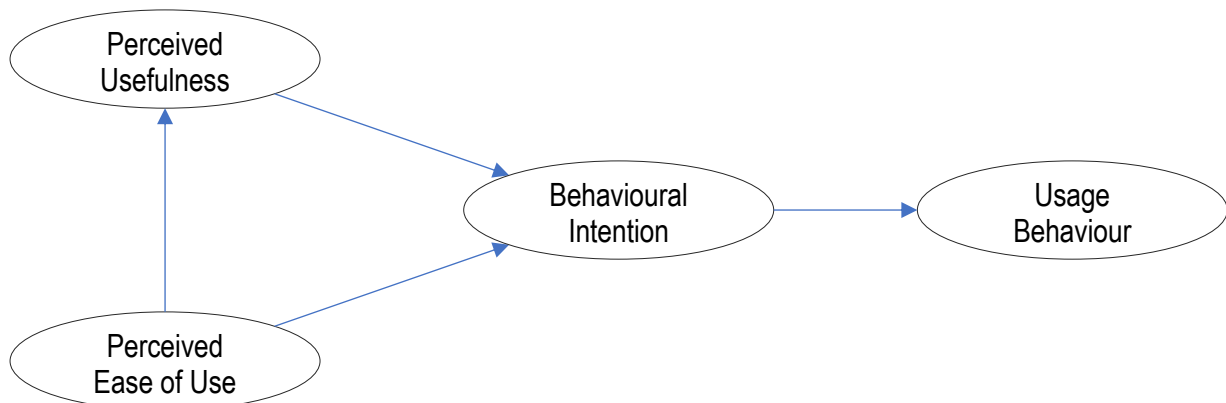


Figure 2-4: Technology Acceptance Model (Davis, 1985)

The Technology Acceptance Model (TAM) proposed by Davis (1989) is an extension of the TRA, and has risen to become one of the most influential technology adoption models in information systems research (Salahshour Rad et al., 2018; Venkatesh & Davis, 2000). It expanded on the attitude measures from the TRA to include Perceived Usefulness and Perceived Ease of Use. Both constructs are rooted in the Expectancy-Value Theory, in which achievement is driven by two constructs: Expectancy and Value. The former refers to the

confidence of an individual to successfully accomplish a task, whereas the latter refer to the importance, utility, usefulness or intrinsic value of a task (Wigfield & Cambria, 2010).

Perceived Usefulness, related to Expectancy, is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989). Perceived Ease of Use, related to Value, is defined as "the degree to which a person believes that using a particular system would be free from effort" (Davis, 1989).

Critics have stated that the parsimony of the TAM also is its Achilles' heel. Although the TAM has proven to outperform some other technology models, they argued that it is not realistic that a model as simple as TAM would be optimal to predict technology adoption and use across a wide range of technologies, contexts and user typologies (Bagozzi, 2007).

Figure 2-4 visualises the original Technology Acceptance Model.

#### 2.4.4 Technology Acceptance Model 2 (TAM2)

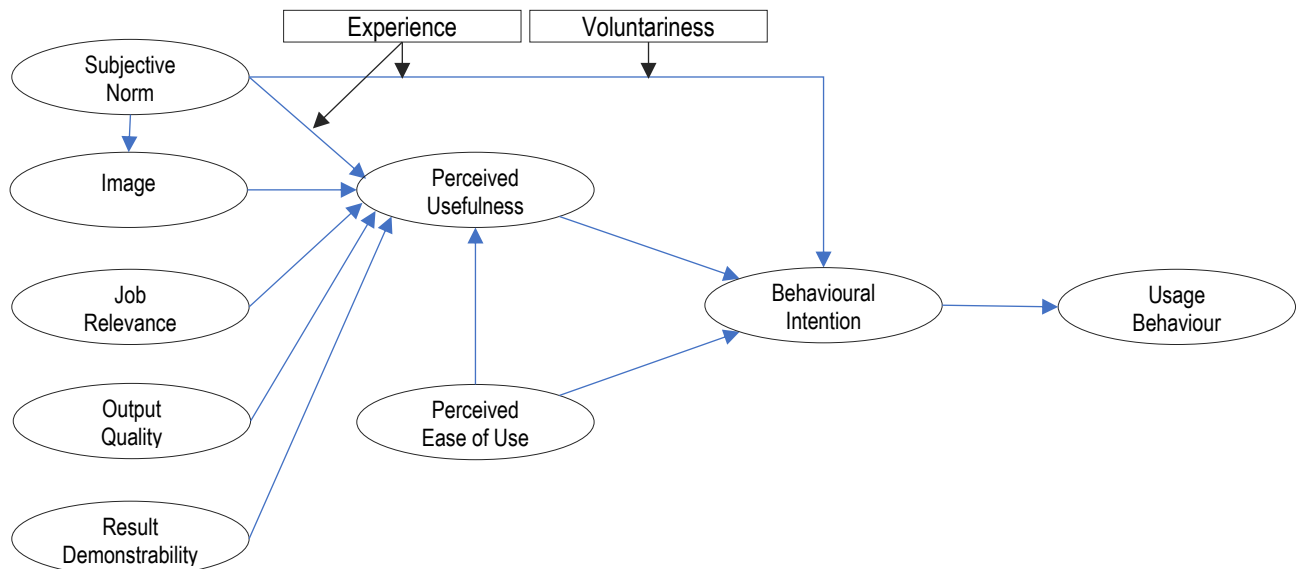


Figure 2-5: Technology Acceptance Model 2 (Venkatesh & Davis, 2000)

In 2000, Venkatesh and Davis published an extension of the TAM, referred to as TAM2, expanding on the constructs preceding Perceived Usefulness. Their stated intention was to

facilitate managerial decision-making in an organisational context with the objective to increase user acceptance and usage of new information systems (Venkatesh & Davis, 2000). The precedents of Perceived Usefulness were theorised as Subjective Norm, Image, Job Relevance, Output Quality and Result Demonstrability. All these factors were theorised to precede Perceived Usefulness. Subjective Norm was also hypothesised to influence directly Image and Intention to Use, yet moderated by Experience and Voluntariness.

The second Technology Acceptance Model is illustrated in Figure 2-5.

### 2.4.5 Technology Acceptance Model 3 (TAM3)

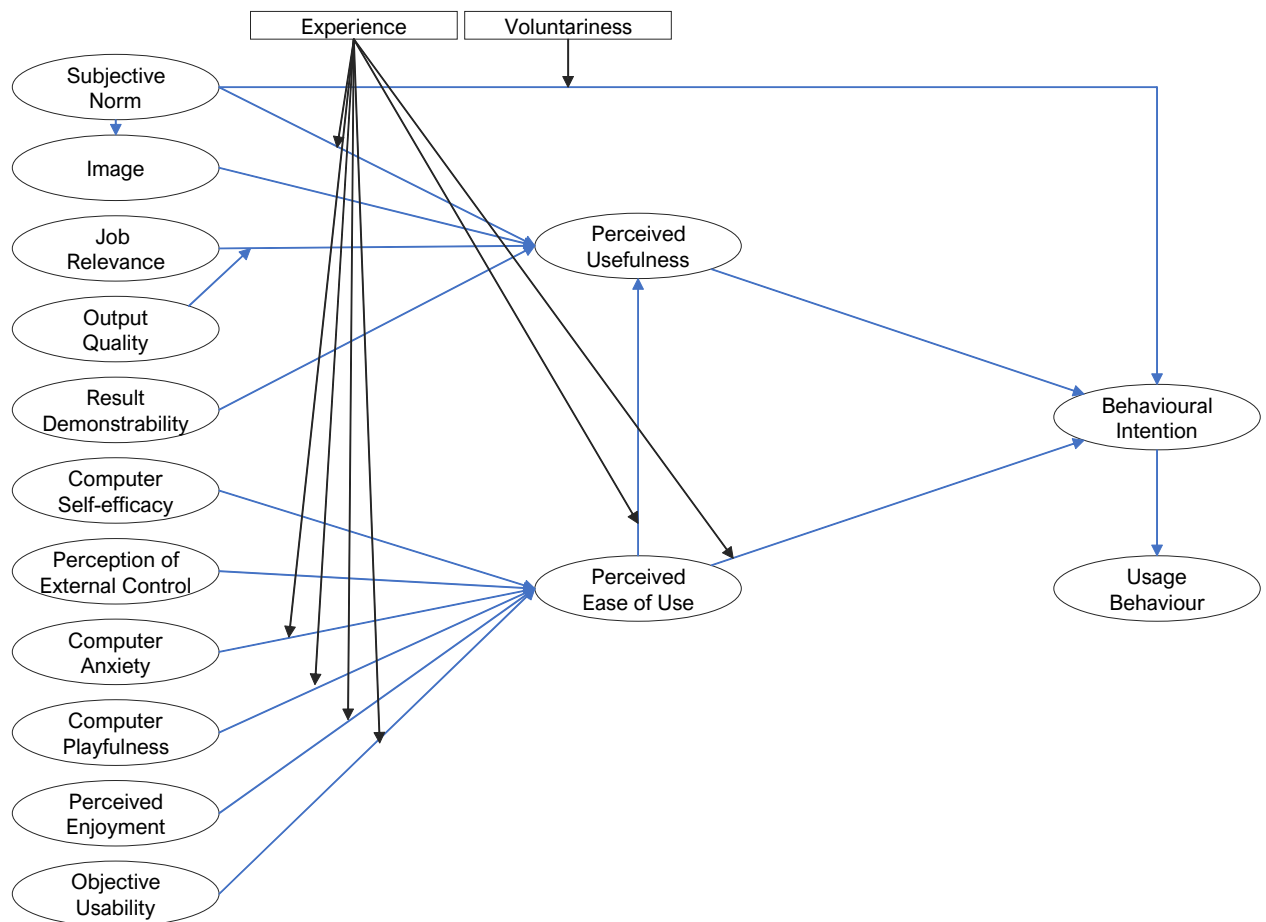


Figure 2-6: Technology Acceptance Model 3 (Venkatesh & Bala, 2008)

Similar to the elaboration of the Perceived Usefulness construct in TAM2, Venkatesh and Bala also elaborated on the Perceived Ease of Use in a model labelled TAM3. Again, the objective

was to aid managerial decision making in an organisational context aimed at promoting the acceptance of information systems.

The precedents of Perceived Ease of Use that were adopted in TAM3 are Self-Efficacy (as defined in the SCT by Compeau and Higgins (1995)), Perception of External Control, Anxiety, Playfulness, Enjoyment and Objective Usability,

Figure 2-6 visualises the third Technology Acceptance Model.

#### 2.4.6 Combined Technology Acceptance Model – Theory of Planned Behaviour (TAM-TPB)

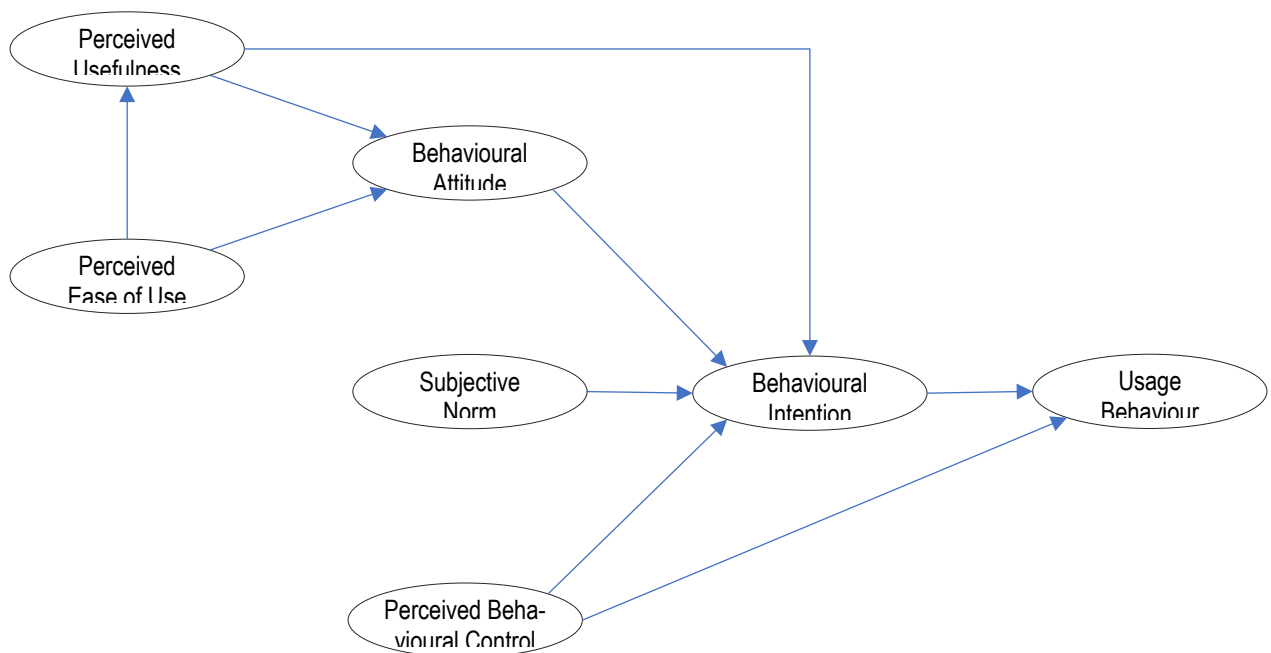


Figure 2-7: Combined Technology Acceptance Model - Theory of Planned Behaviour (Taylor & Todd, 1995a)

Taylor and Todd (1995a) combined the TAM and the TPB to a single model, aimed at combining the explanatory factors of its two predecessors. Their theorised model can be construed by considering the key concepts of the TAM – Perceived Usefulness and Perceived Ease of Use – as precedents of Behavioural Attitude, a key construct of the TPB, although not

present in the TAM. Their empirical research confirmed that Perceived Usefulness still had a direct impact on Intention, as opposed to Perceived Ease of Use (Taylor & Todd, 1995a).

The Combined Technology Acceptance Model - Theory of Planned Behaviour is presented in Figure 2-7.

#### 2.4.7 The Model of PC Utilisation (MPCU)

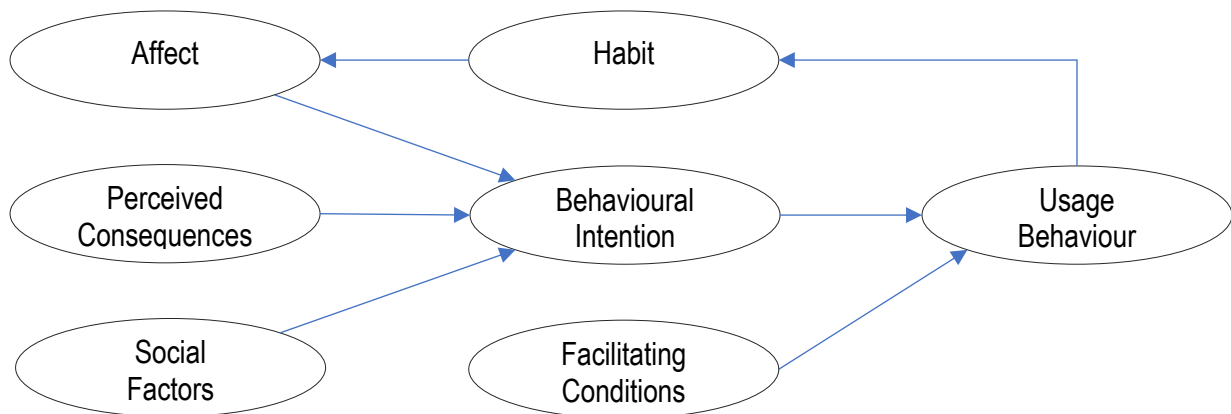


Figure 2-8: Model of PC Utilisation (Thompson & Higgins, 1991)

The Model of PC Utilisation is rooted in the work of Triandis, who developed an alternative perspective to Fishbein's & Ajzen's. Triandis theorised that intentions are driven by social and affective factors and by the expectation of future consequences (Triandis, 1979). Thompson and Higgins (1991) applied these concepts for modelling the use of personal computers, and confirmed the validity of constructs as Emotions (Affect), Social Norms and Expected Consequences in predicting both behavioural intent and actual behaviour.

Figure 2-8 presents the Model of PC Utilisation as proposed by Thompson and Higgins (1991).



## 2.4.8 Social Cognitive Theory (SCT)

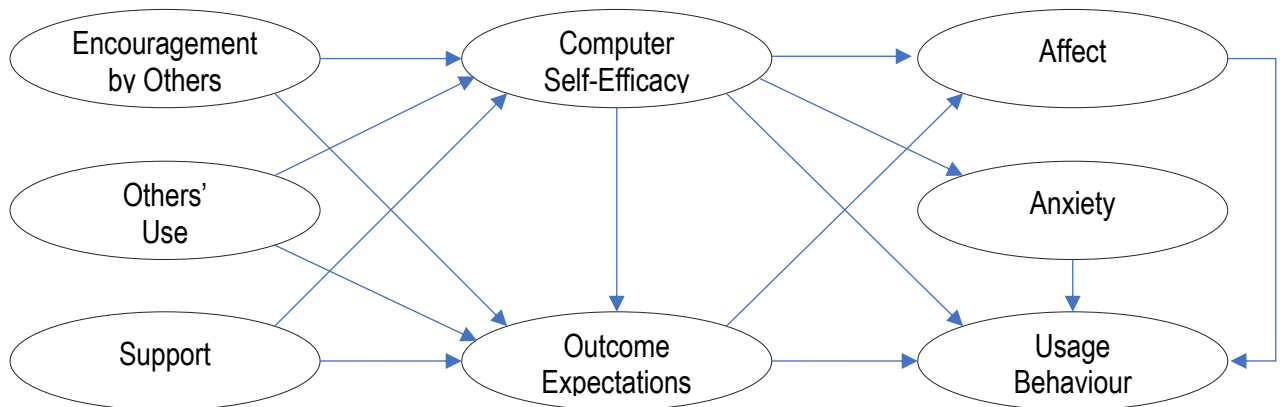


Figure 2-9: Social Cognitive Theory (Compeau & Higgins, 1995)

The Social Cognitive Theory (Compeau & Higgins, 1995) propels the concept of Self-Efficacy, defined as the individual belief in one's competency. This definition continuous on the work of Bandura, who hypothesised that Perceived Self-Efficacy influences whether, how, and how long an individual is likely to engage in a certain behaviour (Bandura, 1977).

Self-Efficacy was found to be a strong individual moderator for organisational influences on the use of computer systems (Compeau & Higgins, 1995). Some authors argue that Self-Efficacy is not an objective measure of skill, it rather reflects what individuals believe they are able to accomplish. This is very similar to Outcome Expectations, which also is a self-assessment of one's own capacities. Therefore, the criticism argues that both constructs conceptually are highly correlated (M. H. Hsu, Chiu, & Ju, 2004).

The Social Cognitive Theory is visually presented in Figure 2-9.

## 2.4.9 Innovation Diffusion Theory (IDT)

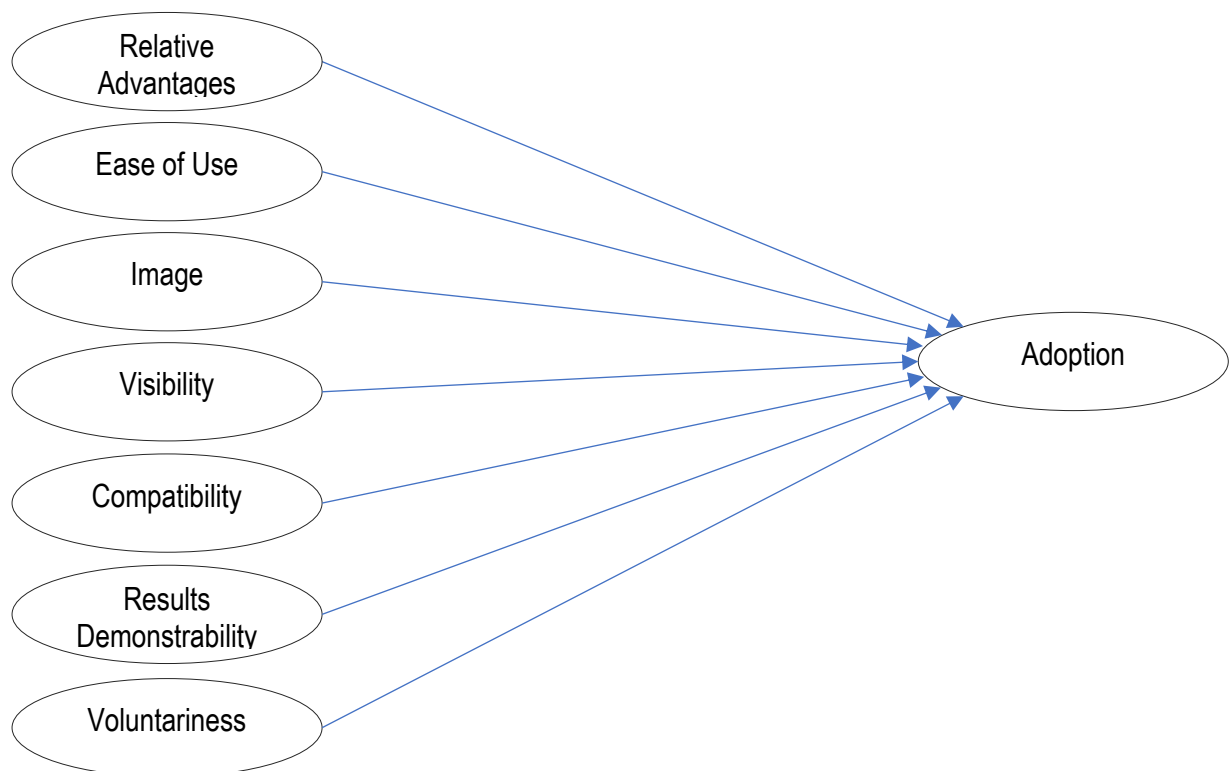


Figure 2-10: Innovation Diffusion Theory (G. C. Moore & Benbasat, 1991)

Everett Rogers has researched and published extensively on the subject of diffusion of innovations since the early 60's. He developed the Innovation Diffusion Theory (IDT), also known as the Diffusion of Innovations model (DOI). His main hypothesis was that the degree of willingness to adopt an innovation differs between individuals. This willingness was theorised to follow a normal distribution, and individuals could be categorised accordingly as innovators, early adopters, early majority, late majority or laggards (E.M. Rogers, 2003). The cumulative adoption rate hence takes the form of an S-shaped curve. The model developed by Rogers identifies five factors influencing the S-shape of the adoption rate: Relative Advantage, Compatibility, Trialability, Observability and Complexity, with the former four exercising a positive influence on the adoption rate, the latter being an inhibiting factor (E.M. Rogers, 2003).

Subsequent research in an information research context added Image, related to the enhancement of one's social status, and Voluntariness of Use, related to the organisational context of technology adoption, as influencing factors (G. C. Moore & Benbasat, 1991), as illustrated in Figure 2-10.

A general comment on models inspired by Rogers' innovation diffusion model when applied to IS contexts, is that focus should be more on factors related to the technological contexts and interactions such as interface design, data structures, training, and actual usage behaviour that influences adoption, diffusion, and infusion the use of technology, rather than to attitude constructs and personality factors. A second comment is that the usage construct in these models does not allow for differentiation. It has been suggested that future research could be examining and integrating different forms of usage, as well as the specific instrumental goals and the outcomes that the usage behaviour is meant to achieve. These could be operationalised by constructs dealing with usage continuation or repetition (Chin & Marcolin, 2001).

#### 2.4.10 Motivation Model (MM)

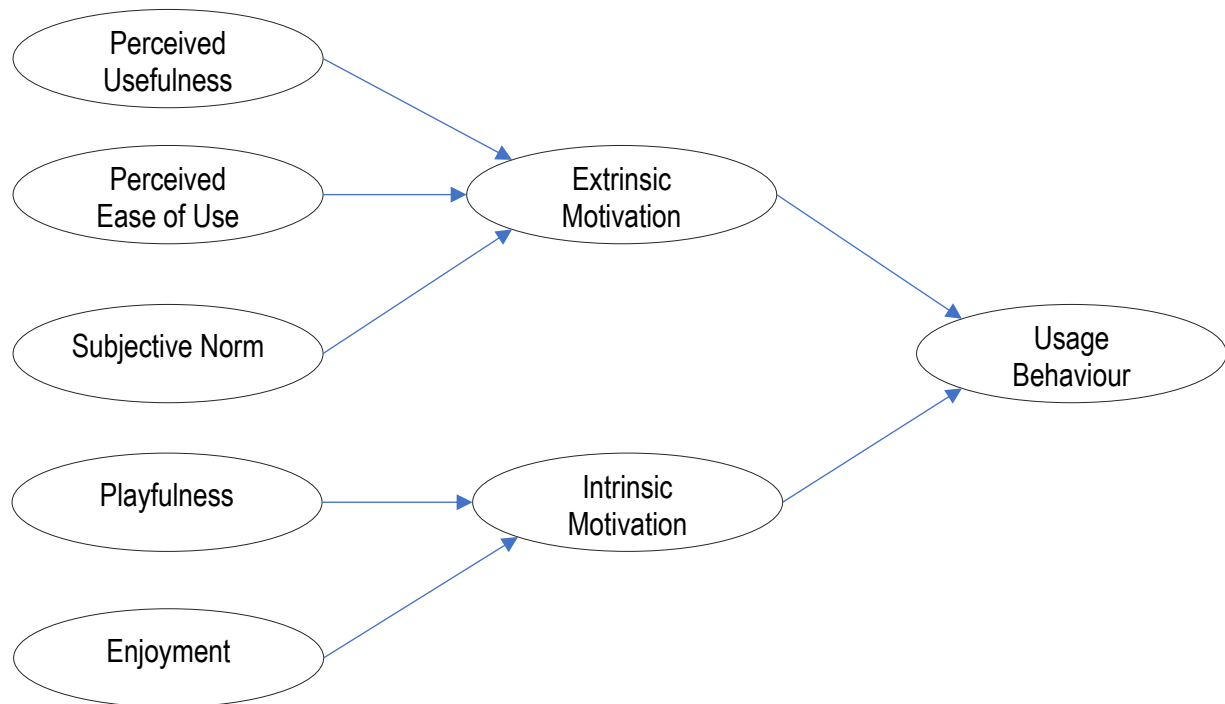


Figure 2-11: Motivation Model (Davis et al., 1992)

The Motivation Model (Davis et al., 1992) applies concepts from general motivation theories in psychology to the use of technology. More specifically, the authors distinguish between Extrinsic and Intrinsic Motivators. The former relates to the expectation that technology can be instrumental in achieving outcomes distinct from the usage in itself, whereas the latter is associated with the activity of using technology in se. As the models preceding the MM focused mainly on Perceived Usefulness as an explanatory factor for technology adoption, the major theoretical contribution of the MM is the inclusion of intrinsic motivators, more specifically Enjoyment, as factors explaining individual technology acceptance behaviour (Davis et al., 1992). The model is shown in Figure 2-11.

#### 2.4.11 Expectation-Confirmation Model (ECM)

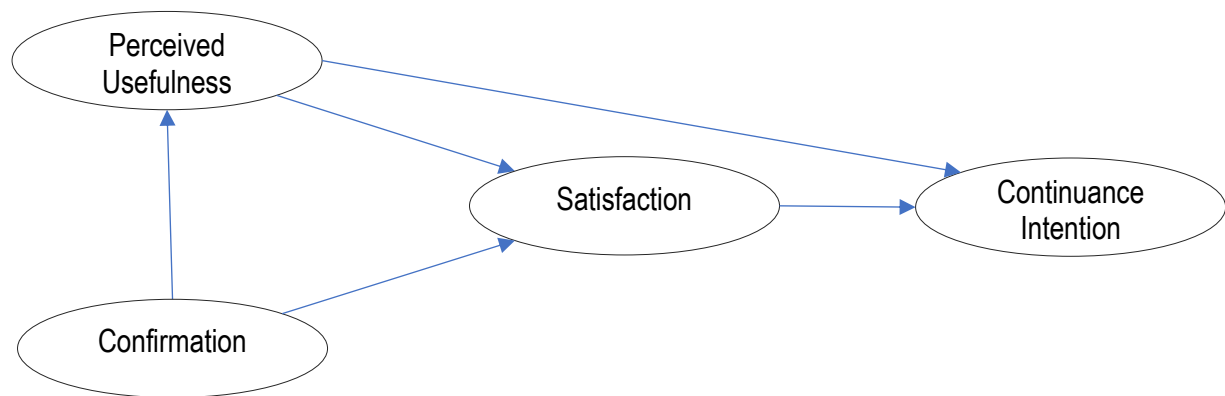


Figure 2-12: Expectation-Confirmation Model (Bhattacharjee, 2001b)

As the commercial value of repeat purchases typically eclipses that of the initial purchase, Bhattacharjee (2001b) added the concept of Continuance of Usage to the Motivation Model.

Based on the observation that earlier models assume that the factors influencing repeat usage are strongly correlated with the factors explaining initial usage, the author theorises that Continuance of Usage is determined by Satisfaction of use and the Perceived Usefulness of continued usage. The former on its turn is influenced by Confirmation, the extent to which the Perceived Usefulness meets or exceeds the prior expectations held by the individual. Both are dynamic measures, as the individual expectations are adjusted based on confirmation or disconfirmation with every subsequent usage. As Satisfaction is dependent of expectation, the former is dynamically adjusted with every usage occasion as well.

The Expectation-Confirmation Model is illustrated in Figure 2-12.

#### 2.4.12 Information Systems Success Model (ISSM)

In information systems research, a significant amount of attention has been directed towards identifying the factors that contribute to the success of information systems. A critical question is the definition of what constitutes success in this context. As different authors have utilised a

different definition of information systems success, this has created hurdles to the advancement of theory in this academic domain (DeLone & McLean, 1992).

The authors have built a taxonomy of what can be considered success in information systems, and came up with five dimensions: system quality, information quality, use, user satisfaction, individual impact, and organisational impact. These dimensions have been integrated as factors into a model, which has been referred to as the IS Success Model (DeLone & McLean, 1992). In this model, visualised in Figure 2-13, use of technology is theorised to be influenced by system quality, information quality and user satisfaction. Use and satisfaction drive impact of IS on the individual level, and subsequently on the organisational level.

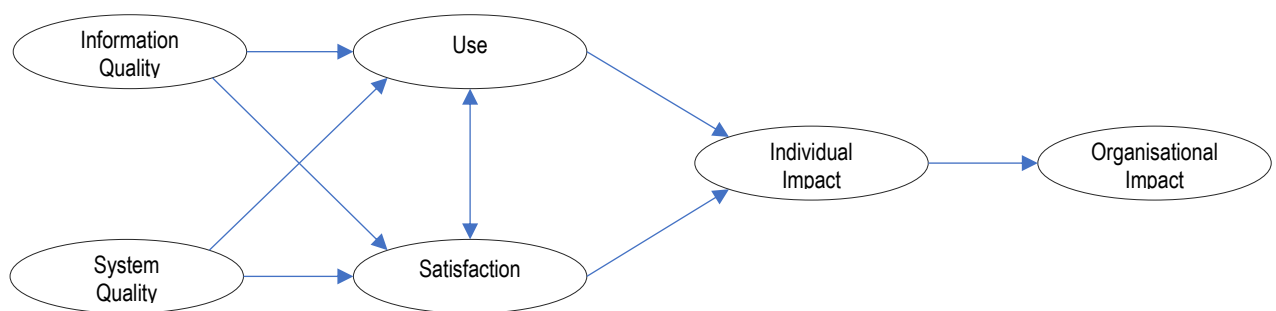


Figure 2-13: Original IS Success Model (DeLone & McLean, 1992)

A later incarnation of their model, illustrated in Figure 2-14, adds service quality as an influencing factor and collapses individual and organisational impact into one single factor ‘net benefits’. Furthermore, the authors suggest to selectively replace ‘use’ by ‘intention to use’, to solve for some theoretical and practical concerns with the model as initially proposed (DeLone & McLean, 2003).

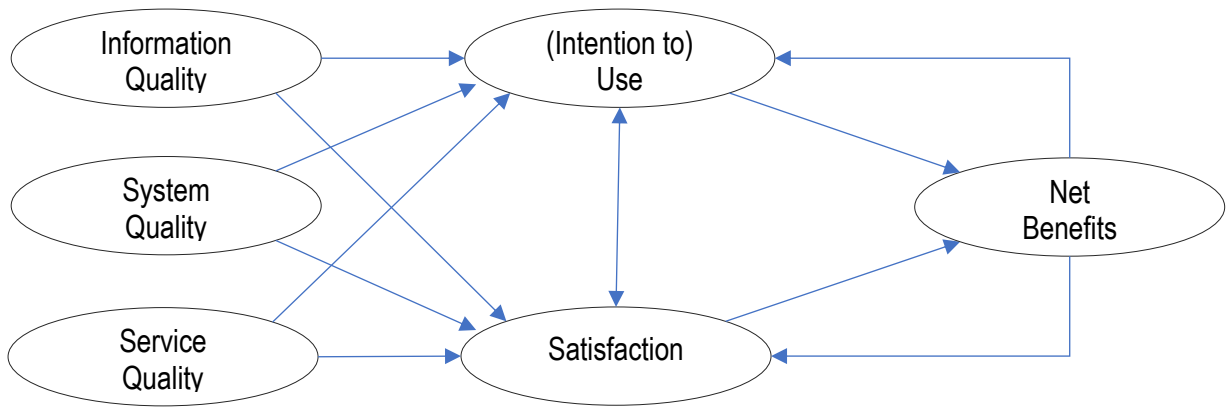


Figure 2-14: Updated IS Success Model (DeLone & McLean, 2003)

The lynchpin of this model is the variable Use of the technology, or its preceding variable Intention to Use, as the various technology acceptance models use these as the dependent variables, covering both actual (or objective) use and reported (or subjective) use – with far more researchers using the latter (Walldén et al., 2016).

#### 2.4.13 Unified Theory of Acceptance and Use of Technology (UTAUT)

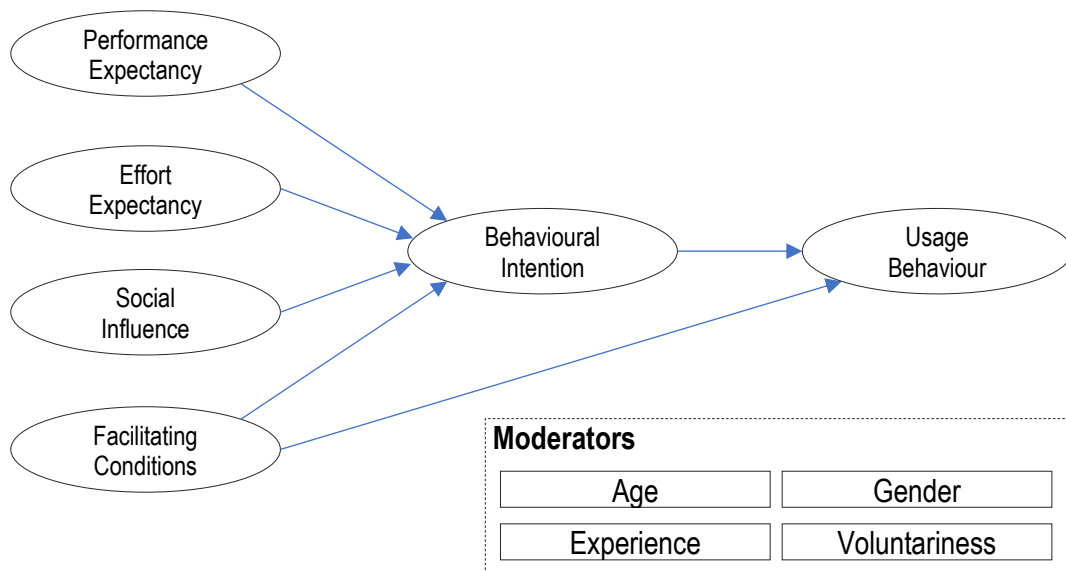


Figure 2-15: Unified Theory of Acceptance and Use of Technology (Venkatesh, Morris, Davis, & Davis, 2003)

Venkatesh et al. (2003) developed the Unified Theory of Acceptance and Use of Technology (UTAUT), integrating elements from eight prior models: TRA, TAM, TPB, TAM-TPB, MPCU, SCT, IDT and MM.

Comparing the different constructs of the retained models, UTAUT proposes following constructs: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions. These four constructs are precedents for Behavioural Intention, which on its turn is a precedent of Use Behaviour. UTAUT also identifies four moderators: Gender, Age, Experience and Voluntariness of Use.

The sheer number of constructs, preceding observable variables and moderators has been a source of criticism on the UTAUT model, claiming the model to be less parsimonious as the TAM (Bagozzi, 2007; Van Raaij & Schepers, 2008). This model is shown in Figure 2-15.

#### 2.4.14 Unified Theory of Acceptance and Use of Technology 2 (UTAUT2)

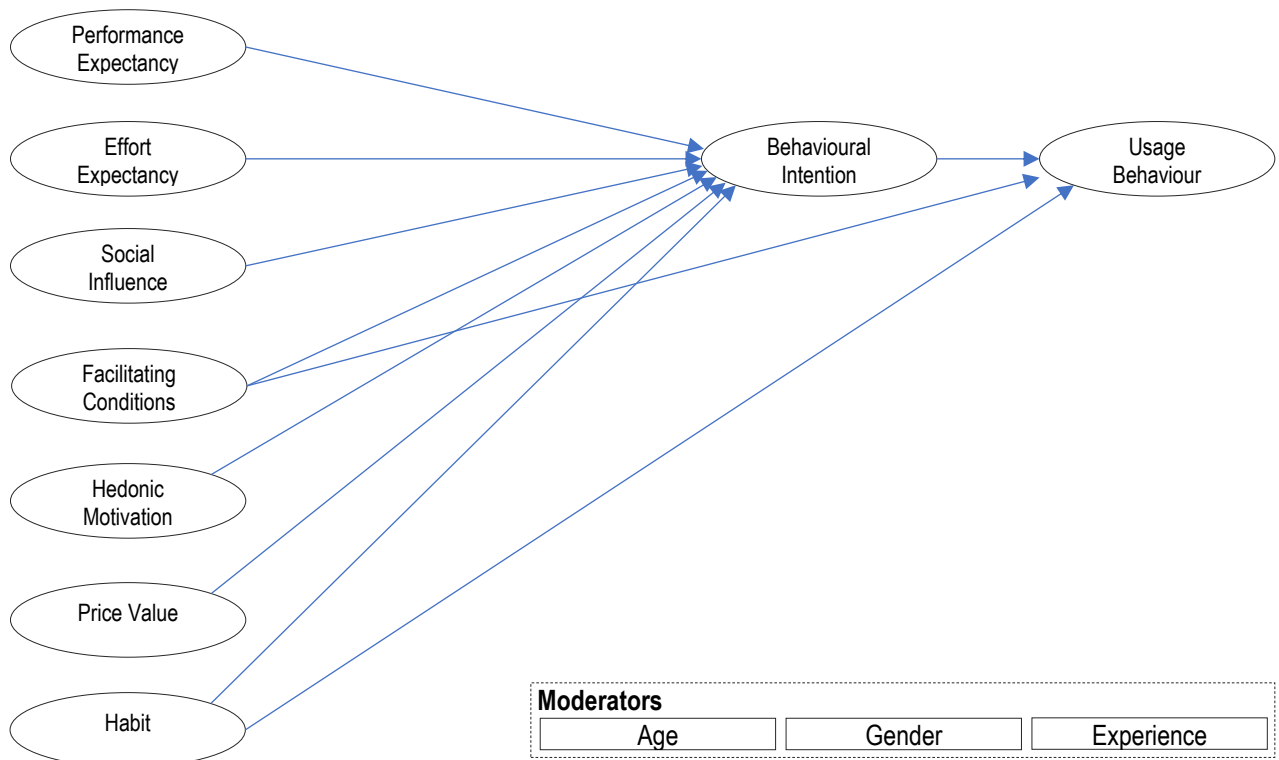


Figure 2-16: Unified Theory of Acceptance and Use of Technology 2 (Venkatesh et al., 2012)

The UTAUT model has been expanded on to incorporate factors that can predict adoption specific to a consumer context, adding Hedonic, Price/Cost and Habit as determining factors for technology adoption: UTAUT2 (Venkatesh et al., 2012). This model, as in Figure 2-16, has



since emerged as a reference for technology adoption by consumers (Tamilmani, Rana, Wamba, & Dwivedi, 2021).

#### 2.4.15 Unified Theory of Acceptance and Use of Technology 2 Extended (UTAUT2E)

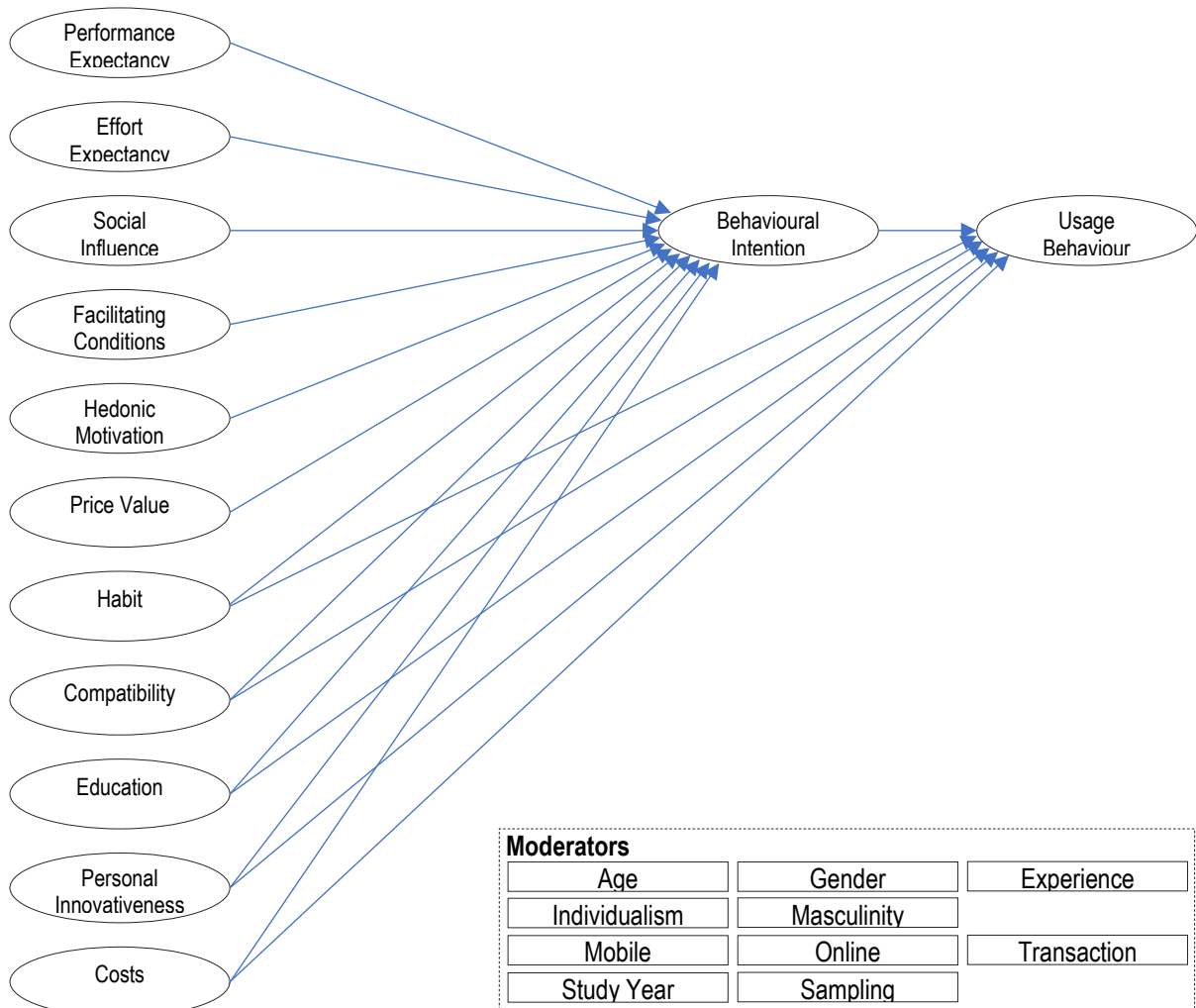


Figure 2-17: Unified Theory of Acceptance and Use of Technology 2 Extended (Blut, Chong, Tsiga, & Venkatesh, 2021)

Based on an extensive meta-analysis of existing research based on the UTAUT and the UTAUT2 models, a group of researchers including the lead author of the previous UTAUT articles, have published an update of the model (Blut et al., 2021). The update introduces a number of factors hailing from other models and extensions, i.e. Compatibility, Education, Personal Innovativeness and Costs.

The authors explicitly mention the need for researchers to pay more attention to dependent variables at the group/organisation level, such as team performance or firm performance, impacts that have been explicitly mentioned in the ISSM.

The updated model, shown in Figure 2-17, also significantly increases the number of moderators, introducing National Culture (individualism, masculinity), Technology (mobile, online, transaction) and Controls (study year, sampling).

## 2.5 Interrelationships between Technology Acceptance Models

As illustrated above, the various technology models were not developed as stand-alone frameworks, but built on and expanded on earlier models or sought to combine (parts of) other models in order to enhance the validity and reliability, and hence their value to theory and practice.

This allows to establish the interrelationships between the various models.

Figure 2-18 visually represents the interrelationships between the most cited technology acceptance models, indicating how subsequent models built on or expanded on earlier models while also representing the chronology of the different models.

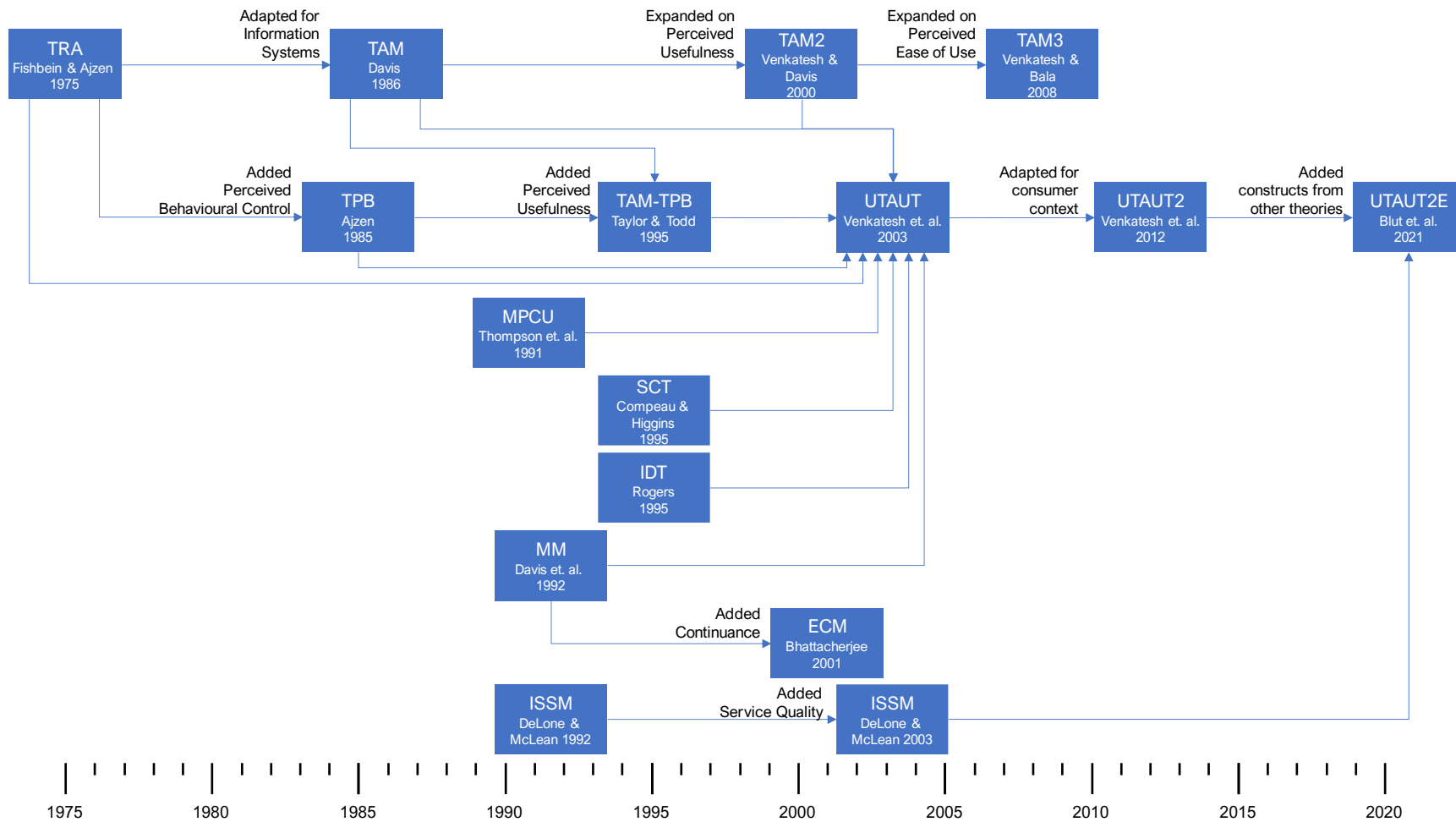


Figure 2-18: Chronology and interrelationships of popular technology acceptance models. Source: author

What is generally considered the first technology acceptance model, Fishbein and Ajzen (1975) introduced the Theory of Reasoned Action (TRA), drawing on theories from social psychology. The TRA posits that the stated intention to adopt a certain behaviour is the best predictor to that behaviour. The intent is driven by two main factors, the individual's attitude towards the behaviour, and the subjective norm, the attitude of others who are considered relevant by the individual.

An individual's attitude toward a behaviour is the product of the probability of a certain outcome and the evaluation of the outcome, whether the outcome is deemed positive or not by the individual.

The subjective norm is the product of a normative belief, the extent to which referent groups consider the outcome of the action as positive, and the motivation of the individual to comply with the perceived normative beliefs of the referent groups.

The model intends to explain behaviour, as exemplified by the fact that the name of the model includes the term 'action'. However, the conclusion that behavioural intention is a strong predictor of behaviour, has led to the development of models predicting behavioural intention, rather than behaviour itself (Salahshour Rad et al., 2018). Subsequent research has confirmed the hypothesis that intention is the best predictor for behaviour, although the gap between both remains non-negligible (Sheeran, 2002). Another point of interest is the distinction between actual and reported usage, with the bulk of research using some form of self-reported usage, which in itself can induce bias in the findings (Walldén et al., 2016).

TRA was used as basis to develop a strain of technology acceptance models that have been shown to be amongst the most cited models in IS literature. The Technology Adoption Model (Davis, 1989) expanded on the attitude measures from the TRA to include Perceived

Usefulness and Perceived Ease of Use, constructs rooted in the Expectancy-Value Theory (Wigfield & Cambria, 2010).

Venkatesh and Davis published an extension of the TAM, referred to as TAM2, expanding on the constructs preceding Perceived Usefulness. Their stated intention was to facilitate managerial decision-making in an organisational context with the objective to increase user acceptance and usage of new information systems (Venkatesh & Davis, 2000).

Similar to the elaboration of the Perceived Usefulness construct in TAM2, a model labelled TAM3 elaborated on the Perceived Ease of Use (Venkatesh & Bala, 2008), to aid managerial decision making in an organisational context aimed at promoting the acceptance of information systems.

Ajzen, one of the original authors of the TRA, extended the model to make it more relevant in situations where the use of the technology would not be voluntary, but driven by factors outside of the individual's will (Ajzen, 1985). The Theory of Planned Behaviour (TPB) expanded on the TRA by adding constructs relating to Perceived Behavioural Control, reflecting individual perceptions of behavioural constraints, both internal and external (Taylor & Todd, 1995a). Taylor and Todd (1995a) used the key concepts of TAM – Perceived Usefulness and Perceived Ease of Use – as precedents of Behavioural Attitude, a key construct of the TPB in the combined TAM-TPB model.

Venkatesh et al. (2003) developed the Unified Theory of Acceptance and Use of Technology (UTAUT), integrating elements from eight prior models: TRA, TAM, TPB, TAM-TPB, MPCU, SCT, IDT and MM.

The sheer number of constructs, preceding observable variables and moderators has been a source of criticism on the UTAUT model, claiming the model to be less parsimonious as the

TAM (Bagozzi, 2007; Van Raaij & Schepers, 2008). This criticism would be even more relevant for two further extensions of the UTAUT model. UTAUT2 (Venkatesh et al., 2012) incorporate factors that can predict acceptance specific to a consumer context, a unique postulate within technology acceptance models. UTAUT2E, based on extensive meta-analysis of technology acceptance models, introduces a number of factors hailing from other models and extensions (Blut et al., 2021), as such significantly increasing the number of independent variables and moderators.

### 2.5.1 Comparison of the Various Technology Acceptance Models

In order to compare the various widely used technology acceptance models, we propose a multi-level categorisation of the factors identified across the models.

*Table 2-4: Definitions of factors utilised in widely used technology acceptance models. Source: author*

<b>Factor</b>	<b>Definition</b>	<b>Source</b>
Affect	"... individual's affect (or liking) for a particular behaviour"	Compeau and Higgins (1995)
Anxiety	"... the tendency of an individual to be uneasy, apprehensive, or fearful about current or future use of [technology] in general."	Igbaria, Pavri, and Huff (1989)
Attitude Toward Behaviour	"... a learned predisposition to respond to an object in a consistently favourable or unfavourable manner."	Fishbein and Ajzen (1975)
Behavioural Intention	"... instructions that people give to themselves to behave in certain ways"	Triandis (1979)
Compatibility	"the degree to which use of the [technology] is compatible with, or requires change, in one's job"	G. C. Moore and Benbasat (1991)
Complexity	"the degree to which an innovation is perceived as relatively difficult to understand and use."	Everett M. Rogers and Shoemaker (1971)
Confirmation	"Users' perception of the congruence between expectation of [technology] use and its actual performance."	Bhattacharjee (2001b)
Continuance Intention	"Users' intention to continue using [technology]."	Bhattacharjee (2001b)
Costs	"The extent to which a user perceives that using a technology is costly"	L. Zhang, Zhu, and Liu (2012)
Education	"The education level of the user."	Blut et al. (2021)
Effort Expectancy	".... the degree of ease associated with the use of the system."	Venkatesh et al. (2003)
Encouragement By Others	"encouragement of others within the individual's reference group - the people to whom an individual looks to obtain guidance on behavioural expectation."	Compeau and Higgins (1995)
Facilitating Conditions	"... objective factors, 'out there' in the environment, that [...] make an act easy to do"	Triandis (1979)
Habit	"... situation-behaviour sequences that are or have become automatic, so that they occur without self-instruction"	Triandis (1979)

<b>Factor</b>	<b>Definition</b>	<b>Source</b>
Hedonic Motivation	"... the fun or pleasure derived from using a technology"	Venkatesh et al. (2012)
Image	"the degree to which the use of the [technology] enhances one's image or status within the organisation."	G. C. Moore and Benbasat (1991)
Information Quality	"... desired characteristics such as accuracy, meaningfulness, and timeliness."	DeLone and McLean (1992)
Job Fit	"... the extent to which an individual believes that using a [technology] can enhance the performance of his or her job"	Thompson and Higgins (1991)
Job Relevance	"... an individual's perception regarding the degree to which the target system is applicable to his or her job."	Venkatesh (2000)
Long-Term Consequences	"... outcomes that have a pay-out in the future"	Thompson and Higgins (1991)
Objective Usability	"... a comparison of systems based on the actual level (rather than perceptions) of effort required to completing specific tasks."	Venkatesh (2000)
Outcome Expectations	"... how likely [...] each of these outcomes would result from their use of [technology]"	Compeau and Higgins (1995)
Output Quality	"... how well the system performs [...] tasks [matching job goals]"	Venkatesh and Davis (2000)
Peer Influence	"... perceptions that [peers] desire the individual to perform or not perform a behaviour."	Taylor and Todd (1995b)
Perceived Behavioural Control	"... perceptions of internal and external constraints on behaviour."	Taylor and Todd (1995b)
Perceived Ease Of Use	"the degree to which a person believes that using a particular system would be free of effort."	Davis (1989)
Perceived Enjoyment	"... the extent to which the activity of using a specific system is perceived to be enjoyable in it's own right."	Venkatesh (2000)
Perceived Usefulness	"the degree to which a person believes that using a particular system would enhance his or her job performance."	Davis (1989)
Performance Expectancy	"... the degree to which an individual believes that using the system will help him or her to attain gains in job performance"	Venkatesh et al. (2003)
Personal Innovativeness	"Represents an individual characteristic reflecting a willingness to try out any new technology"	Agarwal and Karahanna (2000)
Playfulness	"... the degree of cognitive spontaneity in [technology] interactions."	Webster and Martocchio (1992)
Price Value	"... consumers' cognitive trade-off between the perceived benefits of the applications and the monetary cost for using them."	Venkatesh et al. (2012)
Relative Advantage	"the degree to which an innovation is perceived as being better than its precursor"	G. C. Moore and Benbasat (1991)
Results Demonstrability	"... tangibility of the results of using the innovation, including their Observability and Communicability, ..."	G. C. Moore and Benbasat (1991)
Satisfaction	"Users' affect with (feelings about) prior [technology] use."	Bhattacharjee (2001b)
Self-Efficacy	"... an individual's perceptions of his or her ability to use [technology] in the accomplishment of a task..."	Compeau and Higgins (1995)
Service Quality	"... service dimensions of tangibles, reliability, responsiveness, assurance, and empathy"	Pitt, Watson, and Kavan (1995)
Social Factors	"The individual's internalisation of the reference group's subjective culture and specific interpersonal agreements that the individual has made with others, in specific social situations"	Triandis (1979)
Social Influence	"The extent to which members of a social network influence one another's behaviour"	Venkatesh and Brown (2001)
Subjective Norm	"... the person's perception that most people who are important to him think he should or should not perform the behaviour in question."	Fishbein and Ajzen (1975)
Superiors Influence	"... perceptions that [superiors] desire the individual to perform or not perform a behaviour."	Taylor and Todd (1995b)

<b>Factor</b>	<b>Definition</b>	<b>Source</b>
System Quality	"... the desired characteristics of the information system itself which produces the information"	DeLone and McLean (1992)
Visibility	"... the enhancement of positive affect toward a given object, [...] as a result of repeated stimulus exposure."	Zajonc and Markus (1982)
Voluntariness Of Use	"... the degree to which the use of the [technology] is perceived as being voluntary."	G. C. Moore and Benbasat (1991)



Table 2-5: Taxonomy of constructs in widely used technology acceptance models Source: author

Levels		TRA	TAM	TAM2	TAM3	TPB	TAM-TPB	MPCU	MM	ECM	SCT	IDT	ISSM	UTAUT	UTAUT2	UTAUT2E		
1	2	3	<i>Fishbein and Ajzen (1975)</i>	<i>Davis (1989)</i>	<i>Venkatesh and Davis (2000)</i>	<i>Venkatesh and Bala (2008)</i>	<i>Ajzen (1985)</i>	<i>Taylor and Todd (1995a)</i>	<i>Thompson and Higgins (1991)</i>	<i>Davis et al. (1992)</i>	<i>Bhattacharjee (2001b)</i>	<i>Compeau and Higgins (1995)</i>	<i>G. C. Moore and Benbasat (1991)</i>	<i>DeLone and McLean (1992)</i>	<i>Venkatesh et al. (2003)</i>	<i>Venkatesh et al. (2012)</i>	<i>Blut et al. (2021)</i>	
Extrinsic	Instrumental	Usefulness		Perceived usefulness	Perceived usefulness	Perceived usefulness		Perceived usefulness		Perceived usefulness	Perceived usefulness	Outcome expectations	Relative advantage		Performance expectancy	Performance expectancy	Performance expectancy	
		Job relevance			Job relevance	Job relevance			Job fit									
		Output quality			Output quality	Output quality								Information quality				
		Results demonstrability			Results demonstrability	Results demonstrability							Results demonstrability					
		Long-term consequences							Long-term consequences									
		Confirmation									Confirmation							
	Price value															Price value	Price value/ Costs	
	Social	Subjective norm			Subjective norm	Subjective norm	Subjective norm	Subjective norm, Peer influence, Superiors' influence	Social factors	Subjective norm			Encouragement by others			Social influence	Social influence	Social influence
		Others use											Other's use	Visibility				
		Image			Image	Image								Image				
Behavioural control					Perception of external control	Perceived behavioural control	Perceived behavioural control						Voluntariness of use					
Intrinsic	Effort	Ease of use		Perceived ease of use	Perceived ease of use	Perceived ease of use		Ease of use	Complexity	Perceived ease of use			Ease of use		Effort expectancy	Effort expectancy	Effort expectancy	
		Self-efficacy				Self-efficacy		Self-efficacy				Self-efficacy						
		Objective usability				Objective usability								System quality				
		Facilitating conditions						Resource/ Technology facilitating conditions	Facilitating conditions				Support			Facilitating conditions	Facilitating conditions	Facilitating conditions
		Compatibility												Compatibility				Compatibility
		Habit															Habit	Habit
	Education																Education	
	Affect	Playfulness				Playfulness					Playfulness							
		Enjoyment				Perceived enjoyment					Enjoyment						Hedonic motivation	Hedonic motivation
		Satisfaction										Satisfaction		Satisfaction				
Anxiety					Anxiety						Anxiety							
Innovativeness																	Innovativeness	
Attitude toward behaviour		Attitude toward behaviour	Attitude toward usage			Attitude toward behaviour	Attitude toward behaviour	Affect towards use				Affect				Attitude toward behaviour	Attitude toward behaviour	
Behavioural intention	Behavioural intention	Intention to use	Intention to use	Intention to use	Behavioural intention	Behavioural intention				Continuance intention				Behavioural intention	Behavioural intention	Behavioural intention		
Behaviour	Actual behaviour	Actual behaviour	Actual usage	Actual usage	Actual usage	Actual behaviour	Actual behaviour	PC Utilisation	Behaviour			Usage	Adoption		Use behaviour	Use behaviour	Use behaviour	

At the top level, we adopt the categories put forward by Davis et al. (1992) in the Motivation Model (MM). They state that motivation theorists often distinguish between two broad classes of motivators to perform a certain behaviour: Extrinsic and Intrinsic.

Extrinsic motivators influence behaviour because they are instrumental in achieving outcomes distinct from performing the activity in itself, and the value of those outcomes reinforce the usage behaviour (Davis et al., 1992). There are two broad categories that can be considered as extrinsic motivators: instrumental factors, related to how the subject itself perceives or qualifies the output, and social influence factors, related to how others perceive or qualify a given output (Venkatesh & Davis, 2000).

Perceived Usefulness, as an exemplar of an instrumental factor (Davis et al., 1992), is present in many technology models, notably TAM and its derivatives TAM2, TAM3, TAM-TPB, in MM, ECM, UTAUT, UTAUT2 and UTAUT2E. It has been defined as ‘the degree to which a person believes that using a particular system would enhance his or her job performance’ (Davis, 1989). Other models include motivators that also refer in their definition to job and performance, including Job Fit (MPCU), Output Expectations (SCT), Relative Advantage (IDT), and Performance Expectancy (UTAUT, UTAUT2). A number of models also define other instrumental constructs, such as Job Relevance (TAM2, TAM3) or Output Quality (TAM2, TAM3), Results Demonstrability (TAM2, TAM3, IDT). The factor Information Quality (ISSM) reflects the quality aspects of the output of the system, and is therefore assimilated to Output Quality. Other instrumental constructs are specific to one model, such as Long-term Consequences (MPCU), Confirmation (ECM), Price Value (UTAUT2, UTAUT2E) and Costs (UTAUT2E).

The second category within extrinsic motivators are social influence factors. Subjective Norm, which can be categorised as a social factor (Venkatesh & Davis, 2000), is present in many

models, including TRA, TAM2, TAM3, TPB, TAM-TPB and MM, as are constructs that in their definition also refer to interpersonal influences by others that are part of the subject's reference groups, whether private or professional. These constructs include Social Factors (MPCU), Encouragement by Others (SCT) and Social Influence (UTAUT, UTAUT2, UTAUT2E). The TAM-TPB model expands on subjective norm by externalising two social influence constructs, Peer Influence and Superior's Influence. The SCT model include a behavioural social construct with Others' Use (SCT), with a similar construct labelled as Visibility is used in IDT. Although the latter is defined slightly different, based on the works of Zajonc and Markus (1982), in the operationalisation of the construct, the authors of the IDT clearly refer to the use of the technology by others (G. C. Moore & Benbasat, 1991). A specific one-directional construct Image is found in different models (TAM2, TAM3, IDT), Visibility (IDT). Many models also include Perceived Behaviour Control (TAM3, TPB, TAM-TPB) or the related Voluntariness of Use (IDT) to express the role of individual usage within a broader organisational context.

As opposed to extrinsic motivators, intrinsic motivators influence behaviour for no other reinforcement as performing the activity in itself (Davis et al., 1992). The authors refer to constructs as Perceived Ease of Use, Output Quality, Enjoyment, Self-Efficacy, Competence and Self-Determination. (Perceived) Ease of Use has been present in the original TAM and all of its successors (TAM2, TAM3, TAM-TPB) and in the MM and IDT. Venkatesh et al. (2003) define an Effort Expectancy construct with a very similar definition for the UTAUT, UTAUT2 and UTAUT2E. The construct Complexity used in the MCPU has been defined as the opposite of Ease of Use. Self-Efficacy is present as a construct in TAM3, TAM-TPB and SCT. TAM3 adds a complementary Objective Usability construct to the subjective Self-Efficacy. In the ISSM, the factor System Quality refers to the quality characteristics of the system itself, and can be assimilated to Objective Usability. Thompson and Higgins (1991) introduce the

Facilitating Conditions construct, based on the work of Triandis (1979), pointing towards objective external factors. This construct has been integrated into UTAUT, UTAUT2 and UTAUT2E. Compeau and Higgins (1995) also refer to Triandis' definition to external factors affecting the use of technology, but label it Support in the SCT. The construct Service Quality as present in the ISSM refers to the quality of support, which supports equating it to Support. In the IDT, the authors include Compatibility, referring to the effect of external factors, ex-post rather than ex-ante (G. C. Moore & Benbasat, 1991). This factor has also been included in UTAUT2E. Habit has been included in the two most recent UTAUT extensions, whereas the most recent update has also included the level of Education as an explanatory factor.

Next to these factors, relating to the effort required, the extrinsic motivators also include factors that appeal to the Affect. Triandis (1979) defines Affect as positive emotions, including joy, elation and pleasure. In TAM3 and MM, these emotions are operationalised as Playfulness and (Perceived) Enjoyment, whereas UTAUT2 has one construct labelled Hedonic Motivation. The ECM looks ex-post to Affect, with a construct characterised as Satisfaction, also present in the ISSM. TAM3 and SCT include a construct which is the opposite of Affect, labelled Anxiety.

Finally, the passage from Affect to Behaviour not being sharply delineated, most models include an attitudinal construct as a first step towards behaviour, referred to as Attitude toward Behaviour (TRA, TAM, TPB, TAM-TPB) or Affect towards Use (MPCU, SCT). These attitudinal constructs typically precede an intention construct: Behavioural Intention (TRA, TPB, TAM-TPB, UTAUT, UTAUT2, UTAUT2E) or Intention to Use (TAM, TAM2, TAM3, ISSM). Bhattacharjee (2001b) adds a dynamic dimension to the intention construct: Continuance Intention (ECM).

The final construct in most models is actual behaviour (Behaviour, Usage, Utilisation, Adoption), with the exception of the ECM, where the final model construct is intention

(Bhattacharjee, 2001b), and the ISSM, where impact on the individual or the organisation are dependent on Use/Intention to Use and User Satisfaction (DeLone & McLean, 1992, 2003).

### 2.6 Systematic Literature Review

A review of articles that presented empirical research on technology acceptance in the field of payment methods was carried out, published in English-language peer-reviewed journals since 2010, accessible through Northumbria University Library services, rated by the UK Chartered Association of Business Schools (ABS) (for selection criteria and column legends see Table 2-8).

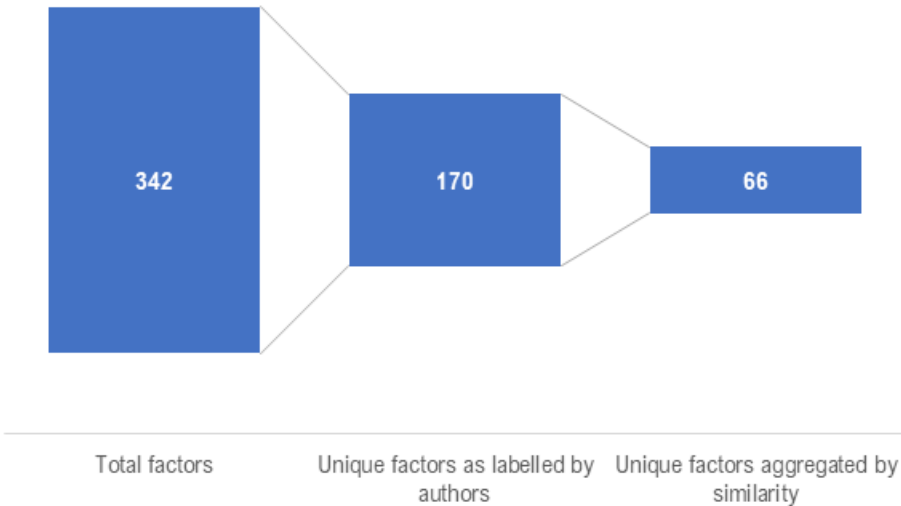


Figure 2-19: Funnel diagram of factors identified in the systematic literature review. Source: author

In total, 40 articles were selected, identifying a total of 342 factors, representing 170 unique constructs, as labelled by the authors. Aggregating different factors with similar definitions as found in the literature further reduces the number of factors to 66. This is presented visually in Figure 2-19. The factors and their number of occurrences are presented in

Table 2-6.

Table 2-6: Factors impacting payment technology acceptance: occurrences from the literature review. Source: author

Factor	#	Factor	#	Factor	#	Factor	#
Behavioural Intention	38	Experience	5	Asset Specificity	1	Number of Workers	1
Performance Expectancy	37	Gender	5	Assurance	1	Payment Method	1
Social Influence	29	Actual Behaviour	3	Benevolence	1	Payment Procedure	1
Effort Expectancy	28	Convenience	3	Business Tie	1	Personal Propensity To Trust	1
Trust	21	Image	3	Comparison	1	Reliability	1
Facilitating Conditions	13	Mobility	3	Confirmation	1	Reputation	1
Risk	13	Network Externalities	3	Customer Service	1	Results Demonstrability	1
Attitude	12	Others' Use	3	Decision-Making Style	1	Structural Assurances	1
Security	11	Education	2	Design	1	System Quality	1
Price Value	9	Habit	2	Functionality	1	Task	1
Innovativeness	8	Income	2	Grievance Redressal	1	Task Technology Fit	1
Anxiety	7	Output Quality	2	Industry	1	Technology Characteristics	1
Compatibility	7	Recommendation	2	Integrity	1	Trialability	1
Hedonic Motivation	7	Service Quality	2	Mood	1	Type of Cards	1
Satisfaction	7	Speed	2	Need for Gratification	1	Uncertainty	1
Age	6	Time Risk	2			Wellbeing	1
Privacy	6	Ubiquity	2				
Self-Efficacy	6						

Out of 40 articles identified, only 2 present results on the acceptance by merchants, and only 1 presents research on the interrelationship between consumers and merchants (J. Wang & Lai, 2020).

Because of the abstraction made of the acceptance side (merchants), most authors focus on the hardware used by consumers, amalgamating proximity payments (using NFC/RFID, QR or Bluetooth technologies, all requiring different technologies at the merchant side) with online payments, although it has been demonstrated that usage and acceptance can differ significantly (De Luna, Liébana-Cabanillas, Sánchez-Fernández, & Muñoz-Leiva, 2019).

The literature review also confirms the observation that mobile payments garner significantly more attention than other forms of payment, although they represent less than 10% of all payment transactions made at the point of sale in the UK (Worldpay from FIS, 2022). 38 out of 40 articles cover mobile payments, with the remaining two covering online payments and contactless payments, both of which can be done using a mobile phone as well.



Table 2-7: Literature review on payment technology adoption 2010-2022. Source: author

Author	Article	Year	Journal	Technology	Geo	Consumer	Merchant	n	DOI	ECM	TAM	TPB	TRA	TTF	UTAUT	UTAUT2	Other
Bailey, Pentina, Mishra, & Ben Mimoun	Mobile payments adoption by US consumers: an extended TAM	2017	International Journal of Retail and Distribution Management	Mobile Payment	USA	General		240			●						●
Cao, Yu, Liu, Gong & Adeel	Understanding mobile payment users' continuance intention:a trust transfer perspective	2018	Internet Research	Mobile Payment	China	Mobile payment users		219		●							●
Chang, Chen, Xu & Xiong	Towards the Customers' Intention to Use QR Codes in Mobile Payments	2021	Journal of Global Information Management	Mobile Payment	China	General		422							●		●
Chin, Harris & Brookshire	An Empirical Investigation of Intent to Adopt Mobile Payment Systems Using a Trust-based Extended Valence Framework	2020	Information Systems Frontiers	Mobile Payment	USA	General		234					●				●
Cocosila & Trabelsi	An integrated value-risk investigation of contactless mobile payments adoption	2016	Electronic Commerce Research and Applications	Mobile Payment	Canada	Mobile phone users		289					●				●
Di Pietro, Mugion, Mattia, Renzi & Toni	The Integrated Model on Mobile Payment Acceptance (IMMPA): An empirical application to public transport	2015	Transportation Research Part C	Mobile Ticketing	Italy	Public Transport users		439	●		●				●		●
Esfahani & Bulent Ozturk	The influence of individual differences on NFC-based mobile payment adoption in the restaurant industry	2019	Journal of Hospitality and Tourism Technology	Mobile Payment Proximity	USA	Restaurant patrons		410									●
Gao & Waechter	Examining the role of initial trust in user adoption of mobile payment services: an empirical investigation	2015	Information Systems Frontiers	Mobile Payment	Australia	General		851			●						●

Author	Article	Year	Journal	Technology	Geo	Consumer	Merchant	n	DOI	ECM	TAM	TPB	TRA	TTF	UTAUT	UTAUT2	Other
Gong, Zhang, Chen, Cheung & Lee	What drives trust transfer from web to mobile payment services? The dual effects of perceived entitativity	2020	Information & Management	Mobile Payment Remote	China	Alipay users		575									●
Johnson, Kiser, Washington & Torres	Limitations to the rapid adoption of M-payment services: Understanding the impact of privacy risk on M-Payment services	2018	Computers in Human Behavior	Mobile Payment Remote	USA	General		270	●								
Kalinic, Marinkovic, Molinillo & Liébana-Cabanillas	A multi-analytical approach to peer-to-peer mobile payment acceptance prediction	2019	Journal of Retailing and Consumer Services	Mobile Payment P2P	Spain	General		701	●	●	●	●				●	●
Kar	What Affects Usage Satisfaction in Mobile Payments? Modelling User Generated Content to Develop the "Digital Service Usage Satisfaction Model"	2020	Information Systems Frontiers	Mobile Payment Remote	India	Payment tweets		400K									●
Karimia & Liu	The differential impact of "mood" on consumers' decisions, a case of mobile payment adoption	2020	Computers in Human Behavior	Mobile Payment Proximity	UK	Non-users		322									●
Khalilzadeh, Bulent Ozturk & Bilgihan	Security-related factors in extended UTAUT model for NFC based mobile payment in the restaurant industry	2017	Computers in Human Behavior	Mobile Payment Proximity	USA	Restaurant patrons		412							●		
Kim, Mirusmonov & Lee	An empirical examination of factors influencing the intention to use mobile payment	2010	Computers in Human Behavior	Mobile Payment Remote	South Korea	Mobile payment users		269			●						
Leung, Hew, Tan & Ooi	Predicting the determinants of the NFC-enabled mobile credit card acceptance: A neural networks approach	2013	Expert Systems with Applications	Mobile Payment Proximity	Malaysia	Cardholders		262			●						●
Liébana-Cabanillas & Lara-Rubio	Predictive and explanatory modeling regarding adoption of mobile payment systems	2017	Technological Forecasting and Social Change	Mobile Payment	Spain		General	151									●

Author	Article	Year	Journal	Technology	Geo	Consumer	Merchant	n	DOI	ECM	TAM	TPB	TRA	TTF	UTAUT	UTAUT2	Other
Liébana-Cabanillas, Muñoz-Leiva & Sánchez-Fernández	A global approach to the analysis of user behavior in mobile payment systems in the new electronic environment	2018	Service Business	Mobile Payment Remote	Spain	Facebook users		2012			●						●
Liébana-Cabanillas, Sánchez-Fernández & Muñoz-Leiva	The moderating effect of experience in the adoption of mobile payment tools in Virtual Social Networks: The m-Payment Acceptance Model in Virtual Social Networks (MPAM-VSN)	2014	International Journal of Information Management	Mobile Payment Remote	Spain	Facebook users		2012			●		X		X		
Luna, Liébana-Cabanillas, Sánchez-Fernández & Muñoz-Leiva	Mobile payment is not all the same: The adoption of mobile payment systems depending on the technology applied	2019	Technological Forecasting and Social Change	Mobile Payment	Spain	General		287			●						
Oliveira, Faria, Thomas & Popoviç	Extending the understanding of mobile banking adoption: When UTAUT meets TTF and ITM	2015	International Journal of Information Management	Mobile Banking	Portugal	Mobile phone users		194						●	●		●
Oliveira, Thomas, Baptista & Camposa	Mobile payment: Understanding the determinants of customer adoption and intention to recommend the technology	2016	Computers in Human Behavior	Mobile Payment Remote	Portugal	General		301	●							●	●
Ozturk	Customer acceptance of cashless payment systems in the hospitality industry	2016	International Journal of Contemporary Hospitality Management	Contactless Payment	USA	Travellers		305			●						●
Park, Ahn, Thavisay & Ren	Examining the role of anxiety and social influence in multi-benefits of mobile payment service	2019	Journal of Retailing and Consumer Services	Mobile Payment	USA	Mobile phone users		361					●				●
Patil, Tamilmani, Rana & Raghavan	Understanding consumer adoption of mobile payment in India: Extending Meta-UTAUT model with personal innovativeness, anxiety, trust, and grievance redressal	2020	International Journal of Information Management	Mobile Payment Remote	India	Mobile phone users		491							●		●

Author	Article	Year	Journal	Technology	Geo	Consumer	Merchant	n	DOI	ECM	TAM	TPB	TRA	TTF	UTAUT	UTAUT2	Other
Purohit, Arora & Paul	The bright side of online consumer behavior: Continuance intention for mobile payments	2022	Journal of Consumer Behaviour	Mobile Payment	India	Mobile phone users		351		●							
Qasim & Abu-Shanab	Drivers of mobile payment acceptance: The impact of network externalities	2016	Information Systems Frontiers	Mobile Payment	Jordan	General		253							●	●	
Rahi & Abd.Ghani	Investigating the role of UTAUT and e-service quality in internet banking adoption setting	2019	TQM Journal	Internet Banking	Pakistan	Bank customers		398							●		
Santosa, Taufik, Prabowo & Rahmawati	Continuance intention of baby boomer and X generation as new users of digital payment during COVID-19 pandemic using UTAUT2	2021	Journal of Financial Services Marketing	Digital Payment	Indonesia	Digital Payment adopters aged 40-74		320								●	
Schierz, Schilke & Wirtz	Understanding consumer acceptance of mobile payment services: An empirical analysis	2010	Electronic Commerce Research and Applications	Mobile Payment	Germany	Mobile phone users		1447			●						●
Semerikova	What hinders the usage of smartphone payments in Russia? Perception of technological and security barriers	2020	Technological Forecasting and Social Change	Mobile Payment Proximity	Russia	Cardholders		1016									●
Singh, Sinha & Liébana-Cabanillas	Determining factors in the adoption and recommendation of mobile wallet services in India: Analysis of the effect of innovativeness, stress to use and social influence	2020	International Journal of Information Management	Mobile Payment	India	General		206			●					●	
Slade, Dwivedi, Piercy & Williams	Modeling Consumers' Adoption Intentions of Remote Mobile Payments in the United Kingdom: Extending UTAUT with Innovativeness, Risk, and Trust	2015	Psychology and Marketing	Mobile Payment Remote	UK	Non-users		268							●		
Tan, Ooi, Chong & Hew	NFC mobile credit card: The next frontier of mobile payment?	2014	Telematics and Informatics	Mobile Payment Proximity	Malaysia	Mobile phone users		156			●						●

Author	Article	Year	Journal	Technology	Geo	Consumer	Merchant	n	DOI	ECM	TAM	TPB	TRA	TTF	UTAUT	UTAUT2	Other
Teo, Tan, Ooi, Hew & Yew	The effects of convenience and speed in m-payment	2015	Industrial Management and Data Systems	Mobile Payment	Malaysia	General		194							●		
Wang & Lai	Exploring innovation diffusion of two-sided mobile payment platforms: A system dynamics approach	2020	Technological Forecasting and Social Change	Mobile Payment	Taiwan	Mobile payment users	General	438+239									●
Widyanto, Kusumawardani & Yohanes	Safety first: extending UTAUT to better predict mobile payment adoption by incorporating perceived security, perceived risk and trust	2021	Journal of Science and Technology Policy Management	Mobile Payment	Indonesia	Mobile phone users		358							●		●
Yang, Lu, Gupta, Cao & Zhang	Mobile payment services adoption across time: An empirical study of the effects of behavioral beliefs, social influences, and personal traits	2012	Computers in Human Behavior	Mobile Payment	China	Alipay users		639									●
Yang, Pang, Liu, Yen, & Tarn	Exploring consumer perceived risk and trust for online payments: An empirical study in China's younger generation	2015	Computers in Human Behavior	Online Payment	China	General		870			●						
Zhang & Mao	Cash, credit, or phone? An empirical study on the adoption of mobile payments in the United States	2020	Psychology and Marketing	Mobile Payment Proximity	USA	Non-users		394			●						

Table 2-8: Selection criteria and legend for the systematic literature review. Source: author

**Selection Criteria**

Field	Information Systems: Technology acceptance
Object	Payment methods
Type	Empirical research
Journals	Peer-reviewed academic journals, with open access or via Northumbria University
Impact	Rated by Academic Journal Guide 2021 - Chartered Association of Business Schools
Period	2010-2022
Databases	Scopus, Web of Science, Google Scholar, Semantic Scholar

**Legend**

Author	Name of author(s)
Article	Title of article
Year	Year of publication
Journal	Name of journal
ABS	Rating in Academic Journal Guide 2021 - Chartered Association of Business Schools
Technology	Type of technology researched
Geo	Geographical location of respondents
Consumer	Description of population, if consumers
Merchant	Description of population, if merchants
n	Number of respondents
DOI	Use of Diffusion of Innovations model (E.M. Rogers, 2003)
ECM	Use of Expectation-Confirmation model (Bhattacharjee, 2001b)
TAM	Use of Technology Acceptance model (Davis, 1985; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000)
TPB	Use of Theory of Planned Behaviour model (Ajzen, 1985)
TRA	Use of Theory of Reasoned Action model (Fishbein & Ajzen, 1975)
TTF	Use of Task-Technology Fit model (Goodhue & Thompson, 1995)
UTAUT	Use of Unified Theory for Acceptance and Use of Technology model (Venkatesh et al., 2003)
UTAUT2	Use of Unified Theory for Acceptance and Use of Technology 2 model (Venkatesh et al., 2012)
Other	Use of different or adapted models

## 2.7 Originality of Research and Research Gaps

In published research around multi-sided platforms, network externalities have been identified as the defining factor (Eisenmann et al., 2006; Hagiwara & Wright, 2015; McIntyre & Srinivasan, 2017; Parker et al., 2016). However, in extant IS literature on technology adoption and use, there's a dearth of understanding of how and through which mechanisms indirect network externalities are an influencing factor on adoption intent and behaviour.

In information systems research, more specifically on acceptance of new technologies, most studies tend to consider users as fully autonomous agents, whether as a consumer or as an organisational user (Salahshour Rad et al., 2018; Venkatesh et al., 2012). Indirect network externalities between groups of users within a network have sporadically been included in technology acceptance models (J. Wang & Lai, 2020), although findings suggest they should be emphasised as a major predictor of technology acceptance (Blut et al., 2021; Kumar et al., 2020; Mallat, 2007; Qasim & Abu-Shanab, 2016).

This research gap has been confirmed by a systematic literature review, highlighting a scarcity of empirical research including network externalities as a explanatory factor for the acceptance of new technologies.

The originality of this research is the addressing the observed research gap by including indirect network externalities between two sides of a platform as an explanatory factor for technology acceptance.

The empirical research will be developed with the context of the payment industry, a prototypical example of a two-sided platform (Kazan et al., 2018; Rochet & Tirole, 2003; Zhu & Iansiti, 2012), where the introduction of a new technology, contactless payments, has been

dependent on the acceptance by the two sides that characterise the two-sided platform, payers (consumers) and payees (merchants).

## 2.8 Summary

This chapter presented the current state of the research on the intersection between two-sided platforms and technology acceptance models, coming together by considering network externalities - the defining characteristic for platforms - as an influencing factor for technology acceptance. The research gap as identified in the first chapter has been explored, and substantiated by references in the current body of literature and by a systematic review of literature. The next chapter will describe and rationalise the methodology to address the research question, based on the underlying assumptions.



## Chapter 3: Research Methodology

### 3.1 Overview of Chapter

This chapter describes the research methodology. It starts by stating the philosophical paradigm guiding the research. It outlines how the philosophic assumptions have shaped the methodology and methods used for the research. Reflective of a critical realist research paradigm, a mixed methods methodology will be adopted, combining quantitative and qualitative techniques that complement each other, and can help to triangulate the outcomes of the research project.

### 3.2 Overview of the Research Process

Four elements make up the research process: ontology, epistemology, methodology and methods (Crotty, 1998).

To answer the research question, the research adopts a certain methodology, that is operationalised by the choice of a set of methods and techniques. The choice of methodology and methods for answering the research question needs justification. This justification is drawn from the purpose of the research, and is driven by the assumptions of reality held by the researcher, and the view on how the research can contribute to the discovery of this reality (Crotty, 1998).

M. Easterby-Smith, Jaspersen, Thorpe, and Valizade (2021) illustrate these four elements with the metaphor of rings of a tree. The innermost ring of the research paradigm reflects the ontological question, referring to philosophical assumptions on the form and nature of reality. A second ring of the paradigm relates to the epistemological questions, assumptions on how researchers can achieve knowledge about this reality. A third ring designates the methodology, an approach to inquire into a given research questions, with the specific methods and techniques used by the researcher making up the outermost ring. In a similar vein, Saunders,

Lewis, and Thornhill (2019) refer to the ‘research onion’, by combining ontology and epistemology into research philosophy, based on the concept of research paradigms, and by adding research approach, strategy and time horizon as additional rings. The research methodology for this research is presented in Figure 3-1.



Figure 3-1: Research methodology, adapted from Saunders et al. (2019)

### 3.3 Research Philosophy

Academic research in social sciences, such as business and management, does not happen in a void, as it seeks to advance the understanding of phenomena happening in the real world. Therefore, the research itself is influenced by the traditions and ideas that have shaped our current social environment. Awareness of philosophical assumptions can both increase the quality of research and contribute to the creativity of the researcher (M. Easterby-Smith et al., 2021).

In the early 1960's, Thomas Kuhn propagated the notion of paradigm and paradigm shift in his acclaimed work 'The Structure of Scientific Revolutions' (Kuhn, 2012). He posited that science develops within a paradigm, which he defined as universally recognised scientific achievements that for a time provide model problems and solutions to a community of practitioners. What is known as Kuhn's incommensurability thesis, the existence of a paradigm is considered essential to scientific inquiry as no interpretation is possible in the absence of at

least some implicit body of intertwined theoretical and methodological belief that permits selection, evaluation, and criticism. Paradigms also define the problems to be solved through scientific research, as the paradigm provides assurance that the problem will have a solution, within boundaries generally agreed by practitioners of what Kuhn labels as normal science. These boundaries encompass the methodology and methods used for the research (Kuhn, 2012).

Critics of Kuhn commented on the notion of scientific paradigms as dichotomous concepts, taking a science revolution to shift from one paradigm to another. Morgan and Smircich (1980) argue that the transition from one perspective to another must be seen as a gradual one. They introduce a subjective-objective continuum, used for mapping out different assumptions along these two extremities. As one moves along the continuum, the features and assumptions of one paradigm are gradually relaxed and replaced by those of the next (Morgan & Smircich, 1980). Collis and Hussey argue that, although differences between paradigms tend to be highlighted, most paradigms share a number of similarities. These include the use of research questions, the use of various methods to collect data, the use of various methods to summarise the data, the application of techniques to analyse the data, the discussion of findings and the drawing of conclusions of the research (Collis & Hussey, 2013; Onwuegbuzie & Leech, 2005).

Guba operationalised the research paradigm by formulating three basic questions to be responded to by researchers: ontological, epistemological and methodological (Guba & Lincoln, 1994).

A first component of the research paradigm is the ontological question, referring to the form and nature of reality. Ontologies are defined within a continuum between realism and nominalism. A realist ontology assumes that there is a single truth, and that facts exist and can

be revealed. The opposing view, nominalism, denies the existence of truth and considers facts as mere human creations (M. Easterby-Smith et al., 2021).

A second component of the paradigm relates to the epistemological questions, how researchers can achieve knowledge about this reality. The two main perspectives in epistemology are positivism and social constructivism. The former posits that scientific inquiry can uncover the external reality. The latter argues that social interactions create meaning and understanding.

### 3.3.1 Paradigm Perspectives

The research paradigm is a set of assumptions and viewpoints that govern the methodology of the research. The adoption of a particular paradigm will be partly determined by the philosophical assumptions of the researcher, but will also be influenced by the dominant paradigm in the research area and the nature of the research problem under investigation (Collis & Hussey, 2013). A number of widely used paradigms is presented in Table 3-1.

Table 3-1: Common research paradigms. Adapted from Easterby-Smith et al. (2021), Collis & Hussey (2013), Guba and Lincoln (1994); Kelly and Cordeiro (2020); Wynn and Williams (2012)

Paradigm	Ontology	Epistemology	Methodology	Methods
Positivism	Social reality is external and separate from the observer. There only is one reality.	Sensory observation is the only valid source of knowledge, as it is objective and value-free. Research can be undertaken without influence between observer and study object.	Deductive	Quantitative Surveys Experiments
Interpretivism	Social reality is constructed by individuals and interaction within social groups. It does not exist outside of human interpretation, hence multiple social realities exist.	The reality can only be discovered through interpretation, hence there is a mutual influence between observer and study object.	Inductive	Qualitative Case studies
Critical realism	Reality is stratified in three domains; the real (mechanisms), the actual (events) and the empirical (experiences).	Reality can be described based on analysis and interpretation of experiences, with an aim of explaining rather than predicting.	Abductive	Case studies Mixed methods
Pragmatism	Social reality exists but cannot be known directly. It is constantly renegotiated, debated, interpreted.	The value and meaning of opinions and 'facts' captured in research data are assessed through examination of their practical consequences.	Abductive	Mixed methods

### 3.3.2 Justification

This research takes a critical-realist view on ontology and epistemology. This paradigm is rooted in the works of Bhaskar (1978) and is increasingly been adopted in social science

research (Wynn & Williams, 2012). Critical realism embraces the concept of fallibilism and is positioned between the extremities on the paradigm continuum as described by M. Easterby-Smith et al. (2021). It posits that an objective and mind-independent reality exists, but that our knowledge of it is constrained by what we can experience (empirical) as a result of events (actual) driven by causal powers of structures and objects (real) (Saunders et al., 2019).

Scholars taking a critical-realist view on ontology and epistemology use similar methodology and methods as in the pragmatist paradigm. For this research, critical-realism is adopted because it provides a more robust framework for understanding social phenomena. It acknowledges the existence of underlying structures and mechanisms that shape social reality, and emphasises the importance of empirical investigation and critical reflection in uncovering these structures. This approach allows for a deeper and more nuanced understanding of social phenomena and helps to avoid reductionist or simplistic explanations. Furthermore, a critical realist ontology enhances the ability to generalise findings from a specific context, such as contactless proximity payments in the UK, to other contexts, across different technologies, cultural contexts or business models (Danermark, Ekström, & Karlsson, 2019).

In both paradigms, the methodology is inherently abductive, often referred to as retroduction by critical realists (Mingers, Mutch, & Willcocks, 2013; Saunders et al., 2019). It can be characterised as a form of logical inference that involves using observations or data to generate hypotheses or explanations for a given phenomenon or problem. Unlike deductive reasoning, which moves from general premises to specific conclusions, or inductive reasoning, which moves from specific observations to general conclusions, abduction involves making an educated guess or inference about a likely explanation or cause for a phenomenon based on limited or incomplete information. It involves identifying a pattern or relationship between observed phenomena or data and generating a hypothesis or explanation for that pattern. The

hypothesis is then tested by collecting additional data or evidence and evaluating whether the hypothesis is supported or refuted by the new information (Danermark et al., 2019).

Abduction is often used in scientific research, especially in fields where experimentation is difficult or impossible. For example, in social science research, abduction may be used to develop theories or hypotheses about complex social phenomena. In this case, researchers may use observations or data to generate hypotheses about the underlying mechanisms that contribute to these phenomena, and then test those hypotheses using additional data or evidence. (Saunders et al., 2019).

The critical-realist and pragmatist paradigms embrace a multitude of methods and data types to fit the subject matter, including case studies and mixed methods (Creswell, 2018; Mingers et al., 2013; Venkatesh, Brown, & Bala, 2013).

Braa and Vidgen (1999) propose a triangular framework for Information Systems research, based on its intended outcome: prediction, understanding or change. They associate predictive IS research with a positivist approach, as it aims to reduce the area of investigation as to isolate the experimental variable, *ceteris paribus*. At the other hand, research aimed at understanding phenomena is associated with interpretivism, as it seeks to fully assess and describe a situation in order to enhance its understanding. Finally, research aimed at inducing change takes a more interventionist paradigm, as change is the outcome of intervention. This is illustrated in Figure 3-2.

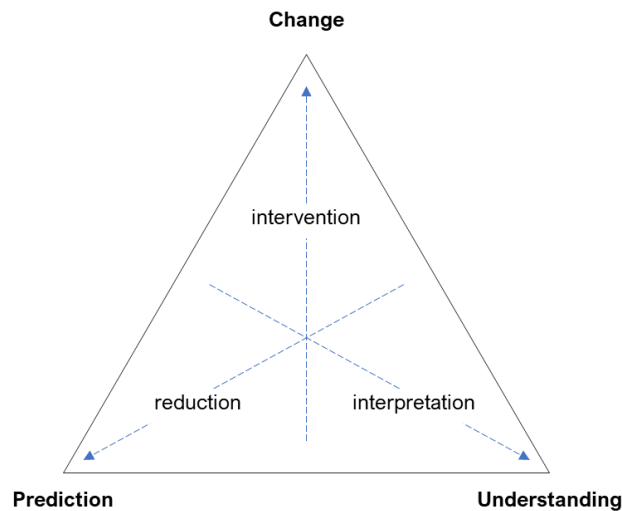


Figure 3-2: An IS research framework. Source: Braa and Vidgen (1999)

Any IS research will have a certain degree of every dynamic (understanding, prediction, change), albeit not in the same proportion, hence the constrained space of the triangle.

This research is conducted in the framework of a professional doctorate, which aims not only to understand a question, but also to come with a commitment to change (The Association to Advance Collegiate Schools of Business, 2013), whether organisational or policy-related (Quality Assurance Agency for UK Higher Education, 2020). This suggests a research philosophy congruent with the interventional stance, aimed at inducing change.

A critical realist position is characterised by the search for generative mechanisms who can be described as causal structures that trigger events in the material world. For this research this would refer to the factors that affect the acceptance and use of contactless proximity payments by consumers (payers) and by merchants (payees), and their mutual interrelationship. The rationale for identifying these factors is fundamentally to provide insights in how management practice can utilise the resulting framework to bring about change. In other words, the research aims to uncover generative mechanisms underlying observable events, a defining characteristic of the critical-realist paradigm.



### 3.4 Research Approach

The relationship between empirical research and theory development is driven by preliminary choices made by the researcher. The two traditional approaches to logic are deduction and induction.

In deductive reasoning, the conclusion is derived logically from a number of premises derived from theory (Saunders et al., 2019). This can be compared to a top-down reasoning, where the research starts from a theory, which is used to formulate a set of hypotheses. Data obtained using observations, subsequently confirm or not the validity of the hypotheses formulated.

Inductive reasoning starts from the observation of a gap between the conclusion and the premises stemming from theory (Saunders et al., 2019). In contrast to deductive reasoning, this equates to a bottom-up method, where the researcher starts from observations, which are used for the recognition of patterns and relationships, in order to be generalised into tentative hypotheses that can contribute to theory.

In this research, the approach is inherently abductive, combining iteratively inductive inferences developed through qualitative methods and deductive inferences tested using quantitative methods (Saunders et al., 2019). As opposed to deduction, an abductive approach does not positively verifies theory, but it tends to infer the best explanation available how the observations relate to the theory, although a certain degree of doubt remains (Lipton, 2004).

An overview of the different approaches is given in Table 3-2.

Table 3-2: Deduction, induction and abduction: from reason to research. Adopted from Saunders et al. (2019)

	<b>Deduction</b>	<b>Induction</b>	<b>Abduction</b>
Logic	In a deductive inference, when the premises are true, the conclusion must also be true	In an inductive inference, known premises are used to generate untested conclusions	In an abductive inference, known premises are used to generate testable conclusions
Generalisability	Generalising from the general to the specific	Generalising from the specific to the general	Generalising from the interactions between the specific and the general
Use of data	Data collection is used to evaluate propositions or hypotheses related to an existing theory	Data collection is used to explore a phenomenon, identify themes and patterns and create a conceptual framework	Data collection is used to explore a phenomenon, identify themes and patterns, locate these in a conceptual framework and test this through subsequent data collection and so forth
Theory	Theory falsification or verification	Theory generation and building	Theory generation or modification; incorporating existing theory where appropriate, to build new theory or modify existing theory

### 3.5 Research Methodology and Methods

Research methodology refers to the way research techniques and methods are grouped together to provide a coherent picture. This bears upon the type of data that will be collected, the origin of the data, the methods of collecting the data and the methods for analysing the data (M. Easterby-Smith et al., 2021).

The methods refers to the set of processes and techniques utilised for collecting and analysing data. Methods are associated with the research design insofar that the latter structures the collection and analysis of data (Bryman & Bell, 2011).

As demonstrated before, methodology and methods are driven by the epistemological and ontological viewpoint the researcher is adopting, although this linkage is not considered absolute by a number of scholars. Some argue that relying on a single research paradigm can

be extremely limiting, and qualify it as a threat to social research. They argue that adopting a variety of methodologies can be the most effective way for attaining epistemological universality (Onwuegbuzie & Leech, 2005).

The methodology and the methods need to be congruent with the research question. The aims need to be capable of being achieved through the methods proposed (M. Easterby-Smith et al., 2021). In general, an inductive approach is associated with qualitative research, whereas quantitative research often takes a deductive approach (Saunders et al., 2019).

### 3.5.1 Mixed methods

A monomethod research design solely uses one type of method, whether quantitative or qualitative. For quantitative studies, data is typically numerical and is analysed using statistical techniques. Data from qualitative studies is typically in textual form and requires qualitative data analysis techniques (Molina Azorín & Roslyn, 2010).

A research design using mixed methods is using both quantitative and qualitative methods, in such a way that both types reinforce each other in order to optimise the data collection and analysis processes. Mixed methods research has emerged as an alternative to the dichotomy of qualitative and quantitative traditions during the past 20 years (Teddlie & Tashakkori, 2008). The combined use of quantitative and qualitative methods in social sciences is gaining popularity (Molina Azorín & Roslyn, 2010). However, although mixed methods in management and organisational research has great potential for finding deeper insights, researchers need to be aware of the pitfalls of combining worldviews that are fundamentally different from each other (M. Easterby-Smith et al., 2021). A number of proponents of social constructionism even contended that qualitative and quantitative methods cannot coexist. This stance is known as the ‘incompatibility thesis’, but has been refuted both by actual research practice as from a methodological point of view (Howe, 1988).

In information research, mixed methods research has not been prevalent, despite its ability to develop rich insights into various phenomena of interest that cannot be fully understood using only qualitative or quantitative methods (Venkatesh et al., 2013).

Drawing on the research question, and choices made with respect to research philosophy and approach, this research will adopt a mixed method approach, combining iteratively quantitative and qualitative methods. This research will take an exploratory sequential, or three-phase, design, in which qualitative methods are utilised to contextualise the drivers for technology acceptance for both groups, consumers and merchants. This contextualisation will be used to build a framework linking observable factors to latent constructs. used as input for a larger-scale confirmative quantitative study among respondents drawn from both groups (Creswell, 2018).

### 3.6 Research Strategy

The word ‘strategy’ stems from the ancient Greek στρατηγός (stratēgos), which refers to the military command, more specifically to the art of making concrete choices in order to achieve one’s (military) goals. In the context of research, a research strategy can therefore be defined as the plan of action to answer the research question (Saunders et al., 2019).

Based on the positions taken in terms of philosophy, approach, methodology and methods, research strategy can be defined as the general orientation to the conduct of business research (Bryman & Bell, 2011).

For this research, we will opt for a survey strategy. This strategy is usually associated with a deductive approach, as it can be instrumental to quantify data points aimed at answering the research question.

For this research, the scope of the survey strategy is broadened to not only encompass quantitative surveys, but also quantified data points collected through interviews, consistent with the mixed-methods approach. As such, the survey strategy will be compatible with the chosen abductive approach, alternating iteratively between induction and deduction.

### 3.7 Time Horizon

The research will take a cross-sectional research design, collecting multiple data points from different individuals at a single point in time (Bryman & Bell, 2011).

### 3.8 Data Collection & Analysis

#### 3.8.1 Qualitative Study

The qualitative data collection has been based on semi-structured remote interviews with industry experts from the UK and the rest of Europe.

Semi-structured interviews include the use of an interview protocol, based on the concepts identified during the exploratory research phase, while allowing the interviewee to have a great deal of leeway in how to reply (Bryman & Bell, 2011).

The sampling method is expert sampling, a form of purposive sampling in which respondents are selected based on their knowledge, experience and expertise about a specific topic. Experts have valuable insights in the root of problems, both in retrospect reflecting on past successes and failures, as by identifying future trends to watch (Patton, 2018). The number of interviewees from both groups has been determined by the achievement of theoretical saturation (Morse, 2000).

Data obtained from transcribed interviews served as input for thematic analysis using NVivo, a computer-assisted qualitative data analysis software. The results of the qualitative study have subsequently been used as input for the quantitative study.

### 3.8.2 Quantitative Study

The quantitative data has been collected using an online survey. The choice for an online survey for answering the research question was driven by its convenience, speed, flexibility and ability to control the sampling. While online surveys also have a number of drawbacks, including sampling bias, privacy issues and low response rates (J. Evans & Mathur, 2005), a number of safeguards have been implemented to avoid and/or control possible negative effects, as developed further in detail below.

Based on the outcomes of the qualitative study, the closed questions measure opinions and attitudes on a number of items using a Likert scale. The questionnaire have been pre-tested and validated with a small group of respondents. Data will be gathered via an online survey platform from two populations: consumers and small and medium-sized merchants, both from the UK.

For the online surveys, a convenience sampling strategy has been applied, very common in the field of business and management (Bryman & Bell, 2011), especially for online surveys. Results obtained using this sampling method cannot be strictly generalised to the entire population, although this strategy is commonly used when focusing on studying the relationship between variables rather than to accurately infer population values (Cozby & Bates, 2018).

Data obtained from the quantitative surveys has been analysed using Structured Equation Modelling (SEM) software. Partial least squares has been used to estimate the SEM model based on its tolerance for smaller sample sizes, leniency for data non-normality, and its suitability for estimating formative predictive models (Christian M. Ringle, Sarstedt, & Straub, 2012).

### 3.9 Ethical Issues

This research has been conducted in full compliance with the Northumbria University's Research Ethics and Governance Handbook (Northumbria University, 2020). All research activity conducted by researchers within the university is subject to appropriate ethical scrutiny and review, proportionate to the potential ethical risks of the research. The research has obtained preliminary formal ethics approval from the Newcastle Business School Ethics Committee (Submission ID 28301).

This research has been classified as 'medium ethical risk' as the research involved data collection from non-vulnerable adults.

#### 3.9.1 Access

Access refers to the methods used to gain access to the appropriate individuals taking part in the surveys, both the semi-structured interviews and the quantitative surveys. There are different ways to categorize the different types of access, all of which influence the ethical considerations around the research methods.

Saunders et al. (2019) define different types of access, based on the medium used (physical, virtual), the organisational context (single-organisation, multi-organisation), and the type of individuals (elite, individual persons).

For the qualitative study, access has been sought to individuals within multiple organisations (multi-organisation access) based on a number of criteria relative to their expertise and seniority within the organisation (elite access) using electronic communication methods (virtual access).

For the quantitative study, surveys have been distributed to individuals whether as consumers or as merchants (multi-organisation access) using internet platforms (virtual access).

### 3.9.2 Ethical Principles

In the 1970s, academic psychologists Diener and Crandall identified four ethical areas of attention to be observed when conducting business research (Bryman & Bell, 2011).

#### **Harm to participants**

This area of ethical attention does not only refer solely to physical harm inflicted to research participants, but also include harm to individuals' self-esteem, stress, career prospects, or inducement to perform reprehensible acts. It is the responsibility of the researcher to assess the potentialities for inflicting any type of harm to participants.

A potential source of harm to participants is when confidentiality and anonymity are not sufficiently protected by the researcher. For this research study, any personal identifiable data have been stripped from all data artefacts, including transcripts and other documents. Individual participants were assigned a numerical identifier without any connection to personal data, such as names, phone numbers or e-mail addresses.

Furthermore, relevant information that could contribute to compromising the identity of expert participants in the qualitative study, such as current or former employer, job title, location, age or gender, has been aggregated into categories broad enough to avoid any positive identification.

#### **Lack of informed consent**

All participants to the study were provided with a consent form, which received prior approval from the University. By signing the form, participants confirmed to have read the information sheet, to have had the opportunity to consider the information, to ask questions and to have had these answered satisfactorily. They confirmed their understanding that the interview was to be recorded and transcribed for further analysis, that their participation was voluntary and that



they were free to withdraw at any time without giving any reason. Furthermore, they confirmed their understanding that the information collected could be used to support other research in the future, and may be shared anonymously with other researchers. Finally, participants explicitly stated their agreement to take part in the study.

### **Invasion of privacy**

Beyond the fact that all participants explicitly consented to participating in the study, the collection and processing of personal data was in full compliance with the UK General Data Protection Regulation (GDPR).

This warrants the protection of all personal data collected, to avoid any invasion of privacy due research activities.

### **Deception**

Deception refers to circumstances in which researchers deliberately misrepresent the goals or the methods of their study towards the research subjects.

All participants of the qualitative study were given an information sheet, which obtained prior approval of the University. This information sheet identified the researcher, the supervisor and the name of the University. It stated the purpose of the research, the selection and exclusion criteria of participants, the voluntary character of their participation, their consent and their right to withdraw at any time. It explicated the format, the duration and the method of the data collection. It stated the legal basis of processing the data, how the data will be stored and analysed, and what will be done with the outcomes of the analysis. The information sheet also informed participants of the prior ethical approval of the research project by the University, and of their rights to consult, withdraw and complain if they feel their rights have not been duly observed by the researcher or by the University.

### 3.10 Chapter Summary

This chapter gave an overview of the research process.

It established the adoption of a critical realistic research paradigm, with an abductive approach.

The choice for sequential exploratory mixed methods was explained, with semi-structured interviews for the qualitative study, and a survey for the quantitative study. These strategies will be explored more in detail in subsequent chapters.

Finally, a number of ethical areas of concern have been identified, and mitigating actions were discussed.

# Chapter 4: Qualitative analysis

## 4.1 Introduction

This chapter describes the qualitative analysis of this research. It details the exploratory research carried out in preparation of the data collection. It explains the use of semi-structured interviews as method for collecting qualitative data, followed by the description of the sampling frame and methods. The next sections explicit the interview process and the thematic analysis. As an outcome of the analysis, the conceptual framework is developed. The chapter concludes with the quality checks of the analysis and the conclusions of this part of the research.

## 4.2 Exploratory Research

The research will take an exploratory sequential, or three-phase, design, in which qualitative methods are utilised as an exploratory research technique. This is illustrated in Figure 4-1.

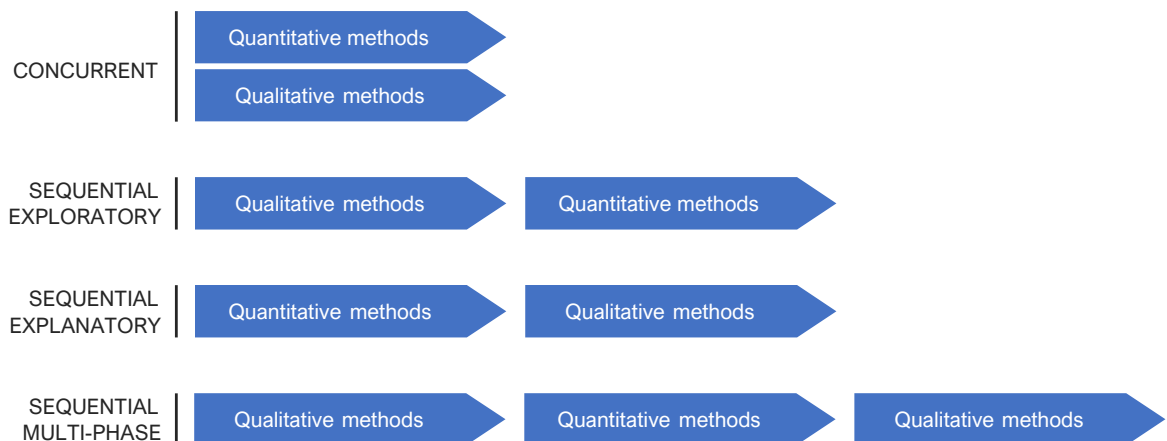


Figure 4-1: Mixed methods research design. Adopted from Saunders, Lewis, and Thornhill (2019)

The three phases for the exploratory sequential design are the qualitative data collection and analysis (phase 1), the identification of features for future testing (phase 2) and the quantitative testing of the identified features (phase 3) (Creswell, 2018).

The reason for the use of qualitative methods as the first phase in the mixed-methods exploratory sequential design is essentially initiation, in which the qualitative methodology is used to define the nature and scope of the of the consecutive quantitative research. It also provides contextual background that contributes to the understanding, the formulation and the operationalisation of the research question (Saunders et al., 2019).

### 4.3 Methodology

To address the research question, a number of qualitative data collection methods can be considered. Each of these methods have been developed and deployed to address the research question in a number of different conditions and circumstances. As the main objective of the qualitative study is to gather insights in order to develop a conceptual framework to address the research question (Bryman & Bell, 2011; M. Easterby-Smith et al., 2021), qualitative semi-structured interviews are retained as the data collection method in this research.

### 4.4 Semi-Structured Interviews

The method selected for this research are semi-structured interviews. These are interviews that follow a pre-established interview protocol, but allow for additional interaction between interviewer and interviewee to elaborate on certain aspects of the questions or the responses (Bryman & Bell, 2011).

The interview is one of the most prevalent methods in qualitative research (Bryman & Bell, 2011; Mason, 2002). It is preferred because of its flexibility (Bryman & Bell, 2011), although they might induce a bias as interviewees might have certain expectations about the interviews and therefore have a tendency to give correct or acceptable responses (Collis & Hussey, 2013). The researcher also has to be aware that an interview is reliant on verbal and textual data only, and tends to steer away from other types of data including visual, spatial and observational social worlds (Mason, 2002).

For this research, adopting a critical realist paradigm, semi-structured interviews are considered an appropriate research method. Pawson (1996) argues that data collection in research with a realist ontology should be theory-driven, i.e. that the starting point of an interview is the theory, and it's the respondent's role to make an informed and critical assessment of the theoretical structures. The interview protocol of the semi-structured interview is an adequate tool to this end. At the same time, semi-structured interviews allow the respondents to elaborate on their answers, so that 'both hard, comparable and rich, meaningful data can ensue' (Pawson, 1996).

## 4.5 Sampling

### 4.5.1 Sampling Method

The qualitative study uses expert sampling as the sampling method. Expert sampling is a form of purposive sampling, in which respondents are selected based on their expertise about a specific topic. This involves identifying key informants who can inform an inquiry through their knowledge, expertise and experience. Experts may have valuable insights in the root of problems, both in retrospect reflecting on past successes and failures, as by identifying future trends to watch (Patton, 2018).

Purposive sampling, also referred to as purposeful, judgmental, subjective or selective sampling, is a non-probability sampling method. Respondents will be selected by the researcher based on their expertise, knowledge and experience of the consumer or merchant side of the payments business, or both (Patton, 2014).

The main difference between purposive and probability sampling is that the former does not intend to make quantified generalisations or statistical inferences towards the population. In this case, the main goal in the study is not to quantify the distribution of characteristics within the population as a whole, but rather to capture its diversity of opinions and attitudes. For this research objective, purposive sampling can be considered an adequate sampling technique

(Patton, 2014). Purposive sampling is especially useful when looking for specific characteristics that are instrumental to the research question and hypotheses. In these circumstances, it is not critical to safeguard the representativity of the population. This should not necessarily be seen as a weakness for this type of exploratory study. As the main purpose of this research phase is to generate hypotheses, rather than validating them, representativity of the population is not required.

#### 4.5.2 Sampling Frame

For this research, respondents were selected based on their professional expertise with payment technologies. The selection criteria include a relevant professional experience of more than 10 years in an organisation that is a key participant in an electronic payment platform.

The types of relevant organisations include payment schemes, issuing and acquiring banks, service providers, hard- and software suppliers and relevant consultancy practice.

Selection channels are industry associations (such as EMVCo, NFC Forum or Payments UK), professional social networks (such as LinkedIn), and professional contacts of the researcher.

#### 4.5.3 Sample Size

Qualitative studies are inherently ideographic, as they focus on individual characteristics, experiences and narratives, and do not attempt to generalise traits from a sample to a wider population. This is why some authors consider sample size an inappropriate concept in the context of qualitative research (Coolican, 2019). The number of respondents will be determined by the achievement of theoretical saturation, which for purposive sampling is typically attained with smaller sample sizes as compared to probabilistic sampling methods.

Theoretical saturation is a concept that has been introduced by the theory of grounded theory, and denotes the point in the research when all major categories have been fully developed and

integrated, while conserving the variation present (Corbin & Strauss, 2015). The determination of saturation is achieved during the data collection process, implying that data collection and data analysis should be carried out together, to assess the incremental information achieved by adding another respondent to the qualitative data set gathered previously (Liamputtong, 2019).

## 4.6 Preparing the Analysis

In qualitative research, interviews are typically recorded and subsequently transcribed whenever possible. Current technological advancements greatly contribute to the convenience of recording and transcribing interviews, including digital recording and digital transcription (Bryman & Bell, 2011). In recent years, the use of voice-to-text methods has found its way into academic research, often in combination with automated methods for content analysis. They are said to be more reliable, more objective, and save much time and effort. Critics, however, state that the technology remains underdeveloped and is less objective than has been claimed (De Graaf & van der Vossen, 2013).

An interview transcription is always considered a partial reflection of the interview, as it fails to capture non-verbal aspects of the interaction, and because it is reflective of the choices of the transcriber to include some verbal utterances or not. Therefore, it is important to consider that a transcription is not an objective record of the interview, but needs to be complemented by the observations, interpretations and experiences of the interviewer (Mason, 2002).

## 4.7 Interview Process

### 4.7.1 Participants

20 interviews were conducted from June 25th, 2021 until September 30st, 2021.

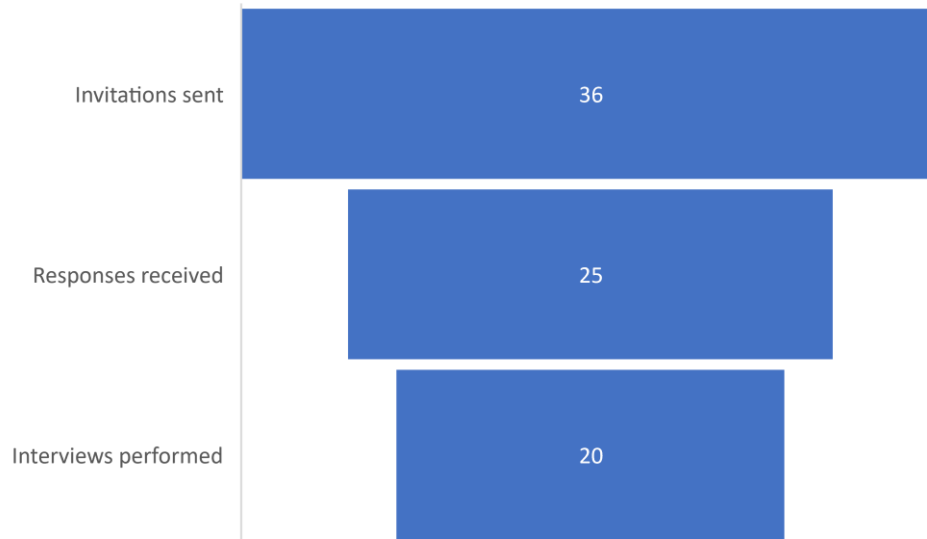


Figure 4-2: Funnel diagram of interview participants. Source: author

In total, 36 individuals were invited to participate in the qualitative study. Of these, a total of 25 responses were received. In case no response was received, a reminder was sent after two weeks.

Eventually, 20 interviews were conducted, with 15 male (75%) and 5 female (15%) interviewees. This corresponds to a response rate of 56%, which can be considered an excellent result, compared to an average response rate for published academic research at the organisational level, which has been found to be only 37.2% (Baruch & Holtom, 2008). A funnel diagram of the selection of interview participants is visualised in Figure 4-2.

Interviewees were selected based on their expertise within the payment industry, with a minimum of 10 years of experience in managerial positions.

The majority of interviewees (17) had between 15 and 25 years of relevant managerial experience in the payments industry, or related sectors.

Most of the interview participants (11) were in the bracket of 40-50 years of age, consistent with the number of years of experience of the participants.



Organisational level, or seniority, varied from manager level up to CEO level. 14 participants (70%) were at vice president level or above.

Diversity was sought in terms of type of employer. The first category of organisations are payments schemes, including American Express, Mastercard, Visa and Western Union. A second category are issuing and acquiring banks, including Bank of America, Citigroup, Credit Suisse, Elavon, HSBC, Nordea and Standard Bank. A third category are payment service providers, including Klarna, Nets, Samsung Pay, Trustly and Worldpay. A fourth category are payment device manufacturers, including Giesecke+Devrient and IBM. A fifth and last category are management consultancy organisations, including Boston Consulting Group, McKinsey & Company and Mercer. As most participants had extensive experience in the payment industry, it is not uncommon to have a combined experience across multiple categories of organisations.

Given the geographical focus on the UK, interviewees were selected on relevant experience and knowledge of the UK market, whether based in the UK or based abroad, but with a geographical scope that includes the UK (e.g. Europe or global).

The profiles of the interview participants are summarised in Table 4-1.

*Table 4-1: Profiles of interview participants. Source: author*

<b>Code</b>	<b>Organisational Level</b>	<b>Sector*</b>	<b>Years of Experience</b>	<b>Gender</b>	<b>Age</b>	<b>Location</b>	<b>Scope of Experience</b>
D1	Director	1, 2	30y	m	40-50	US	Global
VP1	Vice President	1	15y	f	40-50	UK	UK & I
C1	C-Level	1, 2	25y	m	40-50	Sweden	Europe
D2	Director	1	20y	f	50-60	UK	Global
C2	C-Level	1, 2	20y	m	50-60	UK	Europe
D3	Director	1, 2, 3	15y	f	30-40	UK	UK
D4	Director	1	17y	m	30-40	UK	Europe
SVP1	Senior Vice President	1, 2	31y	m	60-70	Germany	Global
CEO1	CEO	1, 4	21y	m	50-60	UK	Europe
D5	Director	1, 4	14y	m	30-40	Belgium	Global

Code	Organisational Level	Sector*	Years of Experience	Gender	Age	Location	Scope of Experience
VP2	Vice President	1	15y	f	30-40	UK	Global
M1	Manager	1	20y	m	40-50	UK	Global
CEO2	CEO	1, 2	20y	m	40-50	Switzerland	EMEA
CEO3	General Manager	1, 2	20y	m	40-50	Belgium	Europe
EVP1	Executive Vice President	1, 5	12y	m	40-50	UK	Global
VP2	Vice President	1, 3	17y	m	40-50	UK	Europe
EVP2	Executive Vice President	1, 5	19y	m	40-50	UK	Global
SVP2	Senior Vice President	1, 5	22y	m	50-60	UK	Europe
VP3	Vice President	1, 4	21y	m	40-50	Germany	Global
SVP3	Senior Vice President	1, 5	18y	f	40-50	UK	Europe

*	Sector	(Former) Employers of Interview Participants
1	Payment schemes	Visa, Mastercard, American Express, Western Union
2	Issuers/Acquirers	HSBC, Bank of America, Citigroup, Credit Suisse, Elavon, Standard Bank, Nordea
3	Payment service providers	Klarna, Worldpay, Nets, Trustly
4	Payment device manufacturers	Giesecke + Devrient, IBM, Samsung
5	Others	McKinsey & Company, Boston Consulting Group, Mercer, London Stock Exchange

#### 4.7.2 Saturation

To illustrate the achievement of theoretical saturation in this research, the cumulative referencing of themes per participant was charted, as illustrated in Figure 4-3.

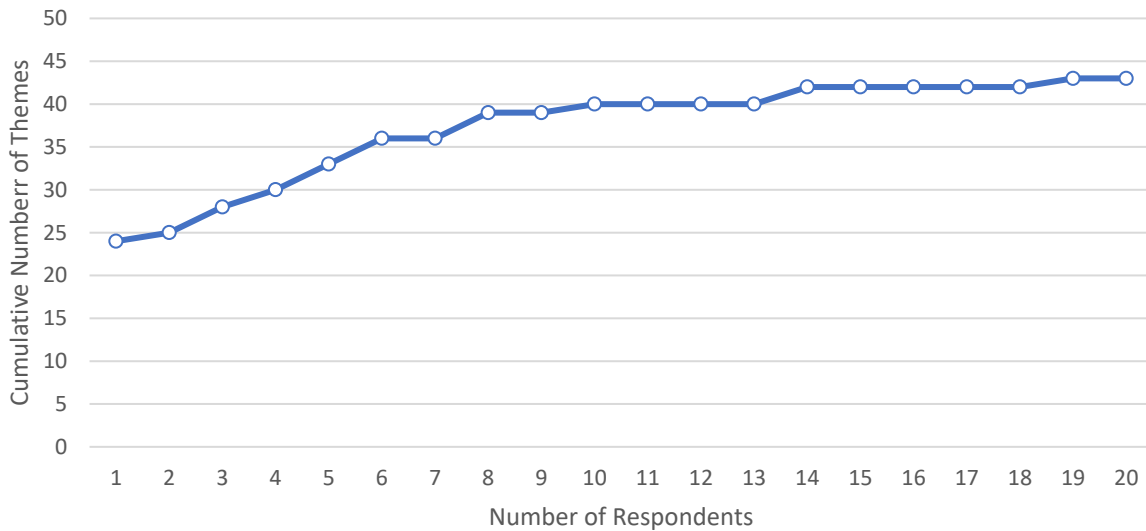


Figure 4-3: Cumulative number of themes identified during thematic analysis. Source: author

After conducting 20 expert interviews, a total of 43 themes have been identified. The first interview made reference to 24 themes, or 56% of all themes identified. The next 9 interviews referenced another 16 themes, so that the first 10 interviews identified 40 themes, or 93% of the final number of themes. The next 10 interviews referenced 3 more themes, and only 1 new theme has been referenced during the last 7 interviews. This leads to the conclusion that most of the themes have been captured by the 20 interviews conducted, i.e. that theoretical saturation has been achieved.

#### 4.7.3 Interview protocol

All interviews were conducted through videocall, using Microsoft Teams software. Prior to the start of the interview and the audio recording, a preliminary conversation between interviewer and interviewee took place. The goal of this preliminary phase was to establish rapport and to provide further background to the interviewee as to the research project, to answer any remaining questions and to take away any possible uncertainties.

After the preliminary exchange, the interviewer explicitly mentioned that the audio recording will be started. This informed the interviewee that the formal part of the interview had started,

and that the statements made as from that point will be included in the data set for further analysis, after recording and transcription.

As suggested by King, Horrocks, and Brooks (2018), the interview started with a relative simply and straightforward question, as to establish a rapport with the interviewee. The first question invited the expert interviewee to elaborate on his or her experience and expertise with payments, the payment industry and its different stakeholders.

The interview protocol was prepared in alignment with the guidelines as laid down by Bryman and Bell (2011). A certain order in the topic areas was maintained, to facilitate a logical flow of the questions. Avoiding leading questions, questions were formulated as to enable the development of the conceptual model and the quantitative survey to validate it, although without being too specific. The language was adapted to be relevant and comprehensible to the interviewees.

The interview protocol has been piloted prior to its administration. Van Teijlingen and Hundley (2001) identified a number of reasons why conducting a pilot study can be useful in qualitative research. Specifically for this study, the following were relevant in the decision to conduct a pilot study:

- Developing and testing adequacy of research instruments
- Designing a research protocol
- Assessing whether the research protocol is realistic and workable
- Identifying logistical problems that might occur using proposed methods

As recommended by Teddlie and Tashakkori (2008), the questions have been reviewed by four academics with extensive experience in the research field, and with the administration of qualitative interviews. As a result of the feedback of the academic reviewers, the number of

base questions in the interview protocol has been reduced and reformulated, other questions were introduced and the information shared with the participants prior to the interview has been adapted.

Subsequently, the interview protocol has been reviewed by three executives that were eligible to participate in the interview. Their feedback and suggestions have been included in the subsequent interviews.

The interview concluded with the question whether there are any other elements that the respondent would like to share that are relevant to the research topic. It is not uncommon for respondents to mention something of significance or interest at this stage. Secondly, it allows to draw a natural end to the interview. This approach is considered good practice in qualitative interviewing (King et al., 2018).

After the interview, it was explicitly mentioned that the recording will be stopped, as to be fully transparent to the interviewee that the formal interview and its audio recording has come to an end. Any further communication between interviewer and interviewee will be not be considered part of the interview, as to protect the confidentiality.

#### 4.7.4 Recording and Transcribing

Subject to the consent of the interviewees, the interviews were recorded and transcribed. As the actual event of the interview itself cannot be reproduced, data collection has to rely on artifacts to ensure the comprehensiveness and reliability of the data collected, and to enable the subsequent analysis of the data. These analytical objects can be field notes, transcripts or audio recordings. With the evolution of technology, tools to record and to transcribe interviews are now easily to obtain and to utilise (Tessier, 2012).

#### 4.7.5 Laddering

In interviewing, laddering refers to the interviewer probing further after the responses given. It can help to reveal underlying values and motivations behind the mere statement of facts mainly by asking additional ‘why’ questions. This is known as ‘laddering up’. The opposite technique, ‘laddering down’ allows the interviewer to solicit concrete examples and behaviours from more abstract statements from the interviewee. Most interviewers use both techniques concurrently in order to gain comprehensive insights into the topic discussed (M. T. Easterby-Smith, Richard; Jackson, Paul R., 2015).

For this research, the laddering technique has been used to get more insights, by using it to both solicit further background on a specific answer, or to ask for concrete examples relating to more generic statements made by the interviewee.

#### 4.8 Thematic Analysis

In a seminal article by Braun and Clarke (2006), the authors define thematic analysis as ‘a method for identifying, analysing and reporting patterns (themes) within data’. Within the thematic analysis approach, the researcher codes the data gathered during qualitative research, and consecutively develops overarching themes representing the meanings contained within the bulk of the data (Coolican, 2019).

Thematic analysis, also known as inductive content analysis, along with grounded theory and interpretative phenomenological analysis, is the approach of choice for analysing data stemming from semi-structured interviews (Coolican, 2019). At the other hand, it has been argued that the term thematic analysis obfuscates a number of approaches that vary in terms of procedures, underlying philosophy and even the conceptualisation of key elements (Braun, Clarke, Hayfield, & Terry, 2019).

Contrary to the other two approaches, thematic analysis does not require to satisfy a number of theoretical and ideological principles (Coolican, 2019), as thematic analysis is considered a flexible approach that can be applied across different epistemological and ontological positions (Braun & Clarke, 2006). These characteristics can help explain why thematic analysis today is the most extensively used qualitative analytic method in the field of social sciences (Swain, 2018).

Thematic analysis can be applied in an inductive way, also labelled data-driven or bottom-up, that starts with the analysis of the data without any preconceived notion of the outcome, and build the theory on the mere analysis of the qualitative data (Coolican, 2019). This application of thematic analysis can be compared to grounded theory. However, as opposed to the latter, thematic analysis does not require the identified themes to cover all the data collected, also known as saturation (Coolican, 2019).

Within the thematic analysis approach also the inverse is possible, where the identification of categories and themes from the qualitative data collected is guided by prior research. This is called deductive, theoretical, theory-led or top-down thematic analysis (Coolican, 2019). This use of thematic analysis is akin to content analysis.

In line with the abductive approach taken in this research, both applications of thematic analysis can be utilised in an iterative sequence (Swain, 2018), combining inductive with deductive steps, aimed at developing and confirming theorised hypotheses with qualitative data.

#### 4.8.1 Performance Expectancy

Respondents have elaborated on a number of themes that illustrate how contactless technology can enhance the performance of the payment process. These have been grouped under the node Performance Expectancy, which has been defined as “... the degree to which an individual

believes that using the system will help him or her to attain gains in job performance” (Venkatesh et al., 2013).

The most cited performance measure, most probably influenced by the Covid-19 pandemic, was the fact that contactless payment technology avoids physical contact between consumer and merchant-operated devices, hence delivering a more hygienic payment experience.

*“Obviously you take the pandemic, that’s something everybody understands. Don’t touch it, get away from people, keep the distance, putting your card on the reader. That’s the right thing to do.” (SVP1)*

Also oft cited as a performance measure is the speed of paying, because of the fact that contactless technology in itself is quicker than contact chip, but also because for most transactions done with contactless technology, there’s no need to key in a personal identification number (PIN).

*“For consumers, the need of the speed is clearly something that can actually push customers to accept more and more contactless” (D4)*

Security is a more contentious factor. Some respondents claim that users see contactless as a secure way of paying.

*“So I guess that’s obvious, it’s like very quick, very convenient, very secure in the sense that you also, I only flashed a card for half a second and that’s it.” (VP2)*

But far more respondents believed consumers had concerns with the security of contactless payments, especially citing the fear that data could be read without consent nor knowledge of the cardholder.



*“There are a lot of concerns around if I use my card, is someone going to be scanning the airwaves and going to be able to take all my card details, all of those kind of urban myths that exist out there in terms of the safety of those transactions.” (C2)*

The expectancy of merchants when it comes to delivering the benefits of contactless displays a wider variety than those mentioned for consumers. A first key expectancy by merchants is that contactless payment technology can increase the speed of completing payments, and hence increase the throughput of consumers. Especially in environments where queuing at the checkout is a common phenomenon, the fact of reducing the time needed to make a payment can increase consumer satisfaction and reduce staffing costs at the same time.

*“So they were just simply doing the mathematics and saying: “Okay, so instead of 15 seconds, now I would spend... a person would spend two or three seconds. So it means I would save X amount of time. So it’s money behind, finally, as simple as that.” (CEO3)*

One respondent nuanced this benefit, tying the type of merchant to the benefit brought about by saving time at the checkout.

*“Schoolbook it is speed of checkout, checkout speed. But actually we did measurements with the largest retailer, and definitely it doesn’t matter. Ultimately it doesn’t matter. Because the checkout speed is not that much faster in retailing. It is different, it’s definitely different in convenience stores, in transport, definitely. But regular retailing, speed is what we tried to convince merchants of, and speed is not, was not an argument.” (CEO2)*

Next to speed and throughput, respondents mentioned an enhanced service level towards customers as a key expectancy from merchants.

*“So if somebody comes into my store, I don’t need them to sign the receipt. I don’t need to then them to enter a PIN. I don’t need to inconvenience them in any way or form and they can just buy and walk out. That is ideal, right?” (D1)*

Also a reduction in cash payments has been put forward by interviewees.

*“[...] that they get quicker the lanes cleared out and less cash in the system. And with all this, they don’t have to count so much money in the evening out of the till.” (VP3)*

Some respondents predicted that contactless payments would induce consumers to buying more items, a practice known as up-sell and cross-sell.

*“I think an ancillary benefit potentially is that if it’s really convenient in the purchase experience, I might be able to upsell or cross-sell to the consumer.” (D1)*

Finally, a couple of respondents saw contactless payments open up the possibility for shifting to self-checkouts, reducing staffing levels and hence operating costs.

*“Because with the ability to be able to pay without a physical cashier being present as such, it really opened up the opportunity to then have self-service checkouts [...], or partially attended checkouts. So I think that’s also driven a change in merchant behaviour, which means that they’ve actually managed to save on costs.” (D3)*

#### 4.8.2 Price Value

A second node groups themes that refer to the trade-off between the perceived benefits and their monetary cost, congruent with the definition of Price Value (Venkatesh et al., 2012).

Price value or costs are factors that for UK cardholders have been eroded over time, as most issuers have been proposing payment cards (debit or credit) for free or as part of a larger bundle of products and services.

*“But if I say contextualising this in the UK, where individuals are used to free financial services, so we get free banking, we get free payment cards. We don't pay fees.” (VP1)*

A number of respondents have mentioned the possibility to monetise contactless technology by adding in more features and benefits.

*“I think it's the overall value that they get from the credit card product that is provided to them, you know insurance, travel insurance, rental car insurance, so all of those services in a package is the one that consumers are prepared to pay a premium for, and then when it's loyalty, there's obviously normally a higher premium that's connected to that.” (D1)*

The price and associated value of contactless payments to merchants has been mentioned by a number of respondents. The common theme is that the financial benefits of accepting contactless payments should at least match the investments and ongoing costs.

*“They do need to be convinced that there is a use case for it, it is an upgrade of their own POS and surely they have to actually pay more to get the new upgrade and through the relationship with their acquirer or, or supplier of POS.” (D4)*

#### **4.8.3 Social Influence**

A number of themes referring to social influence as a factor for technology acceptance were brought up by many interviewees. They have been grouped in a node Social Influence, as per the definition coined by Venkatesh and Brown (2001): "The extent to which members of a social network influence one another's behaviour".

First and foremost, the influence of other shoppers to select contactless payments has been highlighted often. Many participants saw the social influence as a positive factor, starting a virtuous circle of observation and reinforced behaviour.

*“So it started becoming a virtuous circle where the positive experience would make more people [try it], the same people repeat more, do more contactless transactions. More people see, then replicate themselves. And that started growing.” (VP3)*

This social influence is sometimes described as a passive behaviour, referred to in terms of sheep behaviour.

*“So I think maybe pressure is the right word, but it’s what I described earlier as the sheep mentality. Everybody sees you doing. Well okay. It must be okay then. And we go along.” (M1)*

Next to social influence as exerted by other shoppers, interviewees mentioned other peer groups that are relevant in influencing payment behaviour, such as friends and relatives.

*“But I think if their friends had it and I’m still saying: “Look, I go and use this card everywhere”, then they would probably ask for one.” (VP2)*

Also merchants, and more particularly cashiers, can influence the payment method used by consumers.

*“We forget sometimes consumers can be really seriously led by the merchant. So if the cashier directs you to use contactless and your card is contactless enabled and it’s within the transaction limit, I would say nine times out of ten, you will use contactless.” (C2)*

Finally, banks and mobile phone companies have been pointed to as influencing their customers to use contactless technology as much as possible.

*“You know, they want, literally you as a cardholder to open your door with it. Okay. They want you to pay with it. They want you to sleep with it. They want you to have a watch to go with it. And ultimately they want to lock you into their product set as much as possible. So for them, they’re definitely going to try and influence your behaviour and create a payment method that you are ultimately locked into it. So I think it’s the bigger players really that are influencing the technology that we see.” (D3)*

Similar as for consumers, also for merchants, social peer influence has been mentioned by respondents as a factor influencing the acceptance of contactless payments.

The first form of peer pressure emanates from competitors.

*“If you have a multi-lane supermarket and you don’t accept contactless and the neighbour does, it probably does put some pressure on you to make a move as well.” (VP3)*

But also customers can influence the decision to accept contactless payments by merchants.

*“But once again, from an acceptance perspective, once you’ve got a small vocal minority expecting to use it, merchants are then almost obligated to provide it.” (SVP2)*

#### 4.8.4 Network Externalities

Themes relating to the interaction between payers and payees, have been mentioned by all respondents, without exception. The themes have been categorised as Network Externalities, in line with its definition as the impact of the installed base of one side on the growth of the other, and vice versa (Chu & Manchanda, 2016).

The Network Externalities node groups three themes identified. The first one relates to the pure network effect, i.e. that acceptance of contactless cards is critical to consumer acceptance.

*“I’ve seen that in a number of different markets where issuers have rolled out contactless without that critical mass and it has not taken bite. And so you really need that critical mass on the merchant side.” (C2)*

Many respondents indicated that the type of merchant also plays a role. Environments where the benefits of the technology, speed and convenience, matter most to both consumer and merchant, might play a pivotal role in creating that critical mass needed for adoption. Types of merchants that have been called out specifically are public transport, quick-serve restaurants and groceries.

*“In terms of the merchant side of things, It’s not so much about an absolute or a percentage of all merchants. It’s the type of merchants. So it’s key, everyday, merchant categories that you have to activate, so the supermarkets and mass transit on the merchant side. So that gives the perception amongst consumers that it’s widely available.” (CEO1)*

The majority of interviewees did mention network effects also as a factor influencing acceptance of contactless payments by merchants.

*“You talk to the issuers, and if there’s work to be done on both sides, issuers will say: ‘Well, no, I’m waiting to see how many merchants you get on board’. The merchants will say, they’re saying, ‘Well, no, I’m waiting for you to see how many issuers you get on board.’ And then you’ve got yourself a challenge.” (VP1)*

#### 4.8.5 Effort Expectancy

Participants highlighted the efforts required to get acquainted with contactless payment technology. The themes related to this haven been brought together under a node Effort

Expectancy, defined as "... the degree of ease associated with the use of the system" (Venkatesh et al., 2003).

A first factor in the efforts was the fact of getting comfortable with the technology itself.

*"So contactless as a technology is [...] completely non-obvious to most consumers. They don't know what to do with it. They wouldn't understand what it is [...]" (C1)*

A second factor is the fact that the entering of a PIN is not required for contactless transactions below a certain amount. In the UK this amount was formerly £45, recently raised to £100.

*"[...] people feel that it's a much more convenient way to pay especially if you don't have to type your PIN." (D5)*

At the other hand, the mere existence of this threshold was cited as creating confusion for consumers. As consumers sometimes don't pay attention whether the amount is below or above the contactless limit, they would forego contactless to avoid a declined transaction.

*"I think where it becomes difficult is when people don't actually realise what the limit is. Like, I couldn't tell you today, I have to check again, what's the latest limit in terms of contactless, even I should know that. We just don't focus on contactless anymore. I would argue 99% of people I stop on the street don't know what the limit is. So I think for very small purchases, people will give it a go, but for larger purchases, they'll hesitate and they'll just dip." (VP1)*

The effort to accept contactless payments by merchants was brought up by only one respondent as an influencing factor.

*"We don't understand the underlying complexity and intricacies of updating a contactless acceptance environment, right?" (D1)*

#### 4.8.6 Facilitating Conditions

A number of themes relate to external conditions, objective factors in the environment, that make an act easy to do, as per the definition of Facilitating Conditions (Triandis, 1979).

Consumers are believed to rely on their banks, the issuer of their cards, to get support on contactless technology.

*“If I look back, I think what companies tried on the issuer side to do is provide rational arguments, why you should use contactless versus contact.” (CEO2)*

But also manufacturers of cards and digital consumer devices are playing a key role in supporting users to embrace contactless payments.

*“All the cards were all still magstripe and chip. They were not contactless. And the technology needed to be embedded into the cards, with again, another cost. So there was for me, the availability of infrastructure. So that’s really the adoption, first by the manufacturer of the devices, being on acceptance and issuance.” (CEO3)*

A number of respondents pointed to the importance of advertising, communication and PR activities in order to increase awareness and drive acceptance.

*“So through the little logo of contactless, through the fact that I was seeing this contactless sign, at Sainsbury’s and at the London Underground, then it was key, I think, for me as a consumer to really embrace this technology.” (SVP3)*

Respondents saw a number of potential sources of support to merchants in order to start accepting contactless payments.



The most frequent cited source of support is the acquiring bank, who would propose payment terminals able to accept contactless payments.

*“I think merchants are driven by the acquirers and by the standard renewal process of their machines. And typically they have been offered to use contactless POS at some point” (D5)*

Also other actors in the payment industry were seen as facilitators for merchants

*“All the other ancillary players that play in that merchant environment, if you think about, they might be a reseller that is involved in offering some special software for an integrated solution to a merchant, right? So now you need to get a reseller to change this, to allow for contactless.” (D1)*

A specific condition mentioned by a number of respondents was the liability shift to merchants. This measure, implemented by most payment schemes, protects merchants against chargebacks for fraudulent transactions with lost or stolen cards. If an unauthorised transaction turns out to be fraudulent, and could have been prevented by a PIN or a signature, the merchant is not liable if the amount is below the transaction limit.

*“And you know, if I have contactless and I can do an average basket size of below the contactless CVM limit, then basically I, as a merchant, don’t have any liability for those transactions. So that’s why I’m offering the convenience, but I also don’t have any risks to those transactions.” (D1)*

A couple of respondents also mentioned the fact that word-of-mouth by consumers could facilitate the acceptance of contactless payments by merchants.

*“So for me as a merchant, if I make your payment experience very convenient, I’m assuming that for translating, word of mouth, from an*

*experience perspective, people would rather come to my store than another store that doesn't have contactless." (D1)*

#### 4.8.7 Habit

Triandis (1979) defines Habit as "... situation-behaviour sequences that are or have become automatic, so that they occur without self-instruction". Thompson and Higgins (1991) state that Habit is an important determinant of behaviour that needs to be acknowledged within a technology acceptance model.

The need to build a habit of tapping instead of inserting the card has been mentioned by many respondents.

*"So you hear this quite a lot, even in the market, how to build this habit? But equally we know that when they do tap, if the experience is good, they're likely to tap again. And so that's been building, it has to be from that perspective, there's some research that shows that it takes about two taps and more to get them actually adopting contactless cards. I think it's really important. So they have a good experience they're reminded and then they continue to tap and continue to have a good experience." (VP2)*

One respondent mentioned that some merchants resist the acceptance of new technology by the change required to their existing operations and systems:

*"So going from magstripe to contactless was kind of considered, I guess, a quantum leap at the time, and of course required big changes, not only the OpEx in terms of changing the cards or deploying the incremental reader for the terminal, but all the work that needed to be done on the network or in the backend systems and so on. And that of course was quite a large ticket." (VP2)*

#### 4.8.8 Hedonic Motivation

A number of themes can be grouped under a node labelled Hedonic Motivation, defined as "... the fun or pleasure derived from using a technology" (Venkatesh et al., 2012).

Respondents refer to payments as utilitarian, instrumental yet unavoidable to avail of other products or services.

*"I think people [see] payment just as part of the daily lifestyle. So they want to focus on the nice stuff, payment is just a grudge thing. So why do I need to be inconvenienced during my beautiful experience of buying a nice watch or buying a nice jeans or whatever? At the end of the day, the payment just needs to be part of the lifestyle experience." (D1)*

This implies that very few users will be motivated by mere pleasure when performing payments. At the other hand, defining hedonism as the pursuit for pleasure as well as the avoidance of pain (A. Moore, 2019), suggests that a user experience that minimises effort, friction and pain when performing a payment, could be categorised as hedonic motivation.

*"You don't have to queue for as long, it's really quick, it's really easy, it's really convenient. You know, all of those fun, fun things." (D3)*

#### 4.8.9 Personal Innovativeness

Respondents extensively referred to themes reflecting the definition of Personal Innovativeness as put forward by Agarwal and Karahanna (2000): "... an individual characteristic reflecting a willingness to try out any new technology".

This was mentioned in two contexts. The first one was the mere difference between people who are motivated by the novelty of technology, and those who are not:

*“... the consumer sort of early adopters and then fast followers and the [...] segmentation that there’s maybe be a number of people who really, really are keen on getting, again, something new into their hands ...” (VP2)*

A second context referred to the fact that this technology allows for further innovation, i.e. that contactless technology does not only change the way people pay with a payment card, but that it also enables other form factors to be used as consumer payment devices, including mobile phones and wearable devices:

*“[...] that really opened that door for different technologies, because from contactless cards, there were wearables, from wearables there was mobile, there’s a whole bunch of different form factors, you can pay by ring, like it really opened up new technologies for cardholders to utilise that, and that has also then led to, as you can see, it’s all the leapfrog of different technologies.” (D3)*

Furthermore, some respondents also refer to groups of consumers who are resisting change:

*“In the UK we call them Luddites, people that don’t want to move forward. They don’t want to adopt the technology. They want to keep it really old school.” (C2)*

Although less prevalent than for consumers, some respondents also mentioned the willingness to implement new technologies by merchants:

*“I mean, people would like to adopt the technology and to be the first, the first ones. [...] they just wanted to be the first ones to get to market. So I would say you will always have some merchants or cardholders who want to differentiate themselves and to be the disruptive ones, the ones who adopt it...” (CEO3)*

## 4.9 Data Structure

The data structure derived from the thematic analysis for consumers can be summarised, including representative examples of every category in Appendix A.

## 4.10 Conceptual Framework

The template analysis has identified 9 themes that are theorised to influence acceptance and use of contactless payment technology. A number of themes comprise additional factors that have been mentioned by one or more respondents, referring to a consumer context, a merchant context, or both. A visual representation of the conceptual framework is given in Figure 4-4.

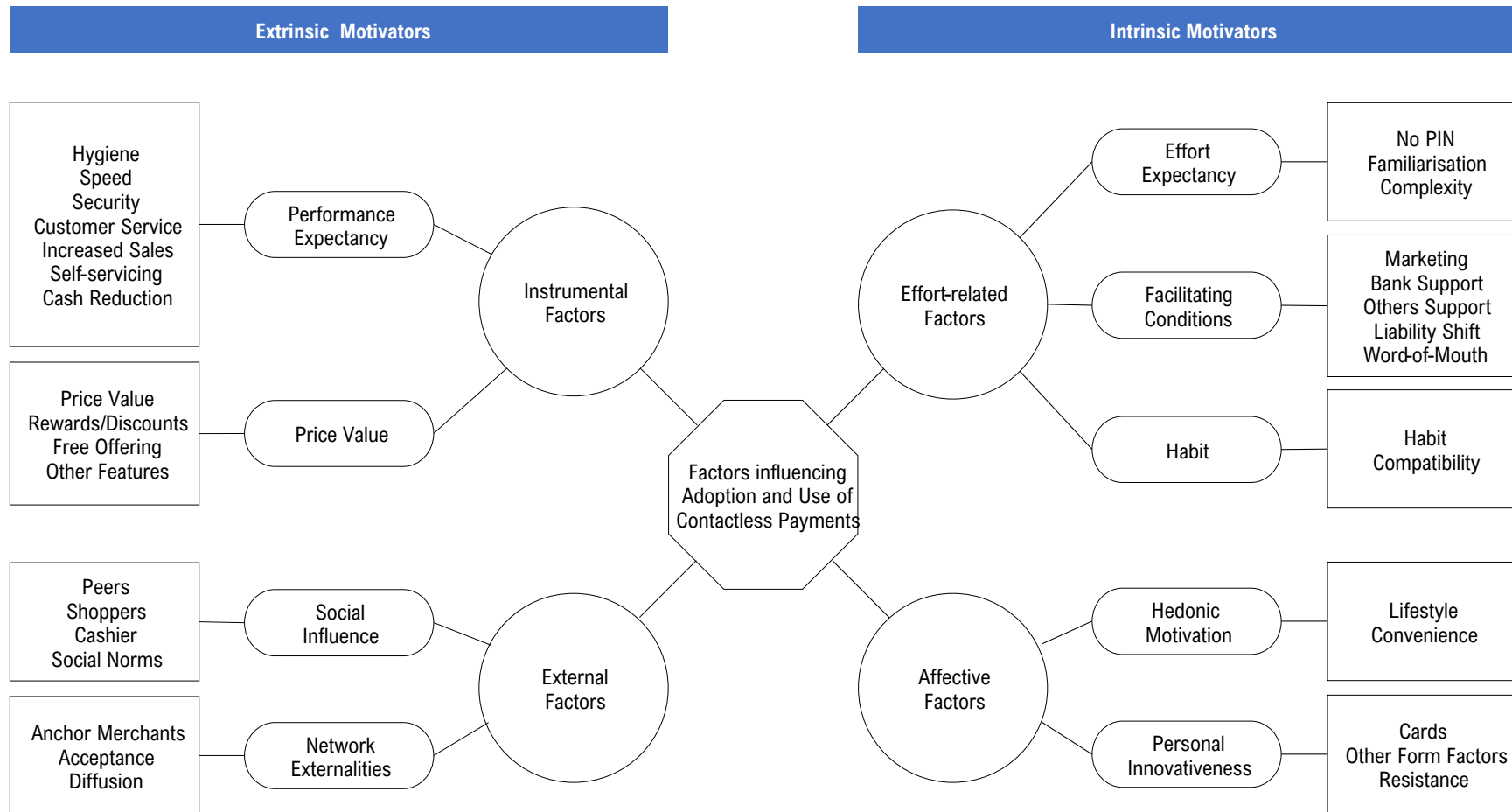


Figure 4-4: Conceptual framework. Source: author

## 4.11 Quality Checks

Qualitative research methods, as any research method, require theoretical sophistication and methodological rigour (Silverman, 2017).

Guba and Lincoln (1989) identify four criteria to evaluate qualitative research in terms of trustworthiness and rigour: credibility, dependability, confirmability, and transferability. These are related to the traditional criteria of reliability and validity that are applicable to quantitative research methods, but they have been redefined and reinterpreted as to avoid the inherent positivist assumptions underlying the latter (Bryman & Bell, 2011).

### 4.11.1 Credibility

Credibility has been defined as the pendant in qualitative research of what is internal validity for quantitative research (Guba & Lincoln, 1989). Validity is a concept that is rooted in the positivist tradition of quantitative research. An oft-cited definition of validity in qualitative research is found in Hammersley (2014): ‘the extent to which an account accurately represents the social phenomena to which it refers’. Winter (2000) argues that validity is a contingent construct, and subject to a fair amount of debate. Maxwell (1992) identifies five typologies of validity, of which the first three are central to a qualitative research project:

Descriptive validity: is factual accuracy in the informational statements that describe what was observed and experienced

Interpretative validity : is the comprehension of phenomena from the participants’ perspective

Theoretical validity: the validity of theoretical concepts as applied to phenomena, and the validity of the theorised relationships among the concepts

Generalisability: the extent to which accounts can be generalised within and between persons, times or settings

Evaluative validity: the application of an evaluative framework to the objects of the study

Guba and Lincoln (1989) suggest an approach of respondent validation as a means to ensure credibility. This entails cross-checking outcomes of the results of analysis with the respondents, to validate whether these correspond with the realities as perceived by them. However, this approach has been questioned as presenting a number of theoretical flaws and practical difficulties (Bryman & Bell, 2011).

Another technique to establish credibility is triangulation. It refers to the use of multiple sources of data and multiple methods to confirm findings and conclusions. Four common types of triangulation have been identified (Patton, 2014): triangulation of qualitative sources, mixed qualitative–quantitative methods triangulation, analyst triangulation and theory/perspective triangulation.

For this research, triangulation of qualitative sources will be used to establish credibility. This implies confirming the consistency of different data sources within the same method, or stated differently, confirming consistency across interviewees. This does not entail that only conclusions or themes will be taken into account that have been expressed by multiple respondents, or that differences in points of view will disqualify themes (Patton, 2014). In this research, themes that have been identified by multiple respondents will carry more weight in subsequent phases of the research, and reasonable explanations for divergent viewpoints can add to the credibility of the themes.

#### 4.11.2 Dependability

Dependability is parallel to the criterium of reliability in quantitative research (Guba & Lincoln, 1989). Reliability is a concept stemming from the positivist paradigm underpinning quantitative research methods (Guba & Lincoln, 1994). Campbell and Fiske (1959) define reliability as ‘an agreement between two efforts to measure the same thing with the same



methods'. Coolican (2019) defines it as: 'extent to which findings or measures can be repeated with similar results'.

As qualitative research is inherently subjective and distinction between researcher and method is blurred, some authors question reliability as a relevant quality criterion for qualitative research (Stenbacka, 2001). Therefore, dependability focuses on the inquiry process itself, including a responsibility of the researcher to ensure the logic, traceability and documentation of the process (Guba & Lincoln, 1989).

For this research, the process used has been described in detail in this chapter, and the rationale for all steps in the development of the process have been documented to the extent reasonably possible. The traceability of the data and the results will be discussed below.

#### 4.11.3 Confirmability

Confirmability corresponds to the objectivity criterium in quantitative research. It requires that results, whether these are data points, interpretations or inquiries, are rooted outside of the researcher itself (Guba & Lincoln, 1989).

In quantitative research, objectivity is sought by the method of the research, which acts as a sentinel to deter any subjective influences by the researcher. In qualitative research, confirmability can be achieved by traceability of all data elements.

In this research, confirmability has been safeguarded by keeping all data sources and derived documents in a protected digital environment. Audio recordings have been kept as digital audio files. Transcripts of the audio recordings have been kept as Microsoft Word documents. The template analysis, based on the transcripts, has been carried out in the NVivo software package, and the relevant files have been saved, both on a local hard drive as well as a back-up on an encrypted cloud storage system within the Northumbria University environment. All

documents have been stripped from any personally identifiable data, and are linked to one another using a generic identification number as assigned by the researcher.

#### 4.11.4 Transferability

Transferability is analogous to external validity. It seeks to confirm the ability of the results to be transferred to other individuals, groups, contexts or settings (Bryman & Bell, 2011).

This concept is somewhat at odds with the constructivist paradigm, which emphasizes particularity over generalisability (Patton, 2014). Therefore Guba and Lincoln (1989) swap generalisability, which presupposes that there is a reality which exists outside of the subjects, to transferability between two contexts. The main difference is that for generalisability the burden of proof is with the researcher, who has to prove that their results can be extrapolated to other individuals or contexts, while with transferability, the burden of proof is with the receiver of the information, who has to ensure that two contexts represent enough similarities in order to transfer results or interpretations in a meaningful way (Guba & Lincoln, 1989).

#### 4.12 Conclusion

This chapter presented the results of the qualitative study of this research. It detailed the exploratory research carried out in preparation of the data collection. 20 semi-structured interviews with expert interviewees were carried out to explore the main factors that affect the acceptance of contactless proximity payments by consumers and by merchants. The results of the thematic analysis were used to develop a conceptual framework, which will be used in the subsequent chapter to formulate hypotheses for validation by a quantitative study among consumers and merchants.

## Chapter 5: Conceptual Model and Hypotheses

### 5.1 Introduction

Based on a focused literature review, this chapter elaborates and interprets the outcomes of the qualitative study as to answer the research question and achieve the research objectives. It describes how the theoretical research model is developed based on the research framework and the extant literature, and how the variables of the hypothesised model have been operationalised.

### 5.2 Selection of the theoretical framework

As demonstrated in Chapter 2, user adoption of innovations in the payment industry has been approached using a variety of theoretical user acceptance models, with the Technology Adoption Model (TAM) as described by Davis (1985) and the Universal Theory of User Adoption of Technology (UTAUT), and its successors, the UTAUT2 and UTAUT2E, models emerging as the most widely used theoretical frameworks.

The UTAUT2 framework in itself is an extension of the UTAUT framework, which intended to be a synthesis of the most influential technology adoption models in order to develop an all-encompassing model, i.e. TRA, TAM, TPB, TAM-TPB, MPCU, SCT, IDT and MM (Venkatesh et al., 2003). UTAUT has been developed with an organisational context in mind, in which users act in their role within the organisation. UTAUT2 extended the original UTAUT model for use in a consumer context, where users have a more personal finality for their decisions and actions. UTAUT2E, built on a meta-analysis of empirical research based on the UTAUT2 model, combined with original extensions or other frameworks, has shown to be superior in terms of explanatory power as compared to its predecessors.

For this research, the UTAUT2E framework will be used as a starting point for developing factors, identifying underlying constructs and determining interrelationships. As compared to UTAUT2, no factors have been removed, while a number of new factors have been added to the model. This implies that UTAUT2E is more comprehensive, although the fact of merely adding factors without reassessing the existing factors, puts a strain on the parsimony of the model. This will be taken into account when developing the measures.

In the context of this study, UTAUT2E is considered to be appropriate to identify factors influencing technology acceptance by consumers, as it is the successor of UTAUT2, one of the few technology acceptance models that have been designed specifically for use in a consumer context.

From a merchant perspective, this tenet seem less straightforward, as many businesses are organisations, with specific organisational roles assigned to individuals. For this study, the decision has been taken to focus on owners and operators of small- and medium-sized enterprises (SME). In part, the rationale is that an owner/operator of an SME combines multiple roles within the organisation. Hence, as these individuals are not characterised by multiple and highly specialised roles as typically found in larger organisations, their decision-making processes might be more akin to the individual processes than to organisational processes typically modelled in more institutionally-focused technology acceptance models.

A second rationale is that using the same theoretical framework for the two groups (consumers and merchants) will facilitate the comparison and contrasting of results emanating from both studies groups of platform participants.

Given the fact that contactless proximity payments, and more specifically in the UK, have already been widely adopted, adds to the relevance of the conclusions, as respondents can reflect on their own behaviour and relevant behavioural drivers, rather than speculate about

possible future intent or behaviour, as is the case in many acceptance models for emerging technologies. However, this reality puts into question the validity of one of the two dependent variables of the UTAUT models, i.e. Behavioural Intent, as this is inherently a pre-acceptance construct.

Post-acceptance behaviour has been a central focus of the ECM as developed and validated by Bhattacharjee (2001b) and extended in Bhattacharjee, Perols, and Sanford (2008) and Bhattacharjee and Lin (2015). Similar to the UTAUT models, the ECM connect usage intention with actual behaviour. The fundamental difference between both is that the UTAUT models relate prior intentions to ex-post behaviour, whereas ECM connects prior behaviour (as expressed by the Satisfaction construct) with ex-post intentions (as embodied in the Continuance Intention construct). In the extension of the ECM model, an ex-post behaviour construct is included as well, in the form of Continuance Behaviour (Bhattacharjee & Lin, 2015). Given the widespread adoption of contactless proximity payments, the post-acceptance dependent constructs of ECM are preferred over the pre-acceptance constructs of the UTAUT models.

A number of scholars have proposed and validated models connecting the independent factors of the UTAUT model and its successors, with the dependent post-acceptance variables from ECM (see: Purohit, Arora, & Paul, 2022; Tam, Santos, & Oliveira, 2020). A similar approach will be adopted for answering the research questions.

## 5.3 Model Development

### 5.3.1 Network Externalities

The impact of Network Externalities on the adoption and use of contactless proximity payments is key to the main hypothesis of the research, i.e. that indirect network externalities, next to

other factors, represent an explanatory factor for determining the acceptance and use of contactless proximity payments, both with consumers and merchants.

Katz and Shapiro (1986) state that ‘the utility that a given user derives from the good depends upon the number of other users who are in the same network’. Based on the seminal work of Katz and Shapiro (1985, 1986) and Rohlfs (1974), network externalities can be defined as the change in value relative to the number of other users within the same network. For multi-sided networks, this change in value will be determined by the ‘side’ of the network the other user belongs to.

The impact of Network Effects on behavioural intention has been demonstrated in previous research (Barnes & Böhringer, 2011; Lou, Luo, & Strong, 2000; Van Slyke, Ilie, Lou, & Stafford, 2007; C.-C. Wang, Hsu, & Fang, 2005), hence:

*H1a: Network Externalities have a positive and significant effect on Continuance Intention for contactless proximity payments*

Next to a direct effect on behavioural intention, prior research of the effect of network externalities in technology acceptance models has also confirmed an indirect effect, more specifically on habit (Barnes & Böhringer, 2011) hence:

*H1b: Network Externalities have a positive and significant effect on Habit for contactless proximity payments*

### 5.3.2 Habit

Habit is a factor that has been proposed by Venkatesh et al. (2012) when extending the original UTAUT model to a consumer context, utilising Triandis (1979) definition of Habit as ‘... situation-behaviour sequences that are or have become automatic, so that they occur without self-instruction’. Habit has been held back for a long time because of the difficulty of measuring

it as a construct (Thompson & Higgins, 1991). The systematic literature review revealed that Habit as a factor has only been included sparsely in acceptance models for payment technology. In the last decade, however, Habit as a factor in IS research has gained renewed prominence, however its impact is confirmed to be largely dependent on context and models (Jeyaraj, 2022).

Meta-analysis suggests Habit to be a strong predictor of intention, even more articulated for well-established and mature technologies (Tamilmani, Rana, & Dwivedi, 2021). Santosa, Taufik, Prabowo, and Rahmawati (2021), in line with C. Wang, Harris, and Patterson (2013) and Alalwan, Dwivedi, and Rana (2017) confirmed that the continuous use of digital payment technology can become a habit and dependency explaining user satisfaction after use.

A strong association has been established between Habit and the ECM constructs of Continuance Intention (Tam et al., 2020) and Continuance Behaviour (Bhattacharjee & Lin, 2015; Limayem, Hirt, & Cheung, 2007), hence:

*H2a: Habit has a positive and significant effect on Continuance Intention for contactless proximity payments*

*H2b: Habit has a positive and significant effect on Continuance Behaviour for contactless proximity payments*

The qualitative research indicated Habit as a potentially influential factor, as a number of respondents saw positive reinforcement following self-observed behaviour as the first step towards developing a habit for using contactless payment technologies. However, this observation only came up related to consumers, not when it comes to merchants.

### 5.3.3 Social Influence

Social Influence has been defined by Venkatesh and Brown (2001) as "the extent to which members of a social network influence one another's behaviour". Social Influence, an extrinsic

factor present in the consecutive UTAUT models, has been equated to the Social Factors construct in the MCPU, the Encouragement by Others present in the SCT. and the Subjective Norm construct present in the TAM models and the MM model. Venkatesh et al. (2003) also equate it to the Image construct present in the IDT. Social Factors, as well as Subjective Norm, have been associated with the intention to continue the use of a new technology (Bhattacharjee & Lin, 2015; Purohit et al., 2022; Tam et al., 2020), hence:

*H3a: Social Influence has a positive and significant effect on Continuance Intention for contactless proximity payments*

The qualitative research has exemplified Social Influence in five items:

Peers/Friends/Relatives: the social influence experienced in various social circles of the consumer, but not necessarily coinciding with the act of making the payment at the point of sale

Other shoppers: the social influence exerted by people in the immediate environment of the consumer when making the payment at the point of sale

Cashier: the social influence exerted by the merchant when making the payment at the point of sale

Social Norms: the social influence experienced, not through direct personal contact, but through intermediaries as social media or more generally, social norms

#### 5.3.4 Performance Expectancy

Performance Expectancy is an extrinsic instrumental factor. Several technology models include concept very similar or identical to Performance Expectancy, such as Perceived Usefulness



(TAM, TAM2, TAM3, TAM-TPB, MM and ECM), Job Fit (MPCU), Relative Advantage (IDT) and Outcome Expectations (SCT).

Venkatesh et al. (2003) define Performance Expectance for the UTAUT model as ‘the degree to which an individual believes that using the system will help him or her to attain gains in job performance’, a definition they adapted to ‘the degree to which using a technology will provide benefits to consumers in performing certain activities’ for the UTAUT2 model (Venkatesh et al., 2012).

It has been demonstrated that Performance Expectancy influences both the post-acceptance affect Satisfaction, as well as Continuance Intention (Bhattacharjee, 2001b; Bhattacharjee & Lin, 2015), hence:

*H4a: Performance Expectancy has a positive and significant effect on the Continuance Intention for contactless proximity payments*

The results of the qualitative study indicate that Performance Expectancy is relevant for both consumers and merchants. Following items have been associated with Performance Expectancy:

Hygiene: the fact that contactless proximity payments avoid physical contact between the consumer and the merchant payment terminal, as the card does not need to be inserted into the terminal, and the user does not need to type in a PIN code on the PIN-pad connected to the point-of-sale device (POS)

Speed: the fact that contactless proximity payments can be conducted in a shorter timespan than other forms of payment, because of the fact that the card does not need to be inserted into a card slot, because of the fact that the card processing is quicker than traditional contact chip

payments, and also because below a certain transaction amount, no personal identification number (PIN) needs to be provided

Security: the fact that contactless payment cards and devices are protected by state-of-the-art security techniques

Customer Service: the fact that contactless payment provide a better service to customers by increasing convenience and reducing latency

Increased Sales: referring to the positive impact of a better customer experience to cross-sell and upsell opportunities

Self-servicing: the opportunity to reduce cost by reducing staff levels at the check-out by moving more activity toward the consumers

Cash Reduction: the reduction in overhead costs related to the handling of cash, including counting, handling, transporting and securing notes and coins.

### 5.3.5 Effort Expectancy

Effort Expectancy is an intrinsic factor, comparable to (Perceived) Ease of Use (TAM, TAM2, TAM3, TAM-TPB, MM, IDT) and Complexity (MPCU). It is associated with the ease of use of the technology. In the UTAUT model, Venkatesh et al. (2003) simply define effort expectancy as ‘degree of ease associated with the use of technology’. Effort Expectancy has been shown to positively influence both Satisfaction as well as Continuance Intention of technology use (Hamid, Razak, Bakar, & Abdullah, 2016; Purohit et al., 2022), hence:

*H5a: Effort Expectancy has a positive and significant effect on the Satisfaction with contactless proximity payments by consumers*

*H5b: Effort Expectancy has a positive and significant effect on the Continuance Intention for contactless proximity payments by consumers*

*H5c: Effort Expectancy has a positive and significant effect on the Performance Expectancy for contactless proximity payments by consumers*

Based on the qualitative research, following items have been associated with Effort Expectancy:

No PIN: the fact that for the majority of retail payments, i.e. those below a certain threshold amount, no PIN code needs to be entered on the POS payment terminal

Familiarisation: the fact that users need to get familiar with contactless payment cards or devices before being able to use it

Complexity: the fact that contactless payment technology is more complex than incumbent payment technologies

### 5.3.6 Facilitating Conditions

Triandis (1979) defines Facilitating Conditions as ‘... objective factors, “out there” in the environment, that [...] make an act easy to do’. It has been identified as an influencing factor in the TAM-TPB, separating Resource and Technology Facilitating Conditions, and present in MPCU and the UTAUT models. It has also been associated with the Support construct of the SCT, defined as ‘The availability of assistance to individuals who require it...’, also referring to external factors aimed at facilitating a task (Compeau & Higgins, 1995). Bhattacharjee et al. (2008) confirmed the effect of Facilitating Conditions on Continuance Intention, hence:

*H6a: Facilitating Conditions has a positive and significant effect on the Continuance Intention for contactless proximity payments*

The qualitative research has identified following items that relate to Facilitating Conditions.

Marketing: Advertising, communication and PR activities aimed at increasing awareness and driving acceptance

Bank support: support given by the bank or financial institution of the consumer or the merchant

Other: other sources of support to users, including card manufacturers, mobile phone manufacturers and the payment ecosystem in general

Communications: availability of educational or general information to users aimed at facilitating the use of contactless technology.

Liability Shift: a measure implemented by banks, that protects merchants against chargebacks for fraudulent transactions with lost or stolen cards

Word-of-mouth: the fact that experiences are shared between participants

### 5.3.7 Hedonic Motivation

Enjoyment is a construct that has been introduced by Davis et al. (1992) as an example of intrinsic motivation, and has been defined as ‘the extent to which the activity of using the [technology] is perceived to be enjoyable in its own right’. Venkatesh et al. (2012) associated enjoyment with the factor hedonic motivation. This factor, present in TAM3, MM, UTAUT2 and UTAUT2E is generally associated solely with intention to use, rather than use itself. Tam et al. (2020) and Purohit et al. (2022) confirmed the effect of Hedonic Motivation on Continuance Intention, hence:

*H7a: Hedonic Motivation has a positive and significant effect on Continuance Intention for contactless proximity payments*

Based on the qualitative research, enjoyment has been closely related with the convenience of using the technology. Although the act of paying is in itself not gratifying while merely providing utilitarian value, the speed and ease of use are considered by many respondents as providing more enjoyment during the act of paying as opposed to other forms of completing a payment transaction. This factor has only been mentioned for the cardholder experience of paying, not for the merchant experience of accepting payments.

### 5.3.8 Price Value

Price Value and Costs are factors that have been proposed when the scope of technology adoption models was enlarged to move beyond the institutional context towards a consumer setting. One of the identifying aspects of a consumer context is the fact that consumers have to bear the costs associated with the technology, as opposed to organisational contexts (Venkatesh et al., 2012). In the UTAUT2 article, the authors equated Price Value and Costs, but in its successor paper UTAUT2E, two distinct constructs have been defined, Price Value and Costs (Blut et al., 2021). The former has been defined as ‘the individual’s cognitive trade-off between the perceived benefits of the applications and the monetary cost for using them’ and the latter as ‘the extent to which a user perceives that using a technology is costly’. Although the definition of both constructs is very similar – both referring to the monetary costs of using the technology, and the user’s perception of their relative magnitude - the correlation between both factors has been observed to be non-significant. The authors did not provide an explicit discussion of this observation in the article, and a subsequent request for further elaboration to the corresponding author of the article has been left without a response. This research will retain the equivalence of Price Value and Costs as in the original UTAUT2 paper. Tam et al. (2020) associate Price Value to Continuance Intention, and C.-L. Hsu and Lin (2015) confirm the associations with both Continuance Intention as Satisfaction, hence:

*H8a: Price Value has positive and significant effect on Continuance Intention for contactless proximity payments*

*H8b: Price Value has a positive and significant effect on the Satisfaction with contactless proximity payments*

The qualitative research associated three items with perceived costs and value of using contactless technology

Price Value: the relationship between the costs or investments, and the associated returns

Rewards and Discounts: positioned as the negative of a monetary costs, respondents fly the idea of using monetary reward and discount schemes in order to increase the adoption of technology

Free offering: the observation that most payment cards in the UK are offered for free, or are part of a wider banking bundle, and hence are considered free offerings for the consumer. Also for merchants, the upgrade to contactless tend to be transparently priced by merchant acquiring banks.

Other features: a number of respondents mentioned the bundling of contactless technology with other features in order to allow banks to monetise their investments in new payment technology.

### 5.3.9 Compatibility

G. C. Moore and Benbasat (1991) included Compatibility as a factor for technology acceptance, drawing upon the hypotheses as formulated by E.M. Rogers (2003). The authors defined Compatibility as ‘the degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters’. Karahanna,

Agarwal, and Angst (2006) define it as ‘the perceived cognitive distance between an innovation and precursor methods for accomplishing tasks’, and elaborate the multi-dimensional aspect of this construct within technology acceptance research. The authors define four dimensions, i.e. values, past experience, current practices and preferred practices.

The Compatibility construct has not been withheld in many subsequent technology acceptance models, however Blut et al. (2021) did incorporate Compatibility as an independent factor for the UTAUT2E model they proposed, found to affect both use as well as intention to use. Compatibility has been confirmed as an antecedent to Continuance Intention (Sun & Jeyaraj, 2013), hence:

*H9a: Compatibility has a positive and significant effect on Continuance Intention for contactless proximity payments*

Compatibility has only been mentioned once during the qualitative study, in the context of acceptance by merchants, more specifically relating to the operational and financial efforts to implement contactless technology.

### 5.3.10 Personal Innovativeness

Personal Innovativeness was introduced by Agarwal and Karahanna (2000), where it ‘represents an individual characteristic reflecting a willingness to try out any new technology’. Personal Innovativeness has been posited as a precedent of a construct labelled Cognitive Absorption, preceding on its turn Perceived Usefulness and Perceived Ease-of-Use. Blut et al. (2021) have incorporated the construct as a precedent to both use as intention to use in the UTAUT2E model. A positive impact of Personal Innovativeness on Continuance Intention has been demonstrated (Lin & Filieri, 2015), hence:

*H10a: Personal Innovativeness has a positive and significant effect on Continuance Intention for contactless proximity payments*

In the qualitative study, many interviewees have mentioned personal innovativeness as an influencing factor for the adoption of contactless technologies, whether as an additional feature for plastic cards, or as an enabling technology for payments with digital devices, such as mobile phones. On the opposite side, it has been mentioned that some customers might oppose change out of personal resistance.

### 5.3.11 Confirmation

Drawing upon the expectation-confirmation theory as developed by Oliver (1980), Bhattacharjee (2001b) defines Confirmation as the delta between expectations before and the experiences after actual use by the user of a technology. This is also the reason why the same concept is sometime labelled Disconfirmation. It is hypothesised to positively influence post-acceptance Satisfaction. The same study also confirmed a positive effect of the Confirmation construct on Performance Expectancy, as a positive confirmation tends to raise the expectancy post-acceptance, and vice-versa, hence:

*H11a: Confirmation has a positive and significant effect on Performance Expectancy of contactless proximity payments*

*H11b: Confirmation has a positive and significant effect on the Satisfaction with contactless proximity payments*

### 5.3.12 Satisfaction

The ECM is based on the assumption that the Continuance Intention for a given technology is determined by degree of Satisfaction experienced during initial use (Bhattacharjee, 2001b; Oliver, 1980). In this context, Satisfaction is defined as an affect with feelings about prior use



(Bhattacharjee, 2001b). Prior research indicates a two-pronged effect of Satisfaction on future use, a direct effect on Continuance Behaviour and a mediated effect through Continuance Intention (Bhattacharjee & Lin, 2015), hence:

*H12a: Satisfaction has a positive and significant effect on Continuance Intention of contactless proximity payments*

*H12b: Satisfaction has a positive and significant effect on Continuance Behaviour for contactless proximity payments*

### 5.3.13 Continuance Intention

Continuance Intention refers to post-adoption reinforcement of the pre-adoption decision made (Karahanna, Straub, & Chervany, 1999). Initially posited by Fishbein and Ajzen (1975) in the TRA, and subsequently confirmed by many technology acceptance studies, intention is the most influential determining factor of subsequent usage behaviour (Sheeran, 2002). Specifically the impact of Continuance Intention on Continuance Behaviour has been confirmed in the extensions to the original ECM (Bhattacharjee & Lin, 2015; Bhattacharjee et al., 2008), hence:

*H13a: Continuance Intention has a positive and significant effect on Continuance Behaviour for contactless proximity payments*

## 5.4 Conceptual Model

Based on the conceptual framework and the development of hypotheses, a conceptual model is proposed, integrating concepts of the UTAUT2E model by Blut et al. (2021) and the expanded ECM model by Bhattacharjee and Lin (2015), enhanced by the construct of Network Externalities.

The resulting conceptual model is visualised in Figure 5-1.

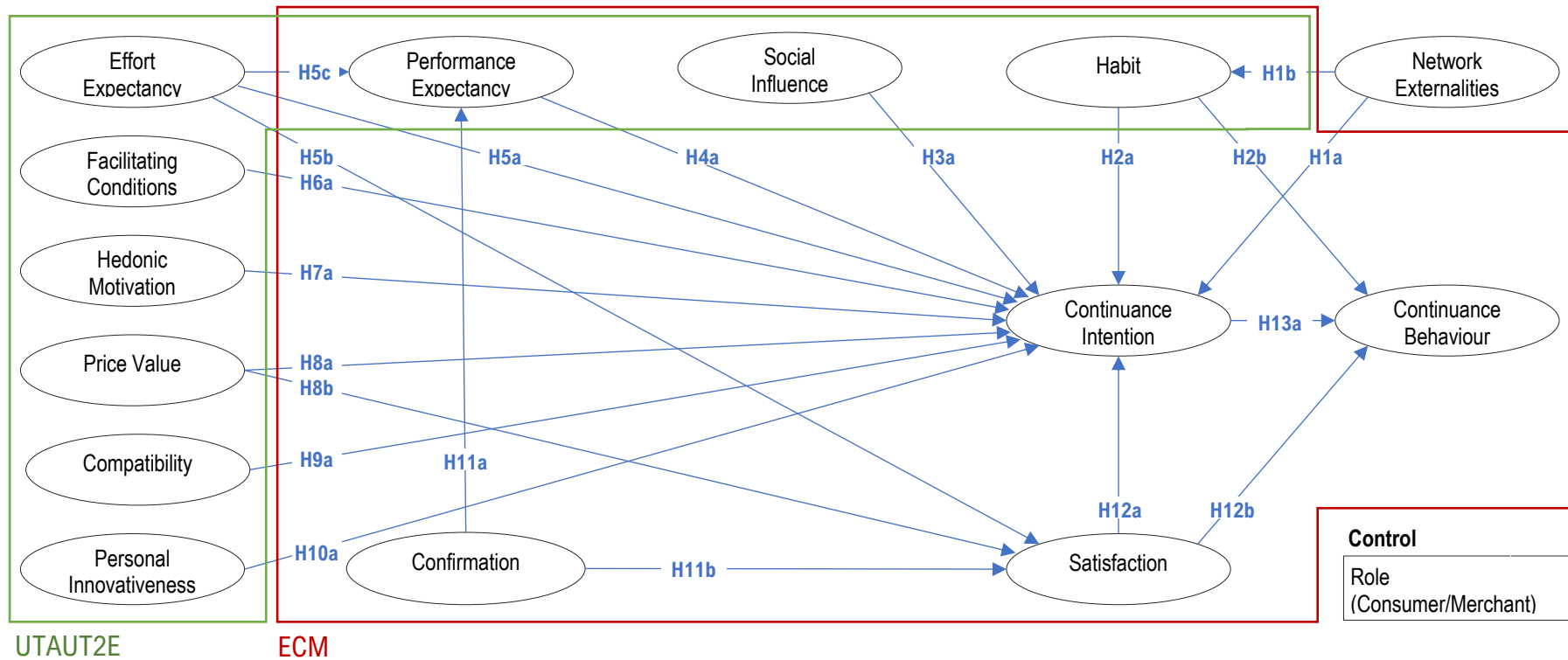


Figure 5-1: Conceptual model. Source: author

## 5.5 Operationalisation of Variables

As suggested by Venkatesh et al. (2003), the operationalisation of the variables to be used as a measurement scale for the different factors has to reflect the specific technology that is under scrutiny. For this research, the results from the qualitative study will be used to adapt the wording of the measures of factors in technology acceptance models as found in the literature.

As illustrated in Table 5-1, the measurement items of the constructs are based on the operationalisation of equivalent constructs in the seminal UTAUT and ECM models.

To operationalise the construct that will be added to the model, Network Effects, the literature suggests to use elasticities (Chu & Manchanda, 2016). In this context, this refers to the increase of the value of the platform to one side as a function of the increase of participation of another side. Network Effects has been operationalised as the perceived number of users (Lou, Luo, & Strong, 2000; Wang, Hsu, & Fang, 2005).

As contactless proximity payments cannot be considered an emerging technology any longer, as a majority of consumers and merchants in the UK have adopted the technology, the tense of the questions is the present, rather than the conditional tense typically used in technology acceptance model questionnaires.

Table 5-1: Constructs and measurement items. Source: author

Construct	Code	Question (Consumers)	Question (Merchants)	Adapted from	Scale
Network Externalities	NE1	From my observations, the number of merchants accepting contactless payments is large	From my observations, the number of merchants accepting contactless payments is large	Wang et al. (2005)	Likert 7-point, from (1) 'Strongly Disagree' to (7) 'Strongly Agree'
	NE2	From my observations, the number of consumers using contactless payments is large	From my observations, the number of consumers using contactless payments is large		
	NE3	In my opinion, many merchants accept contactless payments	In my opinion, many merchants accept contactless payments		
	NE4	In my opinion, many consumers frequently use contactless payments	In my opinion, many consumers frequently use contactless payments		
Habit	HA1	Using contactless technology for payments has become automatic to me	Using contactless technology for accepting payments has become automatic to me	Limayem et al. (2007); Morosan and Defranco (2016); Venkatesh et al. (2012)	
	HA2	Using contactless technology for payments is natural to me	Using contactless technology for accepting payments is natural to me		
	HA3	For paying, using contactless technology is an obvious choice for me	For accepting payments, using contactless technology is an obvious choice for me		
Social Influence	SI1	People who are important to me think that I should adopt contactless technology for paying	People who are important to me think that I should adopt contactless technology for accepting payments	Migliore, Wagner, Cechella, and Liébana-Cabanillas (2022); Morosan and Defranco (2016); Venkatesh et al. (2012)	
	SI2	People who influence my behaviour think that I should adopt contactless technology for paying	People who influence my behaviour think that I should adopt contactless technology for accepting payments		

Construct	Code	Question (Consumers)	Question (Merchants)	Adapted from	Scale
	SI3	People whose opinions that I value prefer that I adopt contactless technology for paying	People whose opinions that I value prefer that I adopt contactless technology for accepting payment		
Performance Expectancy	PE1	I believe that contactless technology enables me to conduct payments more quickly than other forms of payment (e.g. cash, cheques, chip & PIN)	I believe that contactless technology enables me to accept payments more quickly than other forms of payment (e.g. cash, cheques, chip & PIN)	Migliore et al. (2022); Morosan and Defranco (2016); Venkatesh et al. (2012)	
	PE2	I believe that contactless technology enables me to conduct payments in a more hygienic way than other forms of payment (e.g. cash, cheques, chip & PIN)	I believe that contactless technology enables me to accept payments in a more hygienic way than other forms of payment (e.g. cash, cheques, chip & PIN)		
	PE3	I believe that contactless technology enables me to conduct payments more securely than other forms of payment (e.g. cash, cheques, chip & PIN)	I believe that contactless technology enables me to accept payments more securely than other forms of payment (e.g. cash, cheques, chip & PIN)		
Effort Expectancy	EE1	Getting familiar with contactless payment technology is easy for me	Getting familiar with contactless payment technology is easy for me	Migliore et al. (2022); Morosan and Defranco (2016); Venkatesh et al. (2012)	
	EE2	Using contactless payment technology is clear and understandable	Using contactless payment technology is clear and understandable		
	EE3	Contactless technology is easy to use	Contactless technology is easy to use		
Facilitating Conditions	FC1	I have the resources necessary to use contactless payment technology (e.g. contactless card, mobile phone)	I have the resources necessary to use contactless payment technology (e.g. payment terminal with NFC reader)	Migliore et al. (2022); Morosan and Defranco	

Construct	Code	Question (Consumers)	Question (Merchants)	Adapted from	Scale
	FC2	I have the knowledge necessary to use contactless payment technology (e.g. information from my bank)	I have the knowledge necessary to use contactless payment technology (e.g. information from my bank)	(2016); Venkatesh et al. (2012)	
	FC3	Contactless payment technology is compatible with other devices I use (e.g. smartphone).	Contactless payment technology is compatible with other devices I use (e.g. cash register).		
	FC4	Help is available when I have difficulties with contactless payment technology (e.g. from my bank)	Help is available when I have difficulties with contactless payment technology (e.g. from my bank)		
Hedonic Motivation	HM1	Using contactless payment technology is fun	Using contactless payment technology is fun	Migliore et al. (2022); Morosan and Defranco (2016); Venkatesh et al. (2012)	
	HM2	Using contactless payment technology is enjoyable	Using contactless payment technology is enjoyable		
	HM3	Using contactless payment technology is entertaining	Using contactless payment technology is entertaining		
Price Value	PV1	Contactless payment technology is reasonably priced	Contactless payment technology is reasonably priced	Migliore et al. (2022); Venkatesh et al. (2012)	
	PV2	Contactless payment technology is a good value for the money (e.g. through offerings, rewards, discounts, etc.)	Contactless payment technology is a good value for the money (e.g. through liability shift)		
	PV3	At the current price, contactless payment technology provides good value	At the current price, contactless payment technology provides good value		
Compatibility	CP1	Contactless payment technology is compatible with most aspects of my life	Contactless payment technology is compatible with most aspects of my operations	Moore and Benbasat (1991)	

Construct	Code	Question (Consumers)	Question (Merchants)	Adapted from	Scale
	CP2	Contactless payment technology fits well with my lifestyle	Contactless payment technology fits well with my work style	Karahanna et al. (2006); Schierz, Schilke, and Wirtz (2010)	
	CP3	I would prefer using contactless technology instead of alternative modes of payment (e.g. cash, cheques, chip & PIN)	I would prefer using contactless technology instead of alternative modes of payment (e.g. cash, cheques, chip & PIN)		
Personal Innovativeness	PI1	If I heard about a new technology, I would look for ways to experiment with it	If I heard about a new technology, I would look for ways to experiment with it	Karahanna et al. (1999); Schmidhuber, Maresch, and Ginner (2020)	
	PI2	Among my peers, I am usually the first to try out new technologies.	Among my peers, I am usually the first to try out new technologies.		
	PI3	I like to experiment with new technologies	I like to experiment with new technologies		
Confirmation	CF1	My experience with contactless payment technology is better than what I expected	My experience with contactless payment technology is better than what I expected	Bhattacharjee (2001); Tam et al. (2020)	
	CF2	The service level provided by contactless payment technology is better than what I expected	The service level provided by contactless payment technology is better than what I expected		
	CF3	Overall, most of my expectations for using contactless payment technology are confirmed	Overall, most of my expectations for using contactless payment technology are confirmed		
Satisfaction	SF1	I made the correct decision in using contactless technology for payments	I made the correct decision in using contactless technology for accepting payments	Bhattacharjee (2001); Tam et al. (2020); Vila and Kuster (2011)	
	SF2	Experience with contactless payment technology is satisfactory	Experience with contactless payment technology is satisfactory		
	SF3	I am pleased with using contactless technology for payments	I am pleased with using contactless technology for accepting payments		

Construct	Code	Question (Consumers)	Question (Merchants)	Adapted from	Scale
Continuance Intention	CI1	I intend to continue using contactless payment technology rather than discontinue its use	I intend to continue using contactless payment technology rather than discontinue its use	Bhattacharjee (2001); Tam et al. (2020)	
	CI2	My intentions are to continue using contactless technology for payments more than alternative means (cash, cheques, chip & PIN, etc.).	My intentions are to continue using contactless technology for accepting payments more than alternative means (cash, cheques, chip & PIN, etc.).		
	CI3	If I could, I would like to discontinue my use of contactless technology for payments	If I could, I would like to discontinue my use of contactless technology for accepting payments		
Continuance Behaviour	CB1	I use contactless technology for paying frequently	I use contactless technology for accepting payments frequently	Sun, Bhattacharjee, and Ma (2009)	
	CB2	I use contactless technology for paying a lot	I use contactless technology for accepting payments a lot		
	CB3	What percentage of all your payments is carried out using contactless technology?	What percentage of all your payments is carried out using contactless technology?	Bhattacharjee and Lin (2015); Bhattacharjee et al. (2008)	Under 10%; 10–19%; 20–29%; 30–39%; 40–49%; 50–59%; 60–69%; 70–79%; 80–89%; more than 90%
Experience	EX1	How many years have you been using contactless technology for payments?	How many years have you been using contactless technology for accepting payments?		1-15 years



## 5.6 Conclusion

This chapter started from the conceptual framework presented in the previous chapter. The findings of the qualitative study have been interpreted by comparing and contrasting with findings from previous research in the area of technology acceptance. A conceptual model has been developed, based on the operationalisation of the variables as identified, which will be tested and validated in the next chapter.

## Chapter 6: Quantitative Analysis

### 6.1 Overview of Chapter

This chapter describes the quantitative analysis, based on structural equation modelling. It describes the estimation of the measurement model specifying how measured variables relate to the unobservable latent constructs. Subsequently, it describes the fitting of the structural model, representing how latent constructs interrelate between each other. Relevant descriptive statistics are defined, justified and discussed.

### 6.2 Method

The quantitative study has been based on a web-based survey, a method which has risen to prominence in both academic and commercial research (J. R. Evans & Mathur, 2018). One of the strongest drivers for web-based surveys is the cost effectiveness. Web-based research show an increase in cost effectiveness by a ratio 10 (Ebert, Huibers, Christensen, & Christensen, 2018). Furthermore, online surveys are able to reach large parts of individuals within diverse populations, especially in European countries where access to the internet is near universal, and the lag between the collection of the data and the analysis can significantly be reduced through the use of online repositories and built-in analysis tools (J. R. Evans & Mathur, 2018).

To recruit respondents, the services of a UK market research agency specialised in recruiting participants for online surveys have been engaged. They have constituted a base of over 130,000 vetted participants, which can be pre-selected using over 250 socio-demographic criteria.

The use of a pre-established and pre-screened respondent pool can contribute to minimise the impact of typical drawbacks of online surveys, such as lower response rates (Daikeler, Bošnjak, & Lozar Manfreda, 2020; Ebert et al., 2018; Manfreda, Bosnjak, Berzelak, Haas, & Vehovar,

2008), sampling bias (Dillman, Smyth, & Christian, 2014; J. R. Evans & Mathur, 2018), privacy issues (J. R. Evans & Mathur, 2018) and survey fraud (Brazhkin, 2020).

### 6.2.1 Questionnaire Design

Surveys collect data directly from participants by administering questions. This method has become important recently for research into consumer behaviour and opinions (Cozby & Bates, 2018).

The online survey is based on a questionnaire consisting of 2 main parts.

The first part tests the measures developed in the qualitative study and the literature review, using Likert items.

The second part collects information about the socio-demographic characteristics of the respondent such as age, gender, occupation and education.

### 6.2.2 The Likert Scale

The questions in the first part of the questionnaire utilised a 7-point Likert scale. This scale was introduced by psychology scholar Rensis Likert in 1932 as a technical solution to the problem of measuring attitudes (Likert, 1932). More particularly, it has been designed to measure beliefs, opinions of respondents to a survey. A Likert scale is a composite of multiple Likert items. A Likert item is a statement that the respondent is asked to evaluate.

Respondents are asked to rate their amount of agreement by selecting a position, called point, on a continuum between two extreme positions, in this case full agreement and full disagreement. For this research, a 7-point scale has been opted for. Likert scales with an uneven number of points always have a midpoint, which allows the respondent to take a neutral, indifferent or undecided stance. Johns (2005) argues that this possibility helps to increase the validity of a research in which a significant proportion of the respondents is unfamiliar with the

topic. As this research does not want to presume familiarity with all items present in the questionnaire, a scale with an uneven number of response options will be used. Although Likert items with 5 points are still prevalent in social research (Johns, 2005), in contemporary psychonomical research, a 7-point Likert scale was found to rank among the highest in terms of reliability, consistency, discriminatory power or validity, and user preference (Preston & Colman, 2000).

It has been argued that the success of the Likert scale is due to its simplicity, rather than to its validity in all circumstances (Johns, 2005). The Likert scale assumes that the strength of an attitude is linear, i.e. on a continuum from strongly agree to strongly disagree, and makes the assumption that attitudes can be measured quantitatively (Carifio & Perla, 2007; Likert, 1932). However, there is a debate about this assumption, as other scholars argue that a Likert scale is an ordinal scale and hence can only be used to calculate a median and a mode (Jamieson, 2005).

The tendency to agree with statements irrespective of their content, termed acquiescence bias, is also considered a problem associated with the Likert-type format (Schuman & Presser, 1981). However, as this analysis will be using the data obtained by applying a Likert scale to determine a variance/covariance structure, rather than scale means, under the assumption that the acquiescence bias is constant across participants, these analyses will be unaffected by acquiescence bias (Savalei & Falk, 2014).

### 6.2.3 Pre-Test and Pilot Study

Several authors have demonstrated the importance of running a pre-test and a pilot before conducting the principal study. These can be instrumental in surfacing hidden issues with the research instruments utilised that, if undetected, can compromise the results or the interpretation of the research.

For this research, the proposed questions have been reviewed by a panel of three academics with extensive experience in the field of research and the data collection methods utilised. Based on their input, the minimum number of questions per construct have been increased to three, a number of questions have been reworded to minimise the risk of leading questions and additional questions on years of experience and socio-economic factors have been added. The labels of the scales have been adapted as well to avoid any response bias.

After the evaluation by academic reviewers, the proposed questionnaire has also been submitted to a panel of consumers and merchants. They identified some instances of unclear wording, which have been reworded subsequently. Based on their input, the order of the questions has been adapted, to avoid priming bias.

## 6.3 Participants

### 6.3.1 Sampling Frame

The sampling frame is defined as the list of all units in the population from which the sample will be selected (Bryman & Bell, 2011). For the purpose of answering the research question of this research, the population can be subdivided into two groups, representative of both groups participating in a payment platform: consumers (payers) and merchants (payees).

For this study, only respondents over the age of 18 and permanently residing in the UK were considered to be eligible.

The first group of respondents is constituted of all individuals who regularly make purchases in retail settings. As this is a very general behaviour in the UK market, the population is theorised to be all eligible adults.

The second group is formed by retail merchants. In order to warrant the validity of the research, only individuals who have the authority to influence the selection of payment options presented

to the consumers will be considered. To this end, the respondents have been pre-screened, and selected on Industry Type (more specifically Grocery, Hotel and Food Service, Retail, Tourism and Hospitality) and Industry Role (more specifically Self-Employed/Partner or Upper Management). Furthermore, a preliminary screening question probed for decision-making authority when it comes to payment technology at the point of sale.

### 6.3.2 Sampling Method

For the population of consumers, a stratified sampling method has been adopted, ensuring that every gender has equal representation in the survey.

For the population of merchants, the online survey used a convenience sampling strategy, very common in the field of business and management (Bryman & Bell, 2011), especially for online surveys. Results obtained using this sampling method cannot strictly be generalised to the entire population, although this strategy is commonly used when focusing on studying the relationship between variables rather than to accurately infer population values (Cozby & Bates, 2018).

### 6.3.3 Sample size

The optimal sample size for a quantitative study is function of the effort required (cost and time) and the representativity of the sample. The latter is on its turn function of the population size, the confidence level required and the acceptable error margin. A sample size of 200 will allow for a confidence level of 95% and an error margin of 7%, for each population.

Specifically for the use of PLS-SEM, an oft-cited rule of thumb for determining minimum sample size is the 'rule of 10' (Hair, Hult, Ringle, & Sarstedt, 2017), which asserts the sample size should be 10 times the largest number of formative indicators used to measure a single construct, or 10 times the largest number of structural paths directed at a particular construct in the structural model, whichever is the largest.

The conceptual model of this research has a maximum of 4 indicators for a single construct, and one latent construct with 11 structural paths pointing towards it (Continuance Intention). Applying this rule suggests a minimum of 110 observations (10 times 11 paths), which is largely exceeded with over 400 respondents, 200 observations per group.

## 6.4 Data Collection and Analysis

### 6.4.1 Respondents

In total, from the 121,224 UK adults present in the database of the market research agency, 43,038 were invited to take part as consumers. 215 respondents started the questionnaire, of which 12 did not complete the survey or withdrew their participation afterwards. 202 questionnaires were duly completed, of which 188 had all questions answered.

For the merchant respondents, 362 did meet the pre-screening criteria and were invited to participate. 217 respondents started the questionnaire, of which 17 did not complete the survey or withdrew their participation afterwards. 200 questionnaires were duly completed, of which 182 had all questions answered.

This resulted in 402 surveys completed, of which 370 had all questions responded to.

### 6.4.2 Demographic Characteristics

The different socio-demographic characteristics of the survey respondents are summarised in Table 6-1

Table 6-1: Demographic characteristics. Source: author

		Consumers	Merchants	Total
<b>n</b>		202	200	402
<b>Age</b>	18-24	40	16	56
	25-34	81	63	144
	35-44	48	60	108
	45-54	21	30	51
	55-64	6	25	31
	Above 65	6	5	11
	Other/Prefer not to say		1	1
<b>Gender</b>	Female	100	110	210
	Male	101	88	189
	Other/Prefer not to say	1	2	3
<b>Education</b>	Doctorate degree	4		4
	Master's degree	32	18	50
	Bachelor's degree	84	81	165
	High school or equivalent	68	66	134
	Trade/technical/vocational training	12	25	37
	Some high school	2	7	9
	Other/Prefer not to say		3	3
	<b>Employment</b>	Self-employed	6	106
Full-time employment		121	85	206
Part-time employment		27	6	33
Unemployed		14		14
Inability to work		4		4
Student		20	1	21
Other/Prefer not to say		10	2	12

### 6.4.3 Descriptive Statistics

The mean, median, minimum, maximum and standard deviation of each item in each construct are presented in Table 6-2.

Table 6-2: Descriptive statistics of each item in each construct. Source: author

		Mean	Min	Max	Standard Deviation
Network Externalities	NE1	6.471	1	7	0.835
	NE2	6.219	1	7	1.028
	NE3	6.423	3	7	0.779
	NE4	6.308	1	7	0.878
Habit	HA1	6.132	1	7	1.239
	HA2	6.137	1	7	1.227
	HA3	6.047	1	7	1.246
Social Influence	SI1	4.776	1	7	1.369
	SI2	4.364	1	7	1.436
	SI3	4.800	1	7	1.329



Performance Expectancy	PE1	6.150	1	7	1.117
	PE2	6.065	1	7	1.153
	PE3	4.885	1	7	1.617
Effort Expectancy	EE1	6.187	1	7	1.018
	EE2	6.185	1	7	0.858
	EE3	6.336	3	7	0.796
Facilitating Conditions	FC1	6.235	1	7	0.99
	FC2	6.227	1	7	0.937
	FC3	5.973	1	7	1.176
	FC4	5.164	1	7	1.259
Hedonic Motivation	HM1	4.534	1	7	1.412
	HM2	5.388	1	7	1.341
	HM3	4.242	1	7	1.424
Price Value	PV1	5.344	1	7	1.268
	PV2	5.239	1	7	1.261
	PV3	5.468	1	7	1.201
Compatibility	CP1	6.050	1	7	1.116
	CP2	6.085	1	7	1.172
	CP3	5.759	1	7	1.453
Personal Innovativeness	PI1	5.100	1	7	1.279
	PI2	4.338	1	7	1.588
	PI3	5.474	1	7	1.317
Confirmation	CF1	5.393	1	7	1.161
	CF2	5.274	2	7	1.123
	CF3	5.993	1	7	0.949
Satisfaction	SF1	6.087	1	7	1.083
	SF2	6.072	1	7	0.879
	SF3	5.970	1	7	1.098
Continuance Intention	CI1	6.243	1	7	1.139
	CI2	5.998	1	7	1.367
	CI3	5.818	1	7	1.648
Continuance Behaviour	CB1	6.018	1	7	1.374
	CB2	5.910	1	7	1.446
	CB3	7.682	1	10	2.441

#### 6.4.4 Missing Values

In empirical data collection, there almost always are incidences of missing values. Extensive research has been carried out in this area, and several approaches have been proposed to optimally extract conclusions of data set with individual data points missing (Enders, 2022).

In this research, missing values are dealt with using pairwise deletion. This technique only delete cases in pairwise comparisons if one of both data elements is missing, whereas other cases are maintained. Analyses which spread across multiple data points, such as means or variances, will be calculated across all available data points. The upside of this technique is that a maximum of information contained within the dataset is retained.

## 6.5 Structural Equation Modelling

### 6.5.1 Structural Equation Modelling (SEM)

Structural equation modelling is a statistical approach that is utilised to model complex structural relationships between observed variables. Since the early 1980's, structural equation modelling has been widely used as a technique in behavioural sciences in general, and in management and marketing research in particular (Bagozzi & Yi, 1988). Its appeal is largely due to the fact that it deconstructs the full model into an observable part, defined by quantifiable factors, and an unobservable model which is theorised to underly the observable factors. This approach allows researchers to specify theoretical models to explain overt phenomena, and to use empirical data to test and quantify the hypothesised models.

To achieve this, structural equation modelling fits two models: a measurement model and a structural model.

The measurement model ties the observed, or manifest, variables to a number of constructs, termed latent constructs. How the observed variables relate to the latent constructs is hypothesised based on extant literature and is tested using sample data. The structural model construes the interrelationships between the latent constructs.

## 6.5.2 Partial Least Squares SEM

The estimation of the measurement model in this research will be carried out using partial least squares, a variance-based approach to structural equation modelling.

The observed factors typically suffer from a high degree of multicollinearity. As this obfuscates the interpretability of the measurement model parameters, it is important to reduce the multicollinearity by reducing the number of dimensions in the observed variables (Mateos-Aparicio, 2011). Variance-based structural equation modelling estimates the parameters of the factors by using dimensionality-reduction techniques aimed at explaining the variance of the observed factors. This contrasts with covariance-based structural equation modelling (CB-SEM), where model parameters are estimated by minimising the differences between the theoretical covariance matrix and the empirically observed covariance matrix using a maximum likelihood estimation approach. The latter requires the observable variables to be normally distributed, and a relatively large number of cases is required to estimate the fit of the model (Raykov & Marcoulides, 2006)

As opposed to principal component regression (PCR), where components are determined solely based on the capability to explain the variance in the observed independent variables, in partial least squares regression (PLS) components are selected based on the capability to explain the variance in the both the independent as in the dependent variables, making this a suitable technique to reduce multicollinearity while maximising the structural model fit (Mateos-Aparicio, 2011).

As the underlying assumptions for partial least squares regression do not include normality of observed data, nor a high number of cases, PLS-SEM is considered more agile, even with a reduced number of cases (Mateos-Aparicio, 2011).

This research has used SmartPLS software to perform PLS-SEM (Christian M Ringle, Wende, & Becker, 2015).

## 6.6 Measurement Model

The measurement model is the part of the model that examines relationship between the latent variables and their measures (Sarstedt, Ringle, & Hair, 2017).

### 6.6.1 Reliability and Validity

For reflective measurement models, it is suggested to assess indicator reliability, internal consistency reliability, convergent validity, and discriminant validity (Hair et al., 2017).

#### **Indicator Reliability**

Indicator Reliability refers to the fact that an indicator has a lot in common with the associated latent construct. It is measured by assessing the outer loadings of the construct. A number of authors consider a cut-off value of 0.7 or above for individual standardised loadings as an acceptable level, although in larger models, individual loadings as low as 0.5 could still occur in satisfactorily fitting models (Bagozzi & Yi, 2012).

Figure 6-1 illustrates the factor loadings of all indicators present in the model. All but 4 indicator loadings are in excess of 0.7, of which 3 are in excess of 0.6. The only indicator with a considerable lower loading is FC4. As a result, this indicator will be removed from further analysis.

Furthermore, all T-statistics are greater than 1.96 and the associated *p*-values are all < 0.05, indicating that all indicators are significant.

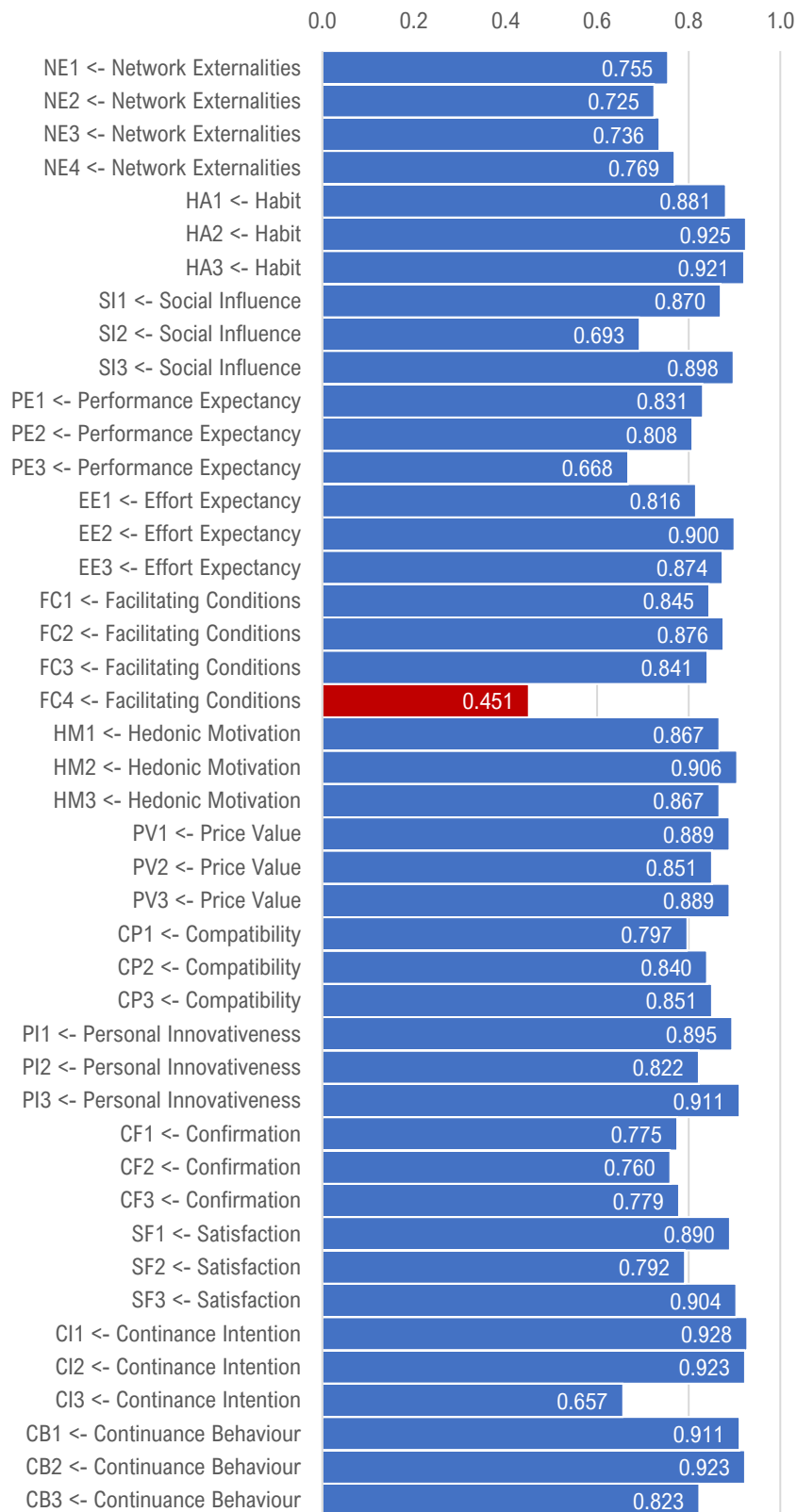


Figure 6-1: Indicator loadings. Source: author

## Internal Consistency Reliability

Internal consistency reliability measures the degree to which different test items that measure the same construct produce similar or consistent results. Cronbach's Alpha is one of the most commonly used indicator of internal consistency reliability (Bryman & Bell, 2011; Cozby & Bates, 2018). A value of 0.8 for this measure has been put forward as an acceptable level, although many authors would accept values as of 0.7 (Bryman & Bell, 2011; M. Easterby-Smith et al., 2021). At the other end of the continuum, values in excess of 0.95 are to be avoided, as they can indicate straight lining (Hair, Risher, Sarstedt, & Ringle, 2019). Next to Cronbach's Alpha, Composite Reliability as introduced by Jöreskog (1970) has been proposed as a more precise measure of internal consistency reliability, as it introduces weighting of items (Hair et al., 2019). The values of Composite Reliability are interpreted similarly to Cronbach's Alpha.

Table 6-3: Internal consistency reliability measures. Source: author

	<b>Cronbach's Alpha</b>	<b>Composite Reliability</b>
Network Externalities	0.823	0.860
Habit	0.895	0.935
Social Influence	0.754	0.860
Performance Expectancy	0.652	0.811
Effort Expectancy	0.842	0.902
Facilitating Conditions	0.822	0.894
Hedonic Motivation	0.865	0.913
Price Value	0.849	0.909
Compatibility	0.808	0.876
Personal Innovativeness	0.847	0.908
Confirmation	0.725	0.829
Satisfaction	0.845	0.903
Continuance Intention	0.859	0.915
Continuance Behaviour	0.790	0.877

Table 6-3 demonstrates that all Cronbach's Alpha and Composite Reliability measures are in excess of 0.7. It can thus be assumed that all test items measuring the same construct produce similar and consistent results.

### **Convergent Validity**

Convergent validity refers to the similarity of a test with measures of the same concept developed through other methods (Bryman & Bell, 2011). A common used rule of thumb in the literature is to evaluate the Average Variance Extracted (AVE), for which values in excess of 0.5 are considered adequate (Bagozzi & Yi, 1988). This indicates that the latent variable is able to explain over half of the variance present in the various constituent variables.

*Table 6-4: Convergent validity measures. Source: author*

	<b>Average Variance Extracted</b>
Network Externalities	0.607
Habit	0.827
Social Influence	0.675
Performance Expectancy	0.591
Effort Expectancy	0.755
Facilitating Conditions	0.738
Hedonic Motivation	0.777
Price Value	0.768
Compatibility	0.703
Personal Innovativeness	0.767
Confirmation	0.618
Satisfaction	0.756
Continuance Intention	0.783
Continuance Behaviour	0.708

As demonstrated in Table 6-4, all AVE measures for the latent variables are in excess of 0.5, suggesting that similar constructs are indeed related.

## Discriminant Validity

Discriminant validity is the pendant of convergent validity, which measures to which extent variables are not related to latent variables they shouldn't be. This can be indicated to verifying if any construct's Average Variance Extracted (AVE) is greater than the variance shared between the construct and other constructs in the model. To assess this, the correlations between the constructs are compared with the square roots of the AVE's calculated for each of the constructs (Fornell & Larcker, 1981; Hulland, 1999).

Table 6-5: Correlation of constructs and square root of AVE (bold). Source: author

	Network Externalities	Habit	Social Influence	Performance Expectancy	Effort Expectancy	Facilitating Conditions	Hedonic Motivation	Price Value	Compatibility	Personal Innovativeness	Confirmation	Satisfaction	Continuance Intention	Continuance Behaviour
Network Externalities	<b>0.779</b>													
Habit	0.568	<b>0.910</b>												
Social Influence	0.183	0.365	<b>0.821</b>											
Performance Expectancy	0.447	0.667	0.367	<b>0.769</b>										
Effort Expectancy	0.655	0.729	0.224	0.616	<b>0.869</b>									
Facilitating Conditions	0.517	0.675	0.180	0.557	0.713	<b>0.859</b>								
Hedonic Motivation	0.245	0.489	0.472	0.577	0.423	0.353	<b>0.882</b>							
Price Value	0.275	0.479	0.319	0.553	0.425	0.378	0.502	<b>0.877</b>						
Compatibility	0.590	0.817	0.392	0.714	0.730	0.658	0.523	0.486	<b>0.838</b>					
Personal Innovativeness	0.236	0.452	0.393	0.432	0.452	0.403	0.549	0.347	0.436	<b>0.876</b>				
Confirmation	0.459	0.567	0.390	0.642	0.636	0.515	0.608	0.544	0.661	0.442	<b>0.786</b>			
Satisfaction	0.571	0.808	0.365	0.704	0.710	0.752	0.537	0.548	0.825	0.451	0.667	<b>0.870</b>		
Continuance Intention	0.518	0.775	0.306	0.610	0.620	0.664	0.417	0.379	0.763	0.305	0.492	0.736	<b>0.885</b>	
Continuance Behaviour	0.602	0.846	0.328	0.695	0.677	0.672	0.436	0.439	0.827	0.362	0.562	0.822	0.784	<b>0.842</b>

The correlation between the latent constructs is reflected in Table 6-5, with the square root of the different AVE's on the main diagonal. The latter is in all cases superior to the correlations with the other constructs.

## Common Method Bias

Common Method Bias refers to the variance that is attributable to the measurement method rather than to the constructs the measures represent. This is prevalent when data is obtained



from the same respondent in the same context (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

To counter this bias, a number of measures as suggested in the extant literature have been taken. First of all, it has been made clear to the respondents that the confidentiality of the answers would at all times be safeguarded. Secondly, the measures used have been taken from previous research, and have been adapted with the input of both academic as well as respondent reviewers to eliminate measure ambiguity to the maximum extent possible. Furthermore, the question order has been adapted to control for priming effects (Podsakoff et al., 2003).

According to Kock (2015), Common Method Bias can be identified in PLS-SEM by evaluating the Variance Inflation Factors (VIF) . If all VIF values are equal or lower than 3.3, the model can be considered not be contaminated by common method bias.

Table 6-6: Variance Inflation Factors for indicators. Source: author

	VIF		VIF		VIF
NE1	1.887	EE1	1.712	PI1	2.224
NE2	1.786	EE2	2.402	PI2	1.772
NE3	1.611	EE3	2.247	PI3	2.487
NE4	2.095	FC1	1.970	CF1	1.545
HA1	2.144	FC2	1.879	CF2	1.496
HA2	3.574	FC3	1.731	CF3	1.320
HA3	3.362	HM1	2.709	SF1	2.765
SI1	1.982	HM2	1.833	SF2	1.609
SI2	1.255	HM3	2.776	SF3	2.658
SI3	1.968	PV1	2.221	CI1	2.745
PE1	1.356	PV2	1.950	CI2	2.573
PE2	1.359	PV3	2.073	CI3	1.298
PE3	1.183	CP1	1.702	CB1	2.639
		CP2	1.883	CB2	2.884
		CP3	1.726	CB3	1.764

As illustrated in Table 6-6, all values are at or below the threshold of 3.3, with the exception of two indicators related to Habit, which are at 3.4 and 3.6, respectively. These values are very

close to the 3.3 cut-off value, and well below 5, the value above which collinearity issues are probable (Hair et al., 2019). This leads to the conclusion that the model overall is not subject to problematic effects of common method bias.

## 6.7 Structural Model

The structural model is the relationship between the latent variables, by testing all the hypothetical dependencies based on path analysis (Sarstedt et al., 2017).

### 6.7.1 Model Fit

Unlike other estimation techniques, model fit measures for PLS-SEM must be approached with a certain level of caution. Many model fit measures have been proposed fairly recently and do not benefit from the depth of experience and research towards similar measures in different contexts (Dash & Paul, 2021; Hair et al., 2017).

A widely used measure of model fit is Chi-squared ( $\chi^2$ ). It tests the discrepancy between the sample and the covariance matrices of the fitted model. Due to its definition, this measure increases with an increase in the number of indicators, as well as with the number of observations, although the model fit itself is not necessarily improved. While the more recent versions of SmartPLS do report the Chi-square measure, authors have warned against its use and interpretation to indicate adequate model fit in PLS-SEM (Hair et al., 2017; Lohmöller, 2013).

For models using PLS-SEM, some authors propose as measure for fit the Standardised Root Mean Square residual (SRMR) as a correlate of the Chi-squared test (Henseler, Hubona, & Ray, 2016). A SRMR value of 0.08 or below is considered to reflect an adequate level of fit for path models (Hu & Bentler, 1999).

The proposed model presents an SRMR value of 0.07, which is below the reported 0.08 cut-off value, hence the model can be considered to represent an adequate fit, with all the caution due to the interpretation of this measure in the context of PLS-SEM.

### 6.7.2 Coefficient of Determination

The measure for determination,  $R^2$  is a number between 0 and 1 that measures how well a statistical model predicts an outcome. More specifically, it expresses the variance in the latent endogenous variables explained by the exogenous variables.  $R^2$ -results of 0.67, 0.33 and 0.19 for latent endogenous variables in the structural model have been considered as substantial, moderate and weak (Chin, 1998). The results for the structural model are reported in Table 6-7.

*Table 6-7: Coefficient of determination of the structural model. Source: author*

	<b>R<sup>2</sup></b>	<b>R<sup>2</sup> (adj)</b>	<b>Qualification</b>
Continuance Behaviour	0.666	0.663	Substantial
Continuance Intention	0.811	0.806	Substantial
Habit	0.323	0.321	Weak
Performance Expectancy	0.485	0.483	Moderate
Satisfaction	0.613	0.610	Moderate

The  $R^2$  (adj) value of the final dependent variable, Continuance Behaviour is 0.663. This means that the proposed factors are able to explain 66.3% of the variance observed in the dependent variable Continuance Behaviour.

The  $R^2$  (adj) value for Continuance Intention is even higher, at 0.806. This means that the independent indicators are able to explain over 80% of the variance observed in the dependent variable Continuance Intention.

The other  $R^2$  (adj) values of dependent variables present in the model are labelled moderate to weak.

### 6.7.3 Path Coefficients

To assess the significance of the path coefficients, a bootstrapping procedure was performed in SmartPLS. With this resampling procedure, observations are drawn randomly from the original dataset, to create subsamples, allowing to test the statistical significance of the path coefficients. 5000 subsamples have been created at a projected confidence level of 95%.

Table 6-8 summarises the path coefficients and the corresponding  $p$ -values. Non-positive path coefficients and  $p$ -values below the 95% confidence level are marked in red.

Six paths are not significant at a 95% confidence level, i.e. Social Influence → Continuance Intention, Effort Expectancy → Continuance Intention, Facilitating Conditions → Continuance Intention, Hedonic Motivation → Continuance Intention, Price Value → Continuance Intention and Satisfaction → Continuance Behaviour. The path Personal Innovativeness → Continuance Intention is only just significant at a 95% confidence level, but reflects a negative path coefficient.

Table 6-8: Path coefficients and significance levels for the structural model. Source: author

	<b>Coefficient</b>	<b>p-values</b>
Network Externalities -> Continuance Intention	0.101	0.032
Network Externalities -> Habit	0.592	0.000
Habit -> Continuance Intention	0.327	0.000
Habit -> Continuance Behaviour	0.407	0.002
Social Influence -> Continuance Intention	-0.002	0.898
Performance Expectancy -> Continuance Intention	0.147	0.001
Effort Expectancy -> Satisfaction	0.451	0.000
Effort Expectancy -> Continuance Intention	-0.086	0.079
Effort Expectancy -> Performance Expectancy	0.351	0.000
Facilitating Conditions -> Continuance Intention	0.044	0.531
Hedonic Motivation -> Continuance Intention	-0.053	0.101
Price Value -> Continuance Intention	-0.049	0.076
Price Value -> Satisfaction	0.211	0.005
Compatibility -> Continuance Intention	0.244	0.000
Personal Innovativeness -> Continuance Intention	-0.055	0.048
Confirmation -> Performance Expectancy	0.43	0.000
Confirmation -> Satisfaction	0.268	0.000
Satisfaction -> Continuance Intention	0.169	0.000
Satisfaction -> Continuance Behaviour	0.248	0.060
Continuance Intention -> Continuance Behaviour	0.369	0.000

To measure effect size, the  $f^2$  measure is used.  $f^2$  is the change in  $R^2$  when an exogenous variable is removed from the model.  $f^2$ -values of 0.02, 0.15 and 0.35 are proposed as cut-off values to indicate if a predictor latent variable has a small, medium or large effect at the structural level (Cohen, 1988). The values are presented in Table 6-9.

Table 6-9: Effect size measures for the indicators of the structural model. Source: author

	<b><math>f^2</math></b>	<b>Qualification</b>
Network Externalities -> Continuance Intention	0.026	Small
Network Externalities -> Habit	0.477	Large
Habit -> Continuance Intention	0.078	Small
Habit -> Continuance Behaviour	0.222	Medium
Social Influence -> Continuance Intention	0.000	None
Performance Expectancy -> Continuance Intention	0.044	Small
Effort Expectancy -> Satisfaction	0.310	Medium
Effort Expectancy -> Continuance Intention	0.011	None
Effort Expectancy -> Performance Expectancy	0.141	Medium
Facilitating Conditions -> Continuance Intention	0.004	None
Hedonic Motivation -> Continuance Intention	0.007	None
Price Value -> Continuance Intention	0.008	None

Price Value -> Satisfaction	0.081	Small
Compatibility -> Continuance Intention	0.067	Small
Personal Innovativeness -> Continuance Intention	0.010	None
Confirmation -> Performance Expectancy	0.205	Medium
Confirmation -> Satisfaction	0.091	Small
Satisfaction -> Continuance Intention	0.024	Small
Satisfaction -> Continuance Behaviour	0.062	Small
Continuance Intention -> Continuance Behaviour	0.093	Medium

The structural model, with the path coefficients and confidence level indicators, is presented in Figure 6-2.

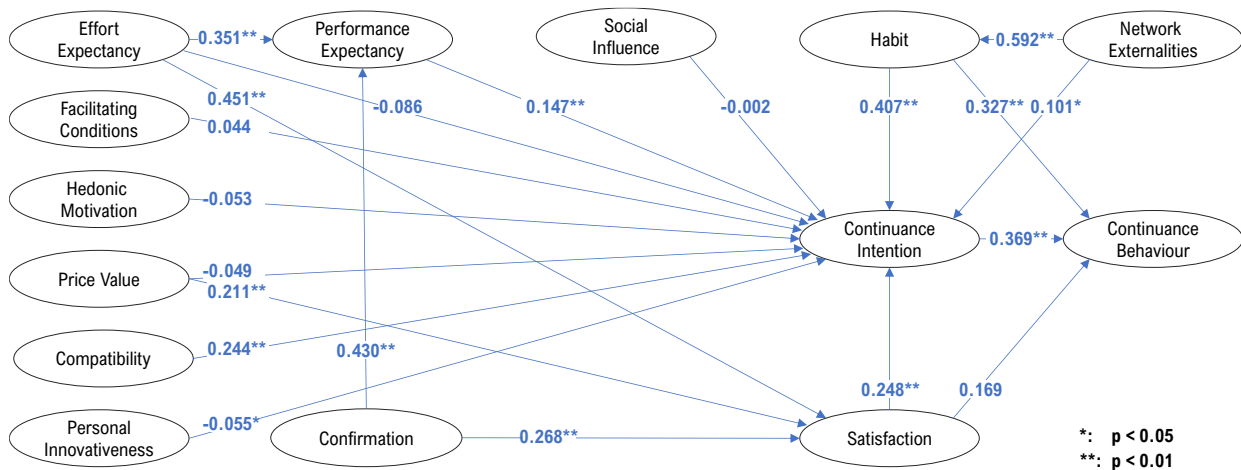


Figure 6-2: Structural model with path coefficients and confidence level indicators. Source: author

#### 6.7.4 Predictive Relevance

Predictive relevance assesses how well the model is able to accurately predict indicators of the endogenous constructs. A commonly used measure for assessing predictive relevance is  $Q^2$ .  $Q^2$ -values above zero indicate that the observed values are well reconstructed and that the model has predictive relevance (Geisser, 1975; Stone, 1974).

In SmartPLS software, the  $Q^2$ -value can be assessed using the PLSpredict algorithm (Hair et al., 2019). This algorithm has been applied, using the default values of 10 folds and 10 repetitions. The results are reported in Table 6-10.

Table 6-10: Predictive relevance measures for the structural model. Source: author

	<b>Q<sup>2</sup></b>
Continuance Behaviour	0.434
Continuance Intention	0.573
Habit	0.367
Performance Expectancy	0.515
Satisfaction	0.654

The reported Q<sup>2</sup>-values for the structural model are all well above zero, indicating that the model has predictive relevance for all dependent constructs.

### 6.7.5 Total Effects

The total effect of a construct is the combination of its direct and indirect effects of a latent variable on the other latent variables. The direct effects have been expressed through the coefficients of the structural model (Henseler, Ringle, & Sinkovics, 2009). From the 31 potential paths between constructs, 21 are considered significant at a 95% confidence level, with none of these displaying a negative path coefficient.

The indirect effects are not apparent in the results of the structural model. Using the bootstrapping technique available in the SmartPLS software, the total effects can be calculated for all possible combinations between latent variables present in the models. The results are presented in Table 6-11.

Table 6-11: Total effects between latent variables of the structural model. Source: author

	<b>Total Effect</b>	<b>p-values</b>
Network Externalities -> Habit	0.592	0.000
Network Externalities -> Continuance Intention	0.341	0.000
Network Externalities -> Continuance Behaviour	0.319	0.000
Habit -> Continuance Intention	0.407	0.000
Habit -> Continuance Behaviour	0.477	0.000
Social Influence -> Continuance Intention	-0.002	0.949
Social Influence -> Continuance Behaviour	-0.001	0.951
Performance Expectancy -> Continuance Intention	0.147	0.001

Performance Expectancy -> Continuance Behaviour	0.054	0.012
Effort Expectancy -> Performance Expectancy	0.351	0.000
Effort Expectancy -> Satisfaction	0.451	0.000
Effort Expectancy -> Continuance Intention	0.077	0.214
Effort Expectancy -> Continuance Behaviour	0.105	0.019
Facilitating Conditions -> Continuance Intention	0.044	0.456
Facilitating Conditions -> Continuance Behaviour	0.016	0.496
Hedonic Motivation -> Continuance Intention	-0.053	0.108
Hedonic Motivation -> Continuance Behaviour	-0.020	0.148
Price Value -> Satisfaction	0.211	0.005
Price Value -> Continuance Intention	0.003	0.935
Price Value -> Continuance Behaviour	0.037	0.197
Compatibility -> Continuance Intention	0.244	0.000
Compatibility -> Continuance Behaviour	0.090	0.003
Personal Innovativeness -> Continuance Intention	-0.055	0.055
Personal Innovativeness -> Continuance Behaviour	-0.020	0.100
Confirmation -> Performance Expectancy	0.430	0.000
Confirmation -> Satisfaction	0.268	0.000
Confirmation -> Continuance Intention	0.130	0.000
Confirmation -> Continuance Behaviour	0.093	0.005
Satisfaction -> Continuance Intention	0.248	0.000
Satisfaction -> Continuance Behaviour	0.261	0.004
Continuance Intention -> Continuance Behaviour	0.369	0.000

## 6.8 Hypothesis Testing

The hypotheses as formulated in Chapter 5 based on the literature review and the qualitative study have been summarised in Table 6-12, along with the corresponding measures from the quantitative study (path coefficient,  $p$ -values and indication of support). From the 20 hypotheses as formulated, 13 are supported by the data emanating from the quantitative study, whereas 7 are not. Six are not supported because the data are inconclusive, i.e. a  $p$ -value below the 95% significance interval, and one is not supported because the polarity of its path coefficient is opposite to the hypothesis as formulated.

Table 6-12: Support of hypotheses. Source: author

Hypothesis		Path coefficient	$p$ -values	Supported
H1a	Network Externalities have a positive and significant effect on Continuance Intention	0.101	0.032	Yes



Hypothesis		Path coefficient	p-values	Supported
H1b	Network Externalities have a positive and significant effect on Habit	0.592	0.000	Yes
H2a	Habit has a positive and significant effect on Continuance Intention	0.327	0.000	Yes
H2b	Habit has a positive and significant effect on Continuance Behaviour	0.407	0.002	Yes
H3a	Social Influence has a positive and significant effect on Continuance Intention	-0.002	0.898	No
H4a	Performance Expectancy has a positive and significant effect on Continuance Intention	0.147	0.001	Yes
H5a	Effort Expectancy has a positive and significant effect on Satisfaction	0.451	0.000	Yes
H5b	Effort Expectancy has a positive and significant effect on Continuance Intention	-0.086	0.079	No
H5c	Effort Expectancy has a positive and significant effect on Performance Expectancy	0.351	0.000	Yes
H6a	Facilitating Conditions has a positive and significant effect on Continuance Intention	0.044	0.531	No
H7a	Hedonic Motivation has a positive and significant effect on Continuance Intention	-0.053	0.101	No
H8a	Price Value has positive and significant effect on Continuance Intention	-0.049	0.076	No
H8b	Price Value has a positive and significant effect on Satisfaction	0.211	0.005	Yes
H9a	Compatibility has a positive and significant effect on Continuance Intention	0.244	0.000	Yes
H10a	Personal Innovativeness has a positive and significant effect on Continuance Intention	-0.055	0.048	No
H11a	Confirmation has a positive and significant effect on Performance Expectancy	0.43	0.000	Yes
H11b	Confirmation has a positive and significant effect on Satisfaction	0.268	0.000	Yes
H12a	Satisfaction has a positive and significant effect on Continuance Intention	0.169	0.000	Yes
H12b	Satisfaction has a positive and significant effect on Continuance Behaviour	0.248	0.060	No
H13a	Continuance Intention has a positive and significant effect on Continuance Behaviour	0.369	0.000	Yes

## 6.9 Heterogeneity Analysis

To assess the difference between the two constituting groups, consumers and merchants, a Multi-Group Analysis (MGA) has been conducted. MGA is a technique to explore differences across groups, in which the full model is compared across groups (Klesel, Schuberth, Henseler, & Niehaves, 2019).

### 6.9.1 Measurement Invariance

Before conducting a MGA, measurement invariance has to be established. This can be determined in a multi-step process as proposed by Henseler, Ringle, and Sarstedt (2016). This process encompasses the confirmation of configural and compositional variance, followed by the rejection of the hypothesis of equal means and variances for the composites across both groups.

#### **Configural Invariance**

Both constituting groups reflect the same basic factor structure in the measurement model, i.e. with the same constructs and items loaded on those constructs, and with identical subsequent data processing. This is the first prerequisite to continue to the next step towards establishing measurement invariance.

#### **Compositional Invariance**

Compositional Invariance is established by analysing whether the composite scores are created equally across both groups (Henseler, Ringle, et al., 2016). The measure for this is the *c*-value, representing the correlation between the composite scores using the weights obtained from both constituting groups. If *c* differs significantly from 1, the resulting conclusion is that there is no compositional invariance. The results in Table 6-13 are obtained by running a permutation algorithm in the SmartPLS software, with 1000 permutations, and pairwise deletion of missing values.

*Table 6-13: Compositional invariance. Source: author*

	<b>c-value</b>	<b>95% confidence interval</b>	<b>Compositional Invariance</b>
Network Externalities	0.993	[0.993; 1.000]	Yes
Habit	1.000	[0.999; 1.000]	Yes
Social Influence	0.979	[0.973; 1.000]	Yes

Performance Expectancy	0.998	[0.993; 1.000]	Yes
Effort Expectancy	1.000	[0.998; 1.000]	Yes
Facilitating Conditions	1.000	[0.995; 1.000]	Yes
Hedonic Motivation	1.000	[0.991; 1.000]	Yes
Price Value	0.998	[0.996; 1.000]	Yes
Compatibility	1.000	[0.997; 1.000]	Yes
Personal Innovativeness	0.998	[0.989; 1.000]	Yes
Confirmation	0.999	[0.996; 1.000]	Yes
Satisfaction	1.000	[0.999; 1.000]	Yes
Continuance Intention	0.999	[0.999; 1.000]	Yes
Continuance Behaviour	0.998	[0.998; 1.000]	Yes

We observe that all *c*-values are within the 95% confidence interval, i.e. not significantly differing from 1, so the condition of compositional invariance is fulfilled.

### Equality of Mean Values

After establishing configural and compositional invariance, the equality of composite mean values is tested. The following measures are obtained by running the same permutation algorithm in SmartPLS.

Table 6-14: Means equality. Source: author

	Difference of Means	95% confidence interval	Equal Mean Values
Network Externalities	-0.008	[-0.182;0.204]	Yes
Habit	0.199	[-0.188;0.188]	No
Social Influence	-0.477	[-0.213;0.186]	No
Performance Expectancy	0.175	[-0.199;0.198]	Yes
Effort Expectancy	0.300	[-0.205;0.202]	No
Facilitating Conditions	0.480	[-0.193;0.190]	No
Hedonic Motivation	-0.056	[-0.206;0.191]	Yes
Price Value	-0.078	[-0.199;0.184]	Yes
Compatibility	0.242	[-0.186;0.207]	No
Personal Innovativeness	-0.164	[-0.209;0.193]	Yes
Confirmation	0.033	[-0.195;0.197]	Yes
Satisfaction	0.132	[-0.202;0.196]	Yes
Continuance Intention	0.607	[-0.185;0.198]	No
Continuance Behaviour	0.236	[-0.199;0.206]	No

Table 6-14 presents the results of the mean comparison across both groups. From the 14 constructs, 7 can be considered as having a mean that is not significantly different, whereas the remaining 7 can be considered as different across groups. This is an indication for partial measurement invariance. This implies that analysis using PLS-MGA is meaningful, hence that the coefficients can be compared across groups (Henseler, Ringle, et al., 2016).

### Equality of Variances

Finally, a comparison of the variances of the different composites across groups is carried out, using the permutation algorithm of SmartPLS.

*Table 6-15: Variance equality. Source: author*

	<b>Difference of Variances</b>	<b>95% confidence interval</b>	<b>Equal Variances</b>
Network Externalities	-0.094	[-0.534;0.507]	Yes
Habit	-0.037	[-0.498;0.554]	Yes
Social Influence	-0.075	[-0.296;0.297]	Yes
Performance Expectancy	-0.270	[-0.472;0.450]	Yes
Effort Expectancy	-0.108	[-0.412;0.423]	Yes
Facilitating Conditions	-0.557	[-0.502;0.525]	No
Hedonic Motivation	0.083	[-0.301;0.310]	Yes
Price Value	-0.070	[-0.334;0.361]	Yes
Compatibility	0.016	[-0.438;0.428]	Yes
Personal Innovativeness	0.202	[-0.280;0.290]	Yes
Confirmation	0.302	[-0.267;0.285]	No
Satisfaction	-0.167	[-0.476;0.455]	Yes
Continuance Intention	-0.539	[-0.453;0.452]	No
Continuance Behaviour	-0.099	[-0.539;0.521]	Yes

Table 6-15 shows the results of the analysis. Similar to the means values, a number of constructs have a significantly differing variance, whereas others do not. This confirms the previous conclusion that Multi-Group Analysis is meaningful.

## 6.9.2 Multi-Group Analysis

Table 6-16: Multi-group analysis. Source: author

	Path Coefficients Consumers	<i>p</i> -Value Consumers	Path Coefficients Merchants	<i>p</i> -Value Merchants
Network Externalities -> Continuance Intention	-0.027	0.694	0.161	0.020
Network Externalities -> Habit	0.526	0.000	0.711	0.000
Habit -> Continuance Intention	0.482	0.000	0.264	0.036
Habit -> Continuance Behaviour	0.411	0.000	0.377	0.000
Social Influence -> Continuance Intention	0.045	0.224	-0.032	0.487
Performance Expectancy -> Continuance Intention	0.063	0.267	0.202	0.010
Effort Expectancy -> Satisfaction	0.446	0.000	0.525	0.000
Effort Expectancy -> Continuance Intention	-0.030	0.698	-0.135	0.075
Effort Expectancy -> Performance Expectancy	0.483	0.000	0.329	0.003
Facilitating Conditions -> Continuance Intention	-0.022	0.783	0.054	0.572
Hedonic Motivation -> Continuance Intention	-0.124	0.001	-0.019	0.745
Price Value -> Continuance Intention	-0.008	0.823	-0.092	0.081
Price Value -> Satisfaction	0.168	0.001	0.103	0.224
Compatibility -> Continuance Intention	0.348	0.007	0.179	0.053
Personal Innovativeness -> Continuance Intention	-0.045	0.239	-0.078	0.155
Confirmation -> Performance Expectancy	0.363	0.000	0.426	0.000
Confirmation -> Satisfaction	0.375	0.000	0.265	0.000
Satisfaction -> Continuance Intention	0.284	0.001	0.292	0.007
Satisfaction -> Continuance Behaviour	0.096	0.298	0.297	0.022
Continuance Intention -> Continuance Behaviour	0.360	0.009	0.296	0.004

Table 6-16 shows the results of the Multi-Group Analysis obtained through the PLS-MGA algorithm in the SmartPLS software. It presents the path coefficients of the two submodels (consumers and merchants), and the associated *p*-values. The results suggest that there are

differences between the models for both subgroups, with path coefficients that can be considered significant for one subgroup, but not for the other.

To test for difference in path coefficients between the two submodels, a number of measures have been proposed. A first measure is the parametric test as proposed by Keil et al. (2000). As this test is inherently a parametric test, it presumes a normal distribution. This is not in line with the original assumptions when using PLS-SEM, which is a non-parametric method without distributive requirements, hence we will not rely upon this measure. A second candidate measure is the Welch-Satterthwaite test, which also is a parametric test which assumes unequal variances between the subgroups (Henseler, 2012). Consistent with the previous, as the Welch-Satterthwaite test is parametric, it relies upon a normal distribution of the sample data, which is not a condition for PLS-SEM. Hence, the results of the Welch-Satterthwaite test will not be reported. A third candidate measure is the bootstrap-based MGA, a non-parametric significance test for the difference of group-specific results. This test compares every estimate of one group to all the estimates of the same parameter in the other group (Henseler et al., 2009). This test confirms a difference in path coefficients between groups if the resulting *p*-value is below 0.05 or above 0.95. The results of this test are reported in Table 6-17.

Table 6-17: PLS-MGA test for differences between path coefficients. Source: author

	<b>Path Coefficients- difference [C-M]</b>	<b>PLS-MGA <i>p</i>-Value difference [C-M]</b>
Network Externalities -> Continuance Intention	-0.187	0.052
Network Externalities -> Habit	-0.185	<b>0.040</b>
Habit -> Continuance Intention	0.218	0.215
Habit -> Continuance Behaviour	0.034	0.794
Social Influence -> Continuance Intention	0.077	0.159
Performance Expectancy -> Continuance Intention	-0.139	0.131
Effort Expectancy -> Satisfaction	-0.079	0.471
Effort Expectancy -> Continuance Intention	0.105	0.344
Effort Expectancy -> Performance Expectancy	0.154	0.263
Facilitating Conditions -> Continuance Intention	-0.076	0.549
Hedonic Motivation -> Continuance Intention	-0.106	0.130
Price Value -> Continuance Intention	0.085	0.159

Price Value -> Satisfaction	0.065	0.509
Compatibility -> Continuance Intention	0.169	0.281
Personal Innovativeness -> Continuance Intention	0.033	0.614
Confirmation -> Performance Expectancy	-0.063	0.604
Confirmation -> Satisfaction	0.110	0.277
Satisfaction -> Continuance Intention	-0.201	0.227
Satisfaction -> Continuance Behaviour	-0.008	0.979
Continuance Intention -> Continuance Behaviour	0.065	0.705

The PLS-MGA *p*-values for the differences in path coefficients between the submodels for consumers and merchants indicate that only one path coefficient can be considered significantly different between the two submodels. The impact of Network Externalities on Habit is significantly Smaller for merchants as compared to consumers, at a 95% confidence level.

### 6.9.3 Consumer Submodel

The submodel with path coefficients and *p*-values fitted exclusively with consumer respondents' data is visualised in Figure 6-3.

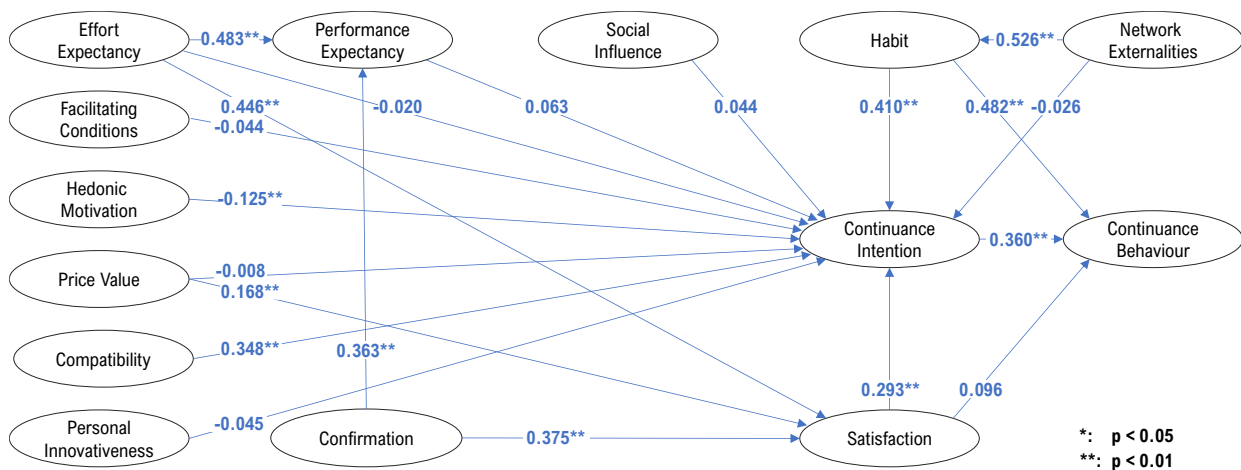


Figure 6-3: Consumer submodel with path coefficients and confidence level indicators. Source: author

### Model fit

The SRMR value for the consumer submodel stands at 0.07. With all caution due this submodel can be considered to represent an adequate fit.

## Coefficient of Determination

The consumer submodel presents 3 constructs with a substantial level of variance explained by the path model, expressed by an  $R^2$  (adj) value in excess of 0.67. In this case, both dependent constructs, Continuance Intention and Continuance Behaviour, have an  $R^2$  (adj) value in excess of 80%, whereas the indicator Satisfaction is over 70%. The construct Performance Expectancy has a moderate level of its variance explained by the path model, that is 60%, and the construct Habit has a Small level of its variance explained by its precedents, i.e. 27%. The full results are presented in Table 6-18

Table 6-18: Coefficient of determination of the consumer submodel. Source: author

	$R^2$	$R^2$ (adj)	Qualification
Continuance Behaviour	0.804	0.801	Substantial
Continuance Intention	0.835	0.825	Substantial
Habit	0.277	0.273	Small
Performance Expectancy	0.601	0.597	Moderate
Satisfaction	0.726	0.722	Substantial

## Path Coefficients

As reflected in Table 6-19, 8 path coefficients are not significant at a 95% confidence level, i.e. Network Externalities → Continuance Intention, Social Influence → Continuance Intention, Performance Expectancy → Continuance Intention, Effort Expectancy → Continuance Intention, Facilitating Conditions → Continuance Intention, Price Value → Continuance Intention, Personal Innovativeness → Continuance Intention and Satisfaction → Continuance Behaviour. Hedonic Motivation → Continuance Intention can be considered significant at a 95% confidence level, but has a negative path coefficient.



Table 6-19: Path coefficients and significance levels for the consumer submodel. Source: author

	<b>Coefficient</b>	<b>p-values</b>
Network Externalities -> Continuance Intention	-0.027	0.701
Network Externalities -> Habit	0.526	0.000
Habit -> Continuance Intention	0.411	0.000
Habit -> Continuance Behaviour	0.482	0.000
Social Influence -> Continuance Intention	0.045	0.213
Performance Expectancy -> Continuance Intention	0.063	0.257
Effort Expectancy -> Satisfaction	0.446	0.000
Effort Expectancy -> Continuance Intention	-0.030	0.707
Effort Expectancy -> Performance Expectancy	0.483	0.000
Facilitating Conditions -> Continuance Intention	-0.022	0.775
Hedonic Motivation -> Continuance Intention	-0.124	0.001
Price Value -> Continuance Intention	-0.008	0.812
Price Value -> Satisfaction	0.168	0.001
Compatibility -> Continuance Intention	0.348	0.005
Personal Innovativeness -> Continuance Intention	-0.045	0.234
Confirmation -> Performance Expectancy	0.363	0.000
Confirmation -> Satisfaction	0.375	0.000
Satisfaction -> Continuance Intention	0.284	0.001
Satisfaction -> Continuance Behaviour	0.096	0.305
Continuance Intention -> Continuance Behaviour	0.360	0.011

### Predictor Effect Sizes

For the consumer submodel, one path can be considered large in size, as it exceeds the 0.35 level for the  $f^2$  statistic, that is Network Externalities  $\rightarrow$  Habit. 7 further path coefficients are qualified as medium and 4 as small. From 7 path coefficients, the effect size cannot be considered as impactful. Table 6-20 represents the  $f^2$  statistic values and their qualifications for the consumer submodel.

Table 6-20: Effect size measures for the indicators of the consumer submodel. Source: author

	<b><math>f^2</math></b>	<b>Qualification</b>
Network Externalities -> Continuance Intention	0.000	None
Network Externalities -> Habit	0.352	Large
Habit -> Continuance Intention	0.188	Medium
Habit -> Continuance Behaviour	0.234	Medium
Social Influence -> Continuance Intention	0.010	None
Performance Expectancy -> Continuance Intention	0.011	None

Effort Expectancy -> Satisfaction	0.297	Medium
Effort Expectancy -> Continuance Intention	0.000	None
Effort Expectancy -> Performance Expectancy	0.312	Medium
Facilitating Conditions -> Continuance Intention	0.001	None
Hedonic Motivation -> Continuance Intention	0.037	Small
Price Value -> Continuance Intention	0.001	None
Price Value -> Satisfaction	0.067	Small
Compatibility -> Continuance Intention	0.123	Small
Personal Innovativeness -> Continuance Intention	0.009	None
Confirmation -> Performance Expectancy	0.200	Medium
Confirmation -> Satisfaction	0.188	Medium
Satisfaction -> Continuance Intention	0.045	Small
Satisfaction -> Continuance Behaviour	0.006	None
Continuance Intention -> Continuance Behaviour	0.160	Medium

## Predictive Relevance

As illustrated in Table 6-21, the  $Q^2$  measures for predictive relevance for the consumer submodel are all positive.

Table 6-21: Predictive relevance measures for the consumer submodel. Source: author

	$Q^2$
Continuance Behaviour	0.467
Continuance Intention	0.604
Habit	0.255
Performance Expectancy	0.582
Satisfaction	0.713

## Total Effects

The total effects of all potential paths in the consumer submodel are presented in Table 6-22.

Out of the 31 potential paths, 14 are positive and significant at a 95% confidence level.

Table 6-22: Total effects between latent variables of the consumer submodel. Source: author

	Total Effect	p-values
Network Externalities -> Habit	0.509	0.000
Network Externalities -> Continuance Intention	0.176	0.089

Network Externalities -> Continuance Behaviour	0.305	0.000
Habit -> Continuance Intention	0.365	0.000
Habit -> Continuance Behaviour	0.607	0.000
Social Influence -> Continuance Intention	0.047	0.179
Social Influence -> Continuance Behaviour	0.019	0.210
Performance Expectancy -> Continuance Intention	0.078	0.199
Performance Expectancy -> Continuance Behaviour	0.032	0.278
Effort Expectancy -> Performance Expectancy	0.474	0.000
Effort Expectancy -> Satisfaction	0.410	0.000
Effort Expectancy -> Continuance Intention	0.137	0.158
Effort Expectancy -> Continuance Behaviour	0.083	0.143
Facilitating Conditions -> Continuance Intention	-0.019	0.811
Facilitating Conditions -> Continuance Behaviour	-0.008	0.825
Hedonic Motivation -> Continuance Intention	-0.113	0.003
Hedonic Motivation -> Continuance Behaviour	-0.046	0.040
Price Value -> Satisfaction	0.176	0.001
Price Value -> Continuance Intention	0.019	0.561
Price Value -> Continuance Behaviour	0.019	0.410
Compatibility -> Continuance Intention	0.405	0.001
Compatibility -> Continuance Behaviour	0.164	0.021
Personal Innovativeness -> Continuance Intention	-0.049	0.216
Personal Innovativeness -> Continuance Behaviour	-0.020	0.277
Confirmation -> Performance Expectancy	0.379	0.000
Confirmation -> Satisfaction	0.362	0.000
Confirmation -> Continuance Intention	0.107	0.023
Confirmation -> Continuance Behaviour	0.068	0.073
Satisfaction -> Continuance Intention	0.214	0.036
Satisfaction -> Continuance Behaviour	0.155	0.096
Continuance Intention -> Continuance Behaviour	0.406	0.005

#### 6.9.4 Merchant Submodel

The submodel with path coefficients and *p*-values fitted exclusively with merchant respondents' data is visualised in Figure 6-4.

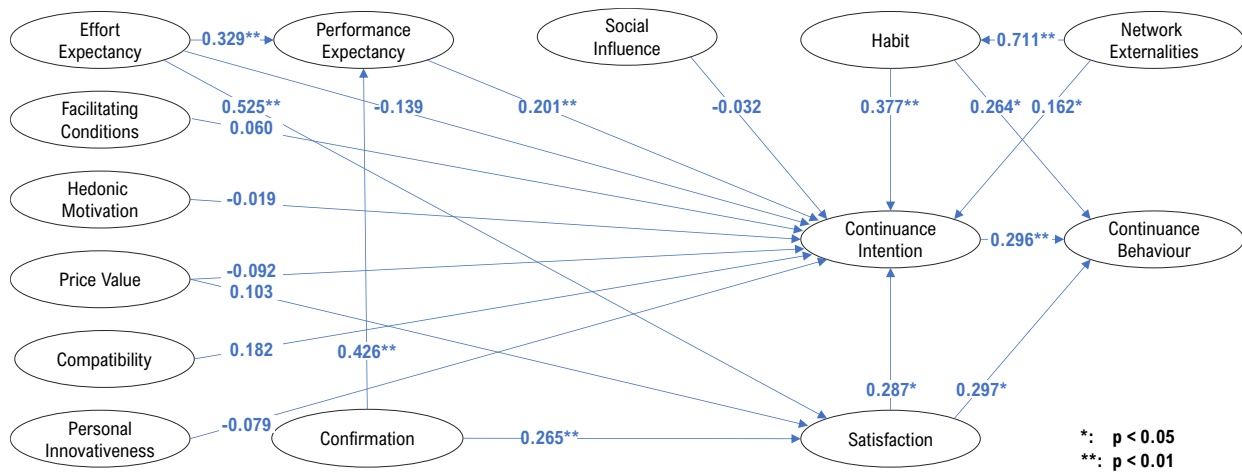


Figure 6-4: Merchant submodel with path coefficients and confidence level indicators. Source: author

### Model fit

For the merchant submodel, the SRMR measure shows a value of 0.08. At the cut-off level for this measure, the merchant submodel can be considered to represent an satisfactory level of fit.

### Coefficient of Determination

In the merchant submodel, only one construct, Continuation Intention, reflects a level of variance explained by the path model that can be qualified as substantial, with an R<sup>2</sup> (adj) of 77%. The other dependent constructs, Continuation Behaviour, has a lower R<sup>2</sup> (adj) value of 63% which is qualified as moderate. Also the other constructs, Habit, Performance Expectancy and Satisfaction present R<sup>2</sup> (adj) values between 33% and 67% hence qualified as moderate, as illustrated in Table 6-23.

Table 6-23: Coefficient of determination of the merchant submodel. Source: author

	R <sup>2</sup>	R <sup>2</sup> (adj)	Qualification
Continuation Behaviour	0.637	0.631	Moderate
Continuation Intention	0.780	0.766	Substantial
Habit	0.505	0.503	Moderate
Performance Expectancy	0.462	0.456	Moderate
Satisfaction	0.637	0.631	Moderate

## Path Coefficients

In the merchant submodel, 8 path coefficients cannot be considered significant at a 95% confidence level, i.e. Social Influence → Continuance Intention, Effort Expectancy → Continuance Intention, Facilitating Conditions → Continuance Intention, Hedonic Motivation → Continuance Intention, Price Value → Continuance Intention, Price Value → Satisfaction, Compatibility → Continuance Intention and Personal Innovativeness → Continuance Intention.

The results are represented in Table 6-24.

Table 6-24: Path coefficients and significance levels for the merchant submodel. Source: author

	<b>Coefficient</b>	<b>p-values</b>
Network Externalities -> Continuance Intention	0.161	0.023
Network Externalities -> Habit	0.711	0.000
Habit -> Continuance Intention	0.377	0.000
Habit -> Continuance Behaviour	0.264	0.035
Social Influence -> Continuance Intention	-0.032	0.462
Performance Expectancy -> Continuance Intention	0.202	0.010
Effort Expectancy -> Satisfaction	0.525	0.000
Effort Expectancy -> Continuance Intention	-0.135	0.070
Effort Expectancy -> Performance Expectancy	0.329	0.002
Facilitating Conditions -> Continuance Intention	0.054	0.601
Hedonic Motivation -> Continuance Intention	-0.019	0.729
Price Value -> Continuance Intention	-0.092	0.087
Price Value -> Satisfaction	0.103	0.246
Compatibility -> Continuance Intention	0.179	0.056
Personal Innovativeness -> Continuance Intention	-0.078	0.166
Confirmation -> Performance Expectancy	0.426	0.000
Confirmation -> Satisfaction	0.265	0.000
Satisfaction -> Continuance Intention	0.292	0.009
Satisfaction -> Continuance Behaviour	0.297	0.019
Continuance Intention -> Continuance Behaviour	0.296	0.005

## Predictor Effect Sizes

Table 6-25 articulates the  $f^2$  values and their qualifications for the merchant submodel. Again, Network Externalities → Habit is the sole path to qualify as having a large effect size. Three

paths qualify as having a medium effect, and a further 11 have a small effect. Five paths are not considered to have a significant effect size.

Table 6-25: Effect size measures for the indicators of the merchant submodel . Source: author

	<b>f<sup>2</sup></b>	<b>Qualification</b>
Network Externalities -> Continuance Intention	0.084	Small
Network Externalities -> Habit	0.682	Large
Habit -> Continuance Intention	0.166	Medium
Habit -> Continuance Behaviour	0.040	Small
Social Influence -> Continuance Intention	0.003	None
Performance Expectancy -> Continuance Intention	0.055	Small
Effort Expectancy -> Satisfaction	0.305	Medium
Effort Expectancy -> Continuance Intention	0.027	Small
Effort Expectancy -> Performance Expectancy	0.071	Small
Facilitating Conditions -> Continuance Intention	0.008	None
Hedonic Motivation -> Continuance Intention	0.000	None
Price Value -> Continuance Intention	0.016	None
Price Value -> Satisfaction	0.087	Small
Compatibility -> Continuance Intention	0.048	Small
Personal Innovativeness -> Continuance Intention	0.017	None
Confirmation -> Performance Expectancy	0.199	Medium
Confirmation -> Satisfaction	0.041	Small
Satisfaction -> Continuance Intention	0.081	Small
Satisfaction -> Continuance Behaviour	0.068	Small
Continuance Intention -> Continuance Behaviour	0.075	Small

## Predictive Relevance

The predictive relevance for the merchant submodel, as exemplified by the Q<sup>2</sup> measures, are all positive, as demonstrated in Table 6-26.

Table 6-26: Predictive relevance measures for the merchant submodel. Source: author

	<b>Q<sup>2</sup></b>
Continuance Behaviour	0.450
Continuance Intention	0.559
Habit	0.497
Performance Expectancy	0.427
Satisfaction	0.583

## Total Effects

When considering all potential paths in the merchant submodel, 16 could be significant and positive. The full results are presented in Table 6-27.

Table 6-27: Total effects between latent variables of the merchant submodel. Source: author

	Total Effect	p-values
Network Externalities -> Habit	0.690	0.000
Network Externalities -> Continuance Intention	0.461	0.000
Network Externalities -> Continuance Behaviour	0.308	0.002
Habit -> Continuance Intention	0.370	0.000
Habit -> Continuance Behaviour	0.351	0.005
Social Influence -> Continuance Intention	-0.029	0.493
Social Influence -> Continuance Behaviour	-0.009	0.517
Performance Expectancy -> Continuance Intention	0.170	0.013
Performance Expectancy -> Continuance Behaviour	0.055	0.079
Effort Expectancy -> Performance Expectancy	0.263	0.004
Effort Expectancy -> Satisfaction	0.476	0.000
Effort Expectancy -> Continuance Intention	0.054	0.535
Effort Expectancy -> Continuance Behaviour	0.161	0.011
Facilitating Conditions -> Continuance Intention	0.062	0.488
Facilitating Conditions -> Continuance Behaviour	0.020	0.533
Hedonic Motivation -> Continuance Intention	0.008	0.886
Hedonic Motivation -> Continuance Behaviour	0.002	0.889
Price Value -> Satisfaction	0.236	0.083
Price Value -> Continuance Intention	-0.011	0.886
Price Value -> Continuance Behaviour	0.068	0.273
Compatibility -> Continuance Intention	0.191	0.015
Compatibility -> Continuance Behaviour	0.061	0.048
Personal Innovativeness -> Continuance Intention	-0.085	0.127
Personal Innovativeness -> Continuance Behaviour	-0.027	0.172
Confirmation -> Performance Expectancy	0.462	0.000
Confirmation -> Satisfaction	0.191	0.030
Confirmation -> Continuance Intention	0.133	0.004
Confirmation -> Continuance Behaviour	0.100	0.052
Satisfaction -> Continuance Intention	0.284	0.007
Satisfaction -> Continuance Behaviour	0.394	0.001
Continuance Intention -> Continuance Behaviour	0.321	0.001

## 6.10 Parsimonious Models

The models presented, based on the extant literature and the outcomes of the qualitative study are relatively complex. To reduce this complexity, a second model has been developed, stripping the original model of all path coefficients that do not support the hypotheses formulated, to assess the impact on the validity and explanatory power of the model. This exercise has been carried out for the model with all respondents, as well as for the submodels for consumers and merchants.

### 6.10.1 All respondents

After removing the seven path coefficients that do not support the research hypotheses, and re-estimating the model, the resulting model is visualised in Figure 6-5.

The number of predictors has been reduced to 7 from the original 12, removing Social Influence, Facilitating Conditions, Hedonic Motivation and Personal Innovativeness. From the remaining predictors, the paths Effort Expectancy → Continuance Intention, Price Value → Continuance Intention and Satisfaction → Continuance Behaviour have been removed, or a total of 7 path coefficients.

After re-estimating the model, the remaining path coefficients are all confirmed to be positive and significant at a 95% confidence level or higher.



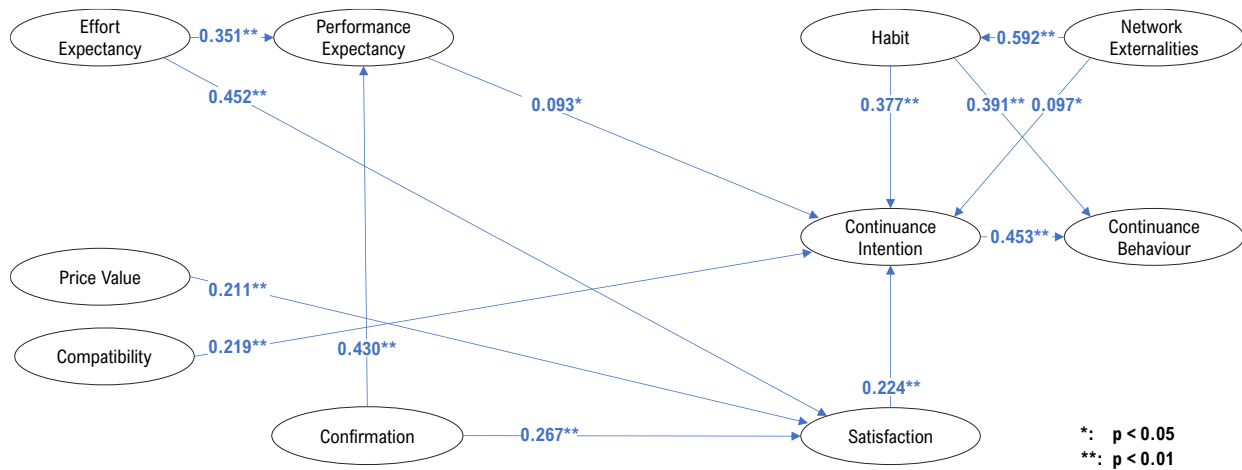


Figure 6-5: Parsimonious model for all respondents with path coefficients and confidence level indicators. Source: author

### Model fit

For the parsimonious model, the SRMR measure is 0.07. With all due caution the parsimonious can be considered to represent an adequate fit, as a SRMR value of 0.08 or below is considered to reflect an acceptable level of fit for PLS path models.

### Coefficient of Determination

In the parsimonious model Continuation Behaviour has an  $R^2$  (adj) value of 80%, similar to the structural model, indicating that a substantial level of variance in this construct is explained by the model. The other dependent construct, Continuation Intention shows an  $R^2$  (adj) value of 66%, similar to the structural model, and considered as moderate. Also Performance Expectancy and Satisfaction have a moderate level of variance explained by the parsimonious model, respectively 48% and 61%. Finally, the  $R^2$  (adj) value of Habit stands at 32%, which is considered Small coefficient of determination.

This supports the conclusion that the parsimonious model has an explanatory power which is very close to the original theorised structural model, shedding 7 path coefficients.

These results are presented in Table 6-28.

Table 6-28: Coefficient of determination of the parsimonious model. Source: author

	<b>R<sup>2</sup></b>	<b>R<sup>2</sup> (adj)</b>	<b>Qualification</b>
Continuance Behaviour	0.800	0.798	Substantial
Continuance Intention	0.658	0.656	Moderate
Habit	0.323	0.321	Small
Performance Expectancy	0.485	0.483	Moderate
Satisfaction	0.613	0.610	Moderate

## Path Coefficients

Table 6-29 visualises the path coefficients of the parsimonious model and their corresponding *p*-values. All path coefficients are found to be significant.

Table 6-29: Path coefficients and significance levels for the parsimonious model. Source: author

	<b>Coefficient</b>	<b><i>p</i>-values</b>
Network Externalities -> Continuance Intention	0.097	0.039
Network Externalities -> Habit	0.592	0.000
Habit -> Continuance Intention	0.377	0.000
Habit -> Continuance Behaviour	0.391	0.000
Performance Expectancy -> Continuance Intention	0.093	0.031
Effort Expectancy -> Satisfaction	0.452	0.000
Effort Expectancy -> Performance Expectancy	0.351	0.000
Price Value -> Satisfaction	0.211	0.005
Compatibility -> Continuance Intention	0.219	0.001
Confirmation -> Performance Expectancy	0.430	0.000
Confirmation -> Satisfaction	0.267	0.000
Satisfaction -> Continuance Intention	0.224	0.000
Continuance Intention -> Continuance Behaviour	0.453	0.000

## Predictor Effect Sizes

The predictor effect sizes for the parsimonious model are represented in Table 6-30. Also here, the Network Externalities → Habit path can be qualified as large, with a further 4 paths to be qualified as medium, and seven as small. One effect size is slightly below the cut-off value of 0.02.

Table 6-30: Effect size measures for the indicators of the parsimonious model. Source: author

	<b>f<sup>2</sup></b>	<b>Qualification</b>
Network Externalities -> Continuance Intention	0.027	Small
Network Externalities -> Habit	0.477	Large
Habit -> Continuance Intention	0.191	Medium
Habit -> Continuance Behaviour	0.127	Small
Performance Expectancy -> Continuance Intention	0.019	None
Effort Expectancy -> Satisfaction	0.311	Medium
Effort Expectancy -> Performance Expectancy	0.141	Small
Price Value -> Satisfaction	0.081	Small
Compatibility -> Continuance Intention	0.053	Small
Confirmation -> Performance Expectancy	0.204	Medium
Confirmation -> Satisfaction	0.090	Small
Satisfaction -> Continuance Intention	0.062	Small
Continuance Intention -> Continuance Behaviour	0.170	Medium

## Predictive Relevance

The predictive relevance of the parsimonious model is confirmed by Q<sup>2</sup> values that all are positive, as illustrated in Table 6-31.

Table 6-31: Predictive relevance measures for the parsimonious model. Source: author

	<b>Q<sup>2</sup></b>
Continuance Behaviour	0.426
Continuance Intention	0.617
Habit	0.394
Performance Expectancy	0.541
Satisfaction	0.674

## Total Effects

There are 23 potential paths between constructs in the parsimonious model, as visualised in Table 6-32. Only one cannot be considered positive and significant at a 95% confidence level, i.e. Performance Expectancy → Continuance Behaviour.

Table 6-32: Total effects between latent variables of the parsimonious model. Source: author

	<b>Total Effect</b>	<b>p-values</b>
Network Externalities -> Habit	0.592	0.000
Network Externalities -> Continuance Intention	0.319	0.000
Network Externalities -> Continuance Behaviour	0.376	0.000
Habit -> Continuance Intention	0.377	0.000
Habit -> Continuance Behaviour	0.562	0.000
Performance Expectancy -> Continuance Intention	0.093	0.031
Performance Expectancy -> Continuance Behaviour	0.042	0.051
Effort Expectancy -> Performance Expectancy	0.351	0.000
Effort Expectancy -> Satisfaction	0.452	0.000
Effort Expectancy -> Continuance Intention	0.134	0.000
Effort Expectancy -> Continuance Behaviour	0.061	0.001
Price Value -> Satisfaction	0.211	0.005
Price Value -> Continuance Intention	0.047	0.031
Price Value -> Continuance Behaviour	0.021	0.031
Compatibility -> Continuance Intention	0.219	0.001
Compatibility -> Continuance Behaviour	0.099	0.002
Confirmation -> Performance Expectancy	0.430	0.000
Confirmation -> Satisfaction	0.267	0.000
Confirmation -> Continuance Intention	0.100	0.000
Confirmation -> Continuance Behaviour	0.045	0.003
Satisfaction -> Continuance Intention	0.224	0.000
Satisfaction -> Continuance Behaviour	0.102	0.001
Continuance Intention -> Continuance Behaviour	0.453	0.000

### 6.10.2 Consumers

When only using data stemming from consumers, out of the 20 path coefficients, 8 of them are not supporting the hypotheses, because of their significance or their polarity. After removing these paths, 5 predictors have been removed, i.e. Social Influence, Performance Expectancy, Facilitating Conditions, Hedonic Motivation and Personal Innovativeness. From the remaining predictors, a further 4 paths have been removed, i.e. Effort Expectancy → Continuance Intention, Price Value → Continuance Intention, Confirmation → Continuance Intention and Satisfaction → Continuance Behaviour. The resulting parsimonious submodel for consumers, as visualised in Figure 6-6, features 7 predictors (out of 12) with a total of 9 paths (out of 20).

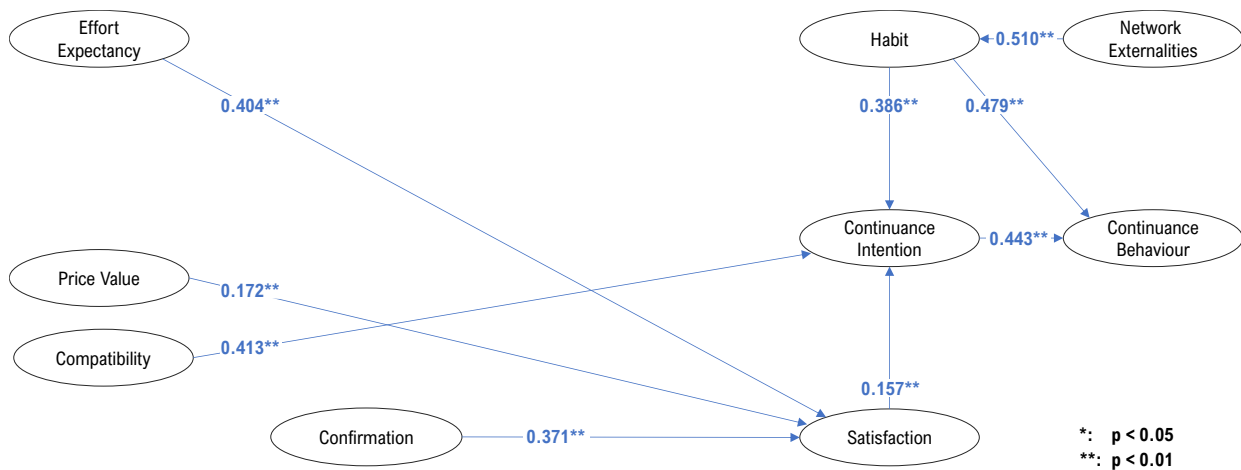


Figure 6-6: Parsimonious submodel for consumers with path coefficients and confidence level indicators. Source: author

### Model fit

With an SRMR measure is 0.07, which is below the 0.08 cut-off value, the parsimonious consumer submodel is considered to reflect an acceptable level of fit for PLS path models, with all caution due.

### Coefficient of Determination

In the parsimonious consumer submodel, four out of five dependent constructs have a substantial level of the variance explained by the model. The  $R^2$  (adj) value of Continuation Behaviour stands at 79%, as in the structural consumer submodel, while the Continuation Intention construct has a  $R^2$  (adj) value of 82%, a slight decrease as compared to the structural consumer submodel. Also Performance Expectancy and Satisfaction have a substantial level of variance at 68% and 79%, respectively. Finally, the  $R^2$  (adj) value of Habit stands at 26%, which is considered a small coefficient of determination. These results can be found in Table 6-33.

This supports the conclusion that the parsimonious submodel for consumers has a nearly identical explanatory power with 5 predictors and 11 paths less as compared to the submodel for consumers as originally formulated.

Table 6-33: Coefficient of determination of the parsimonious consumer submodel. Source: author

	<b>R<sup>2</sup></b>	<b>R<sup>2</sup> (adj)</b>	<b>Qualification</b>
Continuance Behaviour	0.791	0.789	Substantial
Continuance Intention	0.824	0.822	Substantial
Habit	0.261	0.257	Small
Performance Expectancy	0.685	0.680	Substantial

## Path Coefficients

Also for the parsimonious consumer submodel, a bootstrapping procedure was performed to assess the significance of the path coefficients. Table 6-34 visualises the path coefficients and the corresponding *p*-values. All path coefficients are found to be significant as well.

Table 6-34: Path coefficients and significance levels for the parsimonious consumer submodel. Source: author

	<b>Coefficient</b>	<b><i>p</i>-values</b>
Network Externalities -> Habit	0.510	0.000
Habit -> Continuance Intention	0.386	0.000
Habit -> Continuance Behaviour	0.479	0.000
Effort Expectancy -> Satisfaction	0.404	0.000
Price Value -> Satisfaction	0.172	0.001
Compatibility -> Continuance Intention	0.413	0.000
Confirmation -> Satisfaction	0.371	0.000
Satisfaction -> Continuance Intention	0.157	0.042
Continuance Intention -> Continuance Behaviour	0.443	0.000

## Predictor Effect Sizes

The  $f^2$  values for the consumer parsimonious submodel are all above the 0.02 cut-off value put forward for this measure. Also here, the effect size of Network Externalities on Habit is considered to be strong. Six further paths are qualified as having a medium-sized effect, and 2 a small effect. The results of the  $f^2$  values for the consumer parsimonious submodel are represented in Table 6-35.

Table 6-35: Effect size measures for the indicators of the parsimonious consumer submodel. Source: author

	<b>f<sup>2</sup></b>	<b>Qualification</b>
Network Externalities -> Habit	0.354	Strong
Habit -> Continuance Behaviour	0.278	Medium
Habit -> Continuance Intention	0.216	Medium
Effort Expectancy -> Satisfaction	0.288	Medium
Price Value -> Satisfaction	0.065	Small
Compatibility -> Continuance Intention	0.147	Medium
Confirmation -> Satisfaction	0.196	Medium
Satisfaction -> Continuance Intention	0.029	Small
Continuance Intention -> Continuance Behaviour	0.238	Medium

## Predictive Relevance

The four constructs present in the parsimonious consumer submodel all have predictive relevance. Table 6-36 presents the Q<sup>2</sup> values, which are all positive.

Table 6-36: Predictive relevance measures for the parsimonious consumer submodel. Source: author

	<b>Q<sup>2</sup></b>
Continuance Behaviour	0.461
Continuance Intention	0.655
Habit	0.246
Satisfaction	0.703

## Total Effects

Out of the 19 potential paths between constructs in the parsimonious consumer submodel, 7 cannot be considered significant at a 95% confidence level. The total effects of all potential path coefficients and associated *p*-values are presented in Table 6-37.

Table 6-37: Total effects between latent variables of the parsimonious consumer submodel. Source: author

	<b>Total Effect</b>	<b>p-values</b>
Network Externalities -> Habit	0.510	0.000
Network Externalities -> Continuance Intention	0.197	0.001
Network Externalities -> Continuance Behaviour	0.332	0.000

Habit -> Continuance Intention	0.386	0.000
Habit -> Continuance Behaviour	0.650	0.000
Effort Expectancy -> Satisfaction	0.404	0.000
Effort Expectancy -> Continuance Intention	0.063	0.089
Effort Expectancy -> Continuance Behaviour	0.028	0.126
Price Value -> Satisfaction	0.172	0.001
Price Value -> Continuance Intention	0.027	0.068
Price Value -> Continuance Behaviour	0.012	0.093
Compatibility -> Continuance Intention	0.413	0.000
Compatibility -> Continuance Behaviour	0.183	0.005
Confirmation -> Satisfaction	0.371	0.000
Confirmation -> Continuance Intention	0.058	0.051
Confirmation -> Continuance Behaviour	0.026	0.081
Satisfaction -> Continuance Intention	0.157	0.042
Satisfaction -> Continuance Behaviour	0.070	0.071
Continuance Intention -> Continuance Behaviour	0.443	0.000

### 6.10.3 Merchants

From the estimated merchant submodel based on the literature review and the qualitative study, 8 theorised paths did not support the research hypothesis. When removing these, the resulting submodel has 6 predictors out of the initial 12, and 12 paths out of the initial 20. The predictors removed are Social Influence, Facilitating Conditions, Hedonic Motivation, Price Value, Compatibility and Personal Innovativeness. Next to the paths associated with these predictors, also the path Effort Expectancy → Continuance Intention has been removed.

Refitting the submodel results in all remaining paths being positive and significant at a 90% confidence level. All but one paths are significant at a 95% confidence or above, as illustrated in Figure 6-7.



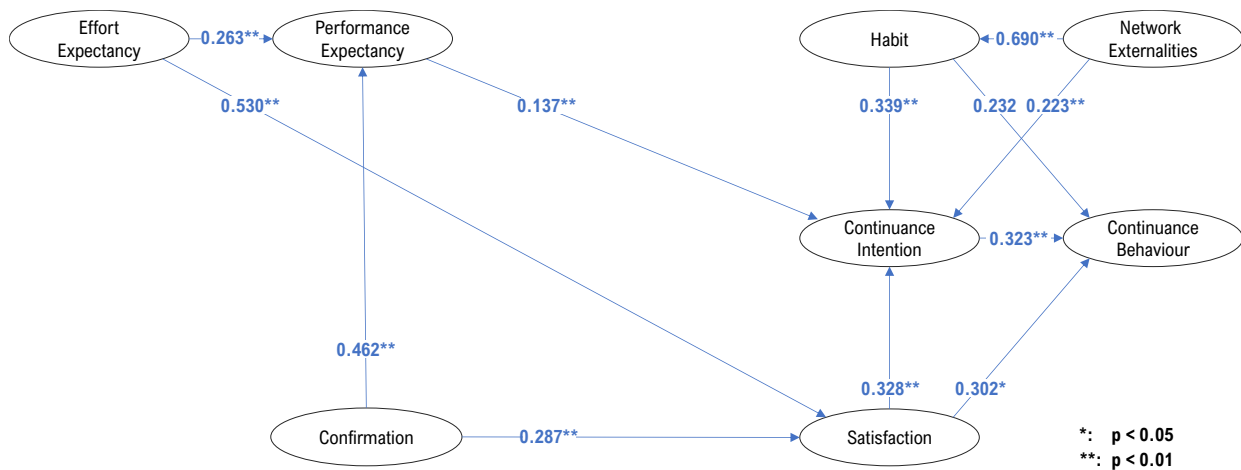


Figure 6-7: Parsimonious submodel for merchants with path coefficients and confidence level indicators. Source: author

### Model fit

For the parsimonious merchant submodel, the SRMR measure is 0.08, equal to the cut-off value of 0.08 which is considered to represent an acceptable level of fit. The parsimonious merchant submodel can be considered to represent an adequate fit, subject to the safeguards when interpreting this measure of PLS-SEM path models.

### Coefficient of Determination

All constructs but one in the parsimonious merchant submodel represent an  $R^2$  (adj) which can be qualified as moderate. Only the construct of Continuation Intention exceeds the cut-off value of 67% to be qualified as substantial. The  $R^2$  (adj) statistic for the parsimonious model for merchants retains for Continuation Intention 0.777 of the initial 0.792. The Continuation Behaviour is just below the cut-off value, at 64%, at the same level as in the structural model. Satisfaction has an  $R^2$  (adj) value of 52%, and the Habit and Performance constructs are both around 40%. The results are presented in Table 6-38.

As with the previous two parsimonious models, a submodel with 6 predictors instead of 12, and with 12 paths instead of 20 has approximately the same explanatory power as the original submodel based on extant literature and on the qualitative study.

Table 6-38: Coefficient of determination of the parsimonious merchant submodel. Source: author

	<b>R<sup>2</sup></b>	<b>R<sup>2</sup> (adj)</b>	<b>Qualification</b>
Continuance Behaviour	0.647	0.642	Moderate
Continuance Intention	0.781	0.777	Substantial
Habit	0.406	0.403	Moderate
Performance Expectancy	0.398	0.392	Moderate
Satisfaction	0.525	0.520	Moderate

### Path Coefficients

The path coefficients and the corresponding *p*-values for the parsimonious merchant submodel are visualised in Table 6-39. Similar to the parsimonious consumer submodel, all path coefficients are found to be significant.

Table 6-39: Path coefficients and significance levels for the parsimonious merchant submodel. Source: author

	<b>Coefficient</b>	<b><i>p</i>-values</b>
Network Externalities -> Habit	0.702	0.000
Network Externalities -> Continuance Intention	0.202	0.005
Habit -> Continuance Intention	0.327	0.000
Habit -> Continuance Behaviour	0.266	0.024
Performance Expectancy -> Continuance Intention	0.142	0.013
Effort Expectancy -> Satisfaction	0.554	0.000
Effort Expectancy -> Performance Expectancy	0.317	0.004
Confirmation -> Performance Expectancy	0.427	0.000
Confirmation -> Satisfaction	0.304	0.000
Satisfaction -> Continuance Intention	0.318	0.000
Satisfaction -> Continuance Behaviour	0.312	0.010
Continuance Intention -> Continuance Behaviour	0.280	0.005

### Predictor Effect Sizes

As illustrated in Table 6-40 and similar to the parsimonious model and the consumer parsimonious submodel, the path Network Externalities → Habit is considered to be large in effect size. Furthermore, also the Effort Expectancy → Satisfaction effect is considered to be large in size. Two effect sizes are considered medium and a further 8 paths are small in size.

Table 6-40: Effect size measures for the indicators of the parsimonious merchant submodel. Source: author

	<b>f<sup>2</sup></b>	<b>Qualification</b>
Network Externalities -> Continuance Intention	0.077	Small
Network Externalities -> Habit	0.970	Large
Habit -> Continuance Intention	0.137	Small
Habit -> Continuance Behaviour	0.058	Small
Performance Expectancy -> Continuance Intention	0.047	Small
Effort Expectancy -> Satisfaction	0.481	Large
Effort Expectancy -> Performance Expectancy	0.113	Medium
Confirmation -> Performance Expectancy	0.204	Medium
Confirmation -> Satisfaction	0.145	Small
Satisfaction -> Continuance Intention	0.127	Small
Satisfaction -> Continuance Behaviour	0.079	Small
Continuance Intention -> Continuance Behaviour	0.060	Small

## Predictive Relevance

Table 6-41 presents all Q<sup>2</sup> measures for the predictive relevance of the constructs in the parsimonious merchant submodel, all of them in excess of zero.

Table 6-41: Predictive relevance measures for the parsimonious merchant submodel. Source: author

	<b>Q<sup>2</sup></b>
Continuance Behaviour	0.439
Continuance Intention	0.568
Habit	0.488
Performance Expectancy	0.425
Satisfaction	0.593

## Total Effects

Between the constructs in the parsimonious merchant submodel, 16 potential paths could be identified. As represented in Table 6-42, all but one, i.e. Performance Expectancy → Continuance Behaviour, can be considered positive and significant at a 95% confidence level.

Table 6-42: Total effects between latent variables of the merchant submodel. Source: author

	<b>Total Effect</b>	<b>p-values</b>
Network Externalities -> Habit	0.702	0.000
Network Externalities -> Continuance Intention	0.431	0.000
Network Externalities -> Continuance Behaviour	0.308	0.000
Habit -> Continuance Intention	0.327	0.000
Habit -> Continuance Behaviour	0.358	0.002
Performance Expectancy -> Continuance Intention	0.142	0.013
Performance Expectancy -> Continuance Behaviour	0.040	0.067
Effort Expectancy -> Performance Expectancy	0.317	0.004
Effort Expectancy -> Satisfaction	0.554	0.000
Effort Expectancy -> Continuance Intention	0.221	0.000
Effort Expectancy -> Continuance Behaviour	0.235	0.000
Confirmation -> Performance Expectancy	0.427	0.000
Confirmation -> Satisfaction	0.304	0.000
Confirmation -> Continuance Intention	0.158	0.000
Confirmation -> Continuance Behaviour	0.139	0.008
Continuance Intention -> Continuance Behaviour	0.280	0.005

## 6.11 Conclusions

This chapter presented the methodology and the results of the quantitative study. It introduced and justified the use of partial least squares – structural equation modelling to reach the research objectives. Two models have been fitted, a measurement model and a structural model, and the quality criteria for acceptance of the results obtained have been discussed. Results of the model fitting have been presented. Beyond the main model, a multi-group analysis was carried out distinguishing between a consumer and a merchant submodel. Based on the results of the original model and both submodels, parsimonious models have been proposed and fitted, and outcomes have been compared and contrasted with the original models.

## Chapter 7: Discussion

### 7.1 Overview of Chapter

This chapter summarises and discusses the findings of the quantitative and qualitative steps of the mixed methods approach and relates them to previous research as presented in the literature review. The structural model and the hypotheses underlying the relationships between the constructs are discussed.

### 7.2 Discussion of Hypothesis Test Results

#### 7.2.1 Network Externalities

*H1a: Network Externalities have a positive and significant effect on Continuance Intention for contactless proximity payments*

From the systematic literature review, only three studies included network externalities as an explanatory factor for payment technology acceptance. In one study, Network Externalities were found to be the single most significant predictor of payment technology acceptance. The authors conclude that creating critical mass is crucial to drive acceptance of payment technology by consumers (Qasim & Abu-Shanab, 2016).

During the qualitative study, all respondents without exception referred to Network Externalities as a critical factor for acceptance of contactless payment technology, linking it to the achievement of critical mass at the level of both sides of the platform, i.e. consumers and merchants.

The quantitative study confirms the hypothesis that Network Externalities have a positive and significant effect on Continuance Intention, with a path coefficient of 0.100. This hypothesis is confirmed at a 95% confidence level. When looking at both constituting groups, the effect

seems stronger and more significant for merchants than for consumers, although the difference between both cannot be confirmed as significant.

*H1b: Network Externalities have a positive and significant effect on Habit for contactless proximity payments*

Research in the broader area of technology acceptance have confirmed the impact of Network Externalities as a precedent of Habit (Barnes & Böhringer, 2011).

The qualitative study provided further support for the mediating effect of Habit between Network Externalities and Continuance Behaviour, as multiple interviewees referred to the importance of the type of merchants when assessing the Network Externalities, as they elaborate on the frequency of use rather than the mere coverage at the acceptance side. This led to the inclusion of a hypothesised path from Network Externalities to Habit next to the direct influence of Network Externalities to Continuance Behaviour.

The effect of Network Externalities on Habit in this research is confirmed to be particularly strong, with a path coefficient of 0.592 at a confidence level of 99%. This coefficient is actually the highest of all theorised paths, in combination with the highest confidence level observed. This is confirmed for both subgroups, with an even stronger effect for merchants. When comparing path coefficients across both groups, this is the only path that can be considered significantly different between groups, although the effect goes in the same direction for both.

## 7.2.2 Habit

Habit has been characterised as an important determinant of behaviour, in some studies even as the strongest single predictor, although it has been held back for a long time because of the difficulty of measuring it as a construct, as its operationalisation is nearly identical to Utilisation (Thompson & Higgins, 1991).

*H2a: Habit has a positive and significant effect on Continuance Intention for contactless proximity payments*

*H2b: Habit has a positive and significant effect on Continuance Behaviour for contactless proximity payments*

The systematic literature review revealed that Habit as a factor has only been included sparsely in acceptance models for payment technology. Santosa et al. (2021), in line with C. Wang et al. (2013) and Alalwan et al. (2017), confirmed that the continuous use of digital payment technology can become a habit and even a dependency, explaining user satisfaction after use.

The qualitative study confirmed that many respondent referred to Habit as an important precedent to the acceptance of contactless payment technology, overcoming the resistance to stick to legacy technologies.

In line with Bhattacharjee and Lin (2015), both hypotheses have been tested, with the quantitative study confirming both hypotheses, i.e. that Habit has a positive and significant effect on Continuance Intention and on Continuance Behaviour, with path coefficients of 0.408 and 0.327, respectively. Both hypotheses are confirmed at a 99% confidence level. Multi-group analysis confirms that path coefficients and significance levels are not dissimilar across both subgroups of consumers and merchants.

These results, combined with the strong influence of Network Externalities on Habit, suggests that Habit is a very strong predictor of Continuance Intention and Behaviour, contrasting with the limited attention this factor has received in previous acceptance research on payment technology. A possible explanation is that Habit might have a stronger impact on repeat behaviour, rather than on initial use. As most technology acceptance models focus on the latter, this might explain the limited occurrence of Habit.

### 7.2.3 Social Influence

*H3a: Social Influence has a positive and significant effect on the Continuance Intention with contactless proximity payments*

Social Influence or Subjective Norm has been present as a potential influencing factor for payment technology acceptance in the majority of empirical studies as referenced in the systematic literature review. Out of the 29 studies that included the construct, 26 found a positive and significant effect. The 3 studies that did not confirm its influence referred to the fact that the technology is so widespread that the social effect of others' opinions have been obscured (Leong, Hew, Tan, & Ooi, 2013; Teo, Tan, Ooi, Hew, & Yew, 2015) or that the importance of social influence is diminished for post-acceptance behaviour (Purohit et al., 2022).

The qualitative study developed a number of items exemplifying Social Influence, including other shoppers, cashiers, peers/friends/relatives, banks, and wider social norms.

With a t-value of 0.13 and a p-value of nearly 0.9, the quantitative study cannot confirm a significant effect of Social Influence on Continuance Intention. This conclusion is validated in both subgroups, consumers and merchants. In line with the suggestions of Purohit et al. (2022), this could be due to the fact that the social effects are realised throughout the adoption curve and hence do not surface as an influencing factor for post-acceptance behaviour.

### 7.2.4 Performance Expectancy

*H4a: Performance Expectancy has a positive and significant effect on the Continuance Intention for contactless proximity payments*

Performance Expectancy or Usefulness is one of the core attributes in many technology acceptance models, from the 29 models that include it as a potential factor in the systematic



literature review, only 1 found it not to significantly influence payment technology acceptance. The authors attributed it to the fact that payments are only an incremental feature of mobile technology, hence that its adoption is not significantly impacted by this specific feature (Teo et al., 2015).

In the qualitative study, respondents operationalised Performance Expectancy for contactless payments along a number of dimensions, i.e. speed, hygiene and security. These dimensions have been reflected in the questions used in the quantitative study to gauge Performance Expectancy.

The quantitative study confirms the positive and significant effect of Performance Expectancy on Continuance Intention, with a path coefficient of 0.15 at a 99% confidence level. When looking at both submodels, in the consumer submodel the significance of the influence of Performance Expectancy on Continuance Intention cannot be confirmed, although its difference with the overall model falls within the boundaries of the confidence level, hence cannot be confirmed as significantly different from the main model.

#### 7.2.5 Effort Expectancy

*H5a: Effort Expectancy has a positive and significant effect on the Satisfaction with contactless proximity payments by consumers*

*H5b: Effort Expectancy has a positive and significant effect on the Continuance Intention for contactless proximity payments by consumers*

*H5c: Effort Expectancy has a positive and significant effect on the Performance Expectancy for contactless proximity payments by consumers*

Effort Expectancy or Ease of Use is an ubiquitous construct in payment technology acceptance studies, as illustrated by the systematic literature review. 28 studies included it as a potential

factor, from whom only 4 found it not to be significant. Explanations for non-significance proffered include the limited influence of technology on changing payment habits (Karimi & Liu, 2020); the familiarity with technology in general (Kar, 2021) and with mobile technology in particular (Qasim & Abu-Shanab, 2016; Slade, Dwivedi, Piercy, & Williams, 2015).

Specifically for contactless payment technology, during the qualitative study respondents mentioned familiarisation and the absence of a PIN as key items defining Effort Expectancy. These items have subsequently been used to adapt the questionnaire used for the quantitative study.

The results of the quantitative study confirm the positive and significant influence of Effort Expectancy on Satisfaction and on Performance Expectancy, with a path coefficient of 0.35 at a 99% confidence level. At the other hand, a positive and significant impact on Effort Expectancy on Continuance Intention cannot be confirmed. Both these conclusions are confirmed for both subgroups, consumers and merchants.

#### 7.2.6 Facilitating Conditions

*H6a: Facilitating Conditions have a positive and significant effect on the Continuance Intention for contactless proximity payments*

In the systematic literature review, 13 studies theorised the significant and positive influence of Facilitating Conditions on the acceptance of new payment technology, and all confirmed this hypothesis.

The qualitative study found three items defining Facilitating Conditions in the context of contactless payment technology: support from banks, communications and other sources of support.

The quantitative study cannot confirm the positive and significant effect of Facilitating Conditions on Continuance Intention, both for the main model as for both submodels. A possible explanation is that Facilitating Conditions become less meaningful over the adoption curve, as they are more critical for the initial adoption of a new technology, rather than its usage continuation.

### 7.2.7 Hedonic Motivation

*H7a: Hedonic Motivation has a positive and significant effect on Continuance Intention for contactless proximity payments*

Hedonic Motivation or Enjoyment has been included as an explanatory factor in 5 acceptance studies in the systematic literature review, and all have confirmed its significant and positive impact.

The qualitative study suggested that Hedonic Motivation would have limited incidence on the acceptance of payment technology, as this is mainly utilitarian rather than experiential. In this context, the Hedonic Motivation has been defined in the light of avoidance of nuisance, rather than in terms of positive sensory reinforcement.

The latter has been confirmed in the quantitative study, as it was not able to confirm a positive and significant effect of Hedonic Motivation on Continuance Intention.

### 7.2.8 Price Value

*H8a: Price Value has positive and significant effect on Continuance Intention for contactless proximity payments*

*H8b: Price Value has a positive and significant effect on the Satisfaction with contactless proximity payments*

Price Value (or similar constructs as Cost or Financial Risk) has been included in 8 of the studies from the systematic literature review, of which its significance has been confirmed in 5. Reasons given for its non-significant influence include the fact that early adopters are hypothesised to be less price-sensitive (Tan, Ooi, Chong, & Hew, 2014) and to the fact that contactless technology is perceived to be free or low-cost (Leong et al., 2013).

During the qualitative study, respondents expressed their doubts on the explanatory power of Price Value on the acceptance of contactless payment technology in the UK, given the fact that most payment technology is offered at no extra cost by banks, whether this are cards or payment apps for consumers, or payment terminal upgrades.

This has been validated in the results of the quantitative study, which cannot confirm a positive and significant effect of Price Value on Continuance Intention. It can confirm a positive and significant effect of Price Value on Satisfaction, with a path coefficient of 0.21 at a 99% confidence level. This observation seems to be more driven by consumers than by merchants, although the difference between both subgroups cannot be considered as significant.

### 7.2.9 Compatibility

*H9a: Compatibility has a positive and significant effect on Continuance Intention for contactless proximity payments*

Compatibility is present as an explanatory factor in 5 of the studies in the systematic literature review, from whom all but one confirm its significant influence on technology acceptance.

During the qualitative study, Compatibility only came up sparsely as a factor with possible impact on the acceptance of contactless payment technology.

The quantitative study confirms the positive and significant effect of Compatibility on Continuance Intention. The results of the MGA suggest that this effect is stronger and more

significant for consumers as compared to merchants, but this difference cannot be confirmed to be significant at a 95% confidence level.

#### 7.2.10 Personal Innovativeness

*H10a: Personal Innovativeness has a positive and significant effect on Continuance Intention*

Out of the 9 studies in the systematic literature review that included Personal Innovativeness as a factor with a potential influence on payment technology acceptance, two of them were not able to confirm a positive influence.

The quantitative study cannot confirm the positive and significant effect of Personal Innovativeness on Continuance Intention. The total model does show a significant effect, but the path coefficient is slightly negative. Furthermore, in both submodels for consumers and merchants, the impact of Personal Innovativeness on Continuance Intention cannot be considered significant within a 95% confidence interval, albeit that this difference with the main model cannot be considered significant. When assessing the total effects of the Personal Innovativeness construct, it does not produce a significant effect on Continuance Behaviour beyond Continuance Intention.

#### 7.2.11 Confirmation

*H11a: Confirmation has a positive and significant effect on Performance Expectancy of contactless proximity payments*

*H11b: Confirmation has a positive and significant effect on the Satisfaction with contactless proximity payments*

Purohit et al. (2022) found a significant strong positive impact of confirmation on Performance Expectancy and Satisfaction when including it in an ECM model for mobile payments, in line with the findings of Bhattacharjee (2001a) and Tam et al. (2020).

Also this study confirms the positive and significant effect of Confirmation on both Performance Expectancy and Satisfaction at a 99% confidence level. This effect is confirmed for both the consumer and merchant submodels.

#### 7.2.12 Satisfaction

*H12a: Satisfaction has a positive and significant effect on Continuance Intention of contactless proximity payments*

*H12b: Satisfaction has a positive and significant effect on Continuance Behaviour for contactless proximity payments*

In the ECM, Satisfaction is a pivotal factor as an antecedent to both Continuance Intention and Continuance Behaviour (Purohit et al., 2022).

Satisfaction has been included as an explanatory factor in 5 studies from the systematic literature review, all of which confirmed its positive impact on acceptance intent.

The quantitative study confirms the positive and significant direct effect of Satisfaction on Continuance Intention, but does not confirm the same for Continuance Behaviour. This can be explained through the fact that Continuance Intention is a mediator variable between Satisfaction and Continuance Behaviour, implying that the total effect of Satisfaction on Continuance Behaviour is captured through the direct effect of Satisfaction on Continuance Intention and through the consecutive direct effect of Continuance Intention on Continuance Behaviour.

#### 7.2.13 Continuance Intention

*H13a: Continuance Intention has a positive and significant effect on Continuance Behaviour for contactless proximity payments*

Continuance Intention is a crucial factor in the ECM models, and a precursor of the behavioural Continuance Behaviour dependent variable (Bhattacharjee & Lin, 2015; Bhattacharjee et al., 2008). From the systematic literature review, only one study included a behavioural construct, preceded by an intentional construct, whereas a further 31 studies had the intentional construct as the final independent variable. The sole study confirmed the significant positive influence of intention on behaviour (Patil, Tamilmani, Rana, & Raghavan, 2020).

The quantitative study confirms the positive and significant effect of Continuance Intention on Continuance Behaviour at a 99% confidence level. For both submodels, consumers and merchants, the same effect can be observed.

### 7.3 Discussion of Mediators

Central to the research question is the identification of the factors that affect the acceptance and use of contactless proximity payments by consumers (payers) and by merchants (payees) and the extent to which the behaviour of each group influences the other. Answering this question requires to consider both sides of the two-sided platform as distinct groups. To this end, two submodels were built and estimated, and results have been contrasted.

Although both submodels had path coefficients and significance levels differing from each other and from the main model, only one path coefficient can be considered as significantly different between the two submodels. The impact of Network Externalities on Habit has in both submodels the largest path coefficient (0.53 for consumers and 0.71 for merchants), and highest significance level (t-values of 7.7 and 13.0, respectively). This implies that in terms of interpretation of this difference, the only conclusion is that the impact of Network Externalities on Habit is very strong and significant for both groups, but even more markedly so for merchants.

At the other hand, a number of path coefficients show differences in polarity, strength and significance between both groups, although these differences are not within a 95% confidence interval. For consumers, the impact of Hedonic Motivation and Compatibility on Continuance Intention and of Price Value on Satisfaction are confirmed to be significant, whereas the same paths are not significant in the merchant submodel. Conversely, the impacts of Network Externalities and Performance Expectancy on Continuance Intention, and of Satisfaction on Continuance Behaviour are significant in the merchant submodel, but not in the consumer submodel.

#### 7.4 Conclusions

In this chapter, the results obtained from the qualitative and quantitative studies, as well as the general and systematic literature review have been consolidated and triangulated in order to adequately answer the research question. The next chapter will summarise the research findings, theoretical, methodological and managerial contributions will be discussed, as well as the limitations of the research and areas for future research.



# Chapter 8: Conclusions

## 8.1 Introduction

This chapter summarises the research and the findings, it formulates an answer to the research question and illustrates how the research objectives have been achieved. It discusses theoretical, methodological and managerial contribution of the research. The limitations of the research are discussed in detail and areas for future research are put forward.

## 8.2 Summary of the Research and Findings

Two-sided markets created by platform intermediaries emerge in many industries. The value of a two-sided platform to any given participant from one group largely depends on the number of participants from the other group. An archetypical example is the payment services industry, hinging upon the acceptance of a common technology platform between payers (consumers) and payees (merchants).

The research question for this study is: What are the factors that affect the acceptance and use of contactless proximity payments by consumers (payers) and by merchants (payees) and to what extent does the behaviour of each group influence the other?

To answer the research question, a number of research objectives have been formulated.

**Objective 1: To identify factors that determine the acceptance of contactless proximity payments within both groups (consumers and merchants) based on literature review.**

To address the first objective, a general literature review has been carried out. It identified the most influential technology acceptance models, presenting a timeline characterising their mutual influences and interrelationships. The different factors impacting technology acceptance as identified and validated by various authors have been acknowledged. Subsequently, a

taxonomy based on the similarities of the various constructs and their definitions within the models have been built. This taxonomy is instrumental in comparing factors and constructs across models and studies. As far as the researcher is aware, in the extant literature, no such comprehensive taxonomy of influencing factors in technology acceptance models research has been developed previously, so this can be considered a contribution to science in the area of information systems.

Subsequently, a systematic literature review of articles with empirical research on technology acceptance in the field of payment methods was carried out, published in ABS-rated journals since 2010. 40 articles have been selected comprising a total of 342 factors. Using the labels as assigned by the authors, 170 unique constructs have been identified. Based on the taxonomy developed earlier, aggregating different factors with similar definitions as found in the literature further reduced the number of factors to 66. Only 2 studies from the 40 did present results from merchants and only a single one focused on both sides of the payment services industry, consumers and merchants. Furthermore, the systematic literature review also revealed an unwarranted bias towards mobile payments, despite the fact that these only represent a minority of all payments carried out between consumers and merchants.

**Objective 2: To develop a conceptual framework linking the factors identified within both groups to theorised latent constructs**

To complete the second objective, a qualitative study with 20 semi-structured interviews with expert interviewees has been carried out. It aims to explore the main factors that affect the acceptance of contactless proximity payments by consumers and by merchants in the UK. This exploratory research with thematic analysis based on the semi-structured interviews devised a conceptual framework.

Further focused literature review contributed to formulating hypotheses to develop a research model.

**Objective 3: To develop a conceptual model of the relationships between the latent constructs to determine technology acceptance within both groups as well as between groups (indirect network externalities) based on literature review**

The conceptual framework has been used to develop a conceptual model embedding the findings of the qualitative study into technology acceptance models as developed in the extant literature. The resulting conceptual model is an integration of the UTAUT2E model (Blut et al., 2021) with the ECM (Bhattacharjee et al., 2008), combining 9 purely independent variables (Network Externalities, Social Influence, Effort Expectancy, Facilitating Conditions, Hedonic Motivation, Price Value, Compatibility, Personal Innovativeness, Confirmation) with 4 variables that are both independent and dependent (Habit, Performance Expectancy, Satisfaction, Continuance Intention), and one solely dependent variable (Continuance Behaviour).

**Objective 4: To test the validity and reliability of the conceptual model**

Finally, the theorised conceptual model was tested and validated through a quantitative study, An online questionnaire, after pre-testing and a pilot study, has been developed to collect quantitative data in order to validate the research model. In total, data from 404 UK respondents has been collected, comprising of with 202 consumers and 200 SME merchants.

The data obtained have been analysed using partial least squares – structural equation modelling , with a measurement model to tie the observed variables to latent constructs, and a structural model to test the formulated hypotheses.

Theoretical and managerial implications of the findings are discussed and suggestions for further research are formulated.

Network Externalities, the defining characteristic of two-sided platforms, has been cited by all respondents in the qualitative study as an influencing factor for the acceptance of contactless proximity payments by both merchants and consumers in the UK. Next to pure Network Externalities, in which the value of participating in a two-sided network for every participant increases with the addition of another participant at the opposite side, respondents also qualified the size of Network Externalities in function of the type of the merchant. This finding has been confirmed in the quantitative study, with Network Externalities emerging as an influential factor to explain Continuance Intention and Behaviour, with Habit acting as a mediating factor.

## 8.3 Contributions and Implications

### 8.3.1 Theoretical Contributions

This research connects two topics in academic research that have recently attracted significant interest: two-sided markets created by platform intermediaries and individual adoption and use of new technologies. It applies concepts as introduced in the literature around two-sided platforms to expand on technology adoption models developed in IS research. The particular focus of the study is the payment behaviour of UK consumers and merchants. It contributes to theory in a number of ways that earlier research have not explored systematically.

#### **Application of technology acceptance models in two-sided platforms**

A first significant theoretical contribution of this research is the application of existing technology acceptance models to the adoption of technology in two-sided markets intermediated by platform operators. In the traditional linear value creation model, value is added to the product or service as it moves through the different steps of the supply chain. This

implies that the product characteristics determine the value creation of the product proposition, whether instrumental (contributing to the achievement of goals) or hedonic (enjoyment of using the technology)(Davis, Bagozzi, & Warshaw, 1992). Although a number of researchers have recently suggested that network externalities could be an important and determining factor to predict technology adoption and usage among users (Kumar et al., 2020; Mallat, 2007; Qasim & Abu-Shanab, 2016), there have been very few studies that attempted to quantify the impact of network externalities on technology adoption. This study confirmed Network Externalities as an impactful factor for technology adoption intention and behaviour, not directly, but rather as an antecedent of Habit.

### **Development of a multi-levelled framework of causal mechanisms driving technology acceptance**

Most technology acceptance models present a number of drivers drawn from social and cognitive psychology to explain agency. These models tend to represent the impacting factors in a two-dimensional plane, with the various atomic drivers interconnecting with each other within the same level. As causality inherently is a multifaceted concept, reflecting the complexity of human decision-making, a planar representation of social-cognitive drivers oversimplifies the underlying mechanisms driving adoption and use of technology.

In the conceptual framework presented in Figure 4-4, the impacting factors are aggregated at multiple levels, ranging from the most specific towards the most generic. At the outer level, based on the exploratory qualitative research, specific themes have been identified by respondents in the particular context of contactless proximity payments as used by consumers and merchants. One level up, these specific themes have been aggregated into factors drawn from the extensive body of research around technology acceptance models, rising above the particular context of this research. At a third level, the factors are grouped based on their

objective (instrumental, effort-related) or subjective (social, affective) nature. Finally, at the innermost level, building on the tenets of motivation theory, a distinction is made between extrinsic and intrinsic motivators (Davis et al., 1992).

This multi-levelled framework is instrumental in embedding the contributions of this research into the wider social and cognitive psychology traditions underlying technology acceptance models. It also enables to transcend the specific context of this research to guide technology acceptance research in other contexts, i.e. with other technologies, in other two-sided or multi-sided platforms or in other geographies.

### **Application of technology acceptance models for contactless proximity payment technology across devices**

Thirdly, this research focuses on all types of contactless proximity payments, encompassing both cards and mobile devices. An impressive body of research has been dedicated to modelling the acceptance of mobile payments. These studies focused on the mobile phone as a consumer device, making abstraction of the technology used, amalgamating proximity payments (using NFC/RFID, QR or Bluetooth technologies, all requiring different technologies at the merchant side) with online payments, although it has been demonstrated that usage and adoption can differ significantly (De Luna, Liébana-Cabanillas, Sánchez-Fernández, & Muñoz-Leiva, 2019).

### **Focus on contactless payment technology acceptance by merchants**

A fourth contribution of this research to theory is the focus on merchants, and more particularly small and medium-sized retailers. Research focusing on the merchant side of payment technology adoption has been rather exiguous (Bounie & Camara, 2020; Dahlberg, Guo, & Ondrus, 2015; Dahlberg, Mallat, Ondrus, & Zmijewska, 2008).

A systematic literature review revealed the lack of research on the merchant side of payment technology acceptance. Out of 40 articles identified, only 2 present results on payment technology adoption by merchants, and only 1 presents research on the interrelationship between consumers and merchants. As the successful introduction of new technologies in the payment industry hinges upon the adoption by both groups, consumers as well as merchants, this research will attempt to re-balance the consumer-side bias in extant literature.

### **Focus on contactless payment technology acceptance in the United Kingdom**

As a final contribution to theory, this research explores the adoption of contactless payments in the United Kingdom. Although Europe is the second largest regional payment market in the world, representing over 31% of global non-cash transactions (Capgemini Research Institute, 2022), and within Europe, the UK is by far the most important card payments market, representing 28.5% of the total number of card payments carried out Europe (European Central Bank, 2019), only 2 out of the 40 research papers in our systematic literature review of technology adoption for payments reflected UK-focused research.

### **8.3.2 Methodological Contributions**

Next to contributions to theory, the present research also contributes to methodology in a number of ways.

#### **Application of technology acceptance models across different types of users**

Firstly, this research is one of the first to develop and fit the same technology acceptance model concurrently across different types of users. Most technology acceptance models only take into account one type of users, whether consumers or institutional users (Venkatesh et al., 2012). Scant research has focused on the acceptance of the same technology by different groups of users, each with different roles, objectives and characteristics. This research addressed this gap

by concurrently modelling usage intention and usage behaviour within two distinct groups of users – merchants and consumers.

### **Integration of the UTAUT2E and ECM models**

This research introduced a technology acceptance model, drawing upon two oft-cited models in IS literature, the UTAUT2E model (Blut et al., 2021) and the extended ECM (Bhattacharjee & Lin, 2015).

The former model, UTAUT2E, is the most recent instalment of the unified theory of acceptance and use of technology series as initiated by Venkatesh et al. (2003). This model was chosen because of its comprehensive nature, integrating constructs from UTAUT and UTAUT2 extensions, as well as from other technology acceptance models. Furthermore, as a successor to the UTAUT2 model, it is one of the few technology acceptance models that is aimed at modelling usage by consumers, rather than institutional users. Given the recent publication of the UTAUT2E model, this research is one of the first to present an extension of the UTAUT2E model as originally published.

The latter model, the ECM, is one of the few technology acceptance models that does not focus on initial adoption of a new technology, but rather on continuance of usage beyond the initial trial.

The fundamental difference between both is that the UTAUT models relate prior intentions to ex-post behaviour, whereas ECM connects prior behaviour with ex-post intentions, and in later ECM extensions, also with ex-post behaviour. Combining both will result in a model relating prior intentions to ex-post intentions, to ex-post behaviour. The overlay of the UTAUT2E model with the ECM model has been based on prior research connecting the independent factors



of the UTAUT model and its successors, with the dependent post-acceptance variables from ECM (see: Purohit, Arora, & Paul, 2022; Tam, Santos, & Oliveira, 2020).

In the context of payment services, the continued usage is considered more relevant, as the acceptance of a technology can only result in commercial value if the change in behaviour is persistent, and is not limited to a single or a limited number of trials. A second reason to integrate a technology acceptance model focused on continuance rather than initial use, is because of the widespread adoption of contactless payment technology among UK consumers and merchants. As for many of these, the moment in time that they made the initial decision to adopt contactless payment technology might be relatively distant and they might not recall their specific motivation that drove this decision. At the other hand, the motivations to continue using contactless technology are more persistent and are reinforced with every contactless payment transaction. This makes a continuance model more relevant and valid in the context of a technology that has moved beyond the initial stages on its adoption curve.

### 8.3.3 Contributions to Practice

This research also contributes to managerial decision-making at several levels.

Firstly, this research helps to understand the factors that influence the adoption of contactless payment technology by both consumers and merchants. The findings of this research can be used to inform the development of business strategies that will help to develop the payment services industry. For product managers in the payment services industry, the insights of this research may help to identify the product attributes that matter most to users, both consumers and merchants. Marketers will be able to design advertising and communication strategies around themes that are most likely to resonate among target audiences. Analysts and strategic planners can develop and refine business models by focusing on target audiences and market opportunities not currently addressed by incumbent parties.

Secondly, the research confirmed that effort expectancy significantly influences the continued usage of a new payment technology. In practice, this can be translated into optimising the user experience for all types of technology users. Understanding the factors that influence the acceptance of contactless payment technology by consumers can help merchants to provide a better customer experience. This can be done by providing training to staff to ensure that they can effectively use the technology, as well as nudging customers that are using less convenient payment methods, such as cash, cheques or chip-and-PIN cards, towards using devices enabled for contactless payments, such as NFC phones or RFID cards.

Thirdly, confirmation, or the difference of expectations before and after use of the technology has been found to indirectly influence continuance of usage of contactless payment technology, through its impact on satisfaction and performance expectancy. In line with the previous recommendation, this can induce practitioners to ensure that the technology overdelivers on the expectations. This can be accomplished through rigorous quality control, thorough testing and certification practices, continuous improvement and performance monitoring procedures.

Fourthly, network externalities have been shown to be an influential factor in the acceptance of new payment technology. This insight is important for practitioners active in the payment services industry, particularly when designing a go-to-market strategy for a new technology. The strategy should encompass all types of users in order to achieve the projected results. A strategy can aim at targeting all types of users concurrently, although this typically would require a significant investment in resources and efforts. Therefore, a more efficient strategy can consist of targeting one side of a multi-sided platform, and leverage the network externalities to more easily target the other sides. Specifically in the payment services industry, a service provider can subsidise deployment through consumers, e.g. by offering a new technology at no extra cost for consumers, with the objective of convincing merchants to invest in the necessary upgrades to offer the new technology.

Finally, this research has also shown that network externalities do not always influence behavioural intent and actual behaviour directly, but that they are instrumental in developing a habit, which on its turn, can drive initial and continued use of a new technology. This insight is useful for practitioners, as they can focus marketing and commercialisation efforts on fostering the development of habits, for example by deploying loyalty or reward schemes related to the use of new technologies.

Beyond the payment industry, general themes, constructs and conclusions of this study may also be applied to other two-sided markets intermediated by platform operators. Examples include products and services as diverse as dating services, social networks, movie streaming services, e-book readers, meal delivery or chauffeur services.

## 8.4 Limitations of the Study

### 8.4.1 Limitation of Context

This study has been carried out among consumers and merchants based in the UK. The UK is generally known as a leading market for financial services in general, and for payment services in particular. Over time, many innovations in term of payment technology have been implemented at scale in the UK before other major markets, including open banking, buy-now-pay-later functionalities, as well as mobile and contactless payments.

As is the case in many domains of the economy and the society at large, Brexit has and will have an impact on how the payments industry in the UK will develop in the near future as compared to its neighbouring countries. In December 2022, HM Treasury has published its Future Regulatory Framework Review, setting the regulatory framework for financial services in the UK and how it will be adapted to reflect the UK's new position outside of the European Union.

As a result of these dynamics, consumers and merchants in other markets might have differing experiences, habits, attitudes, beliefs, perceptions and behaviours as compared to the UK. Therefore, it is advisable to exert caution when generalising the findings of this research to users in different markets and geographies.

Secondly, contactless proximity payments by consumers at merchants in the UK constituted the context for determining the effect of several factors on technology acceptance in two-sided platforms. More robust insights in the impact of these factors in general, and of network externalities in particular, can be achieved by replicating similar studies in other multi-sided platforms, whether two-sided or three-sided, with different platform dynamics, different business models, and in different markets.

#### 8.4.2 Limitation of Cross-Sectional Design

As opposed to a longitudinal design, this study has adopted a cross-sectional study design, a very popular method because of its cost-effectiveness and its ability to collect data in a very short window of time (Cozby & Bates, 2018). But this choice also comes with a number of limitations, most notably its tendency to unambiguously impute causality, whereas a cross-sectional research design returns associations rather than causal inferences (Bryman & Bell, 2011).

More specifically, contactless retail payments in the UK have been introduced over a decade ago, meaning that most users have adopted it over the course of the years. This strengthens the relevance of the findings, as users of the technology can post-hoc assess the factors that have contributed to its adoption and use. At the other hand, it cannot be excluded that the size of the impact of certain factors might change over time. More particularly the role of Network Externalities as an influencing factor might have been largely realised with widespread adoption.

### 8.4.3 Limitation of Sampling Frame

For the quantitative study, the population of merchant respondents has been operationalised as individuals who have the authority to influence the selection of payment options presented to the consumers in an in-store retail payment context. Merchant respondents have been pre-screened on industry type and industry role (more specifically self-employed/partner or upper management). In practice, this induced a bias towards small- and medium-sized enterprises in the retail, hospitality and personal services sectors, as individuals with decision-making authority within larger organisations (such as retailing chains) are less numerous and hence less likely to be represented in line with their decisional impact on in-person payments.

## 8.5 Recommendations for Further Research

Elaborating on the limitation of the studies presented above, further research could strengthen and build upon the findings presented in this study in a number of directions.

First of all, the study of the geographical context can be extended to increase generalisability of the findings. A similar study with respondents from other countries with a similar social, economical and cultural profile, such as other European countries, could generate more insights into the impact of regulatory and market-specific economic factors on the adoption of new technologies. Extending the scope to other markets with marked cultural differences as compared to the UK, such as in other continents, can also shed light on the influence of culture on technology adoption.

Secondly, similar studies in a different technological context can validate the conclusions of this study. This might involve different technologies in the payment services market, such as cryptocurrencies, biometric payments or open banking. But also technology adoption in other two-sided platforms can be evaluated, such as gaming, software, media platforms (Rochet &

Tirole, 2006) or in three-sided platforms, such as hardware-independent operating systems (Hagiu & Wright, 2015) or meal delivery services (Meijerink, Keegan, & Bondarouk, 2021).

Thirdly, a longitudinal study for the same research question has the ability to establish a more robust causality between the influencing factors and the outcomes, i.e. the adoption of a new technology in the context of multi-sided platform. This is particularly relevant as the motivators for individuals to adopt a new technology might differ significantly whether they are an early or a late adopter (E.M. Rogers, 2003). More specifically, in this context, it might be worth formulating the hypothesis that early adopters are driven by Intrinsic Motivators, who influence behaviour for no other reinforcement as performing the activity in itself, whereas late adopters might be motivated more by External Motivators, instrumental in achieving outcomes distinct from performing the activity in itself.

## 8.6 Conclusions

This final chapter summarised the findings of all previous chapters, discussed the contribution of this research to theory and practice, and outlined the limitations of the studies, as well as recommended pathways for future research to deepen the understanding in the subject area of technology acceptance in two-sided platforms.

## Appendix A: Data Structure of Qualitative Analysis

Ref	Items	Theme	Aggregate dimension Level 1	Aggregate dimension Level 2	Aggregate dimension Level 3
C2	But the thing that really pushed it, obviously is the pandemic.	Hygiene	Performance Expectancy	Instrumental Factors	Extrinsic
D4	With Covid, the hygiene factor has played a role. We have had a lot of consumers saying: "Now, I want to do contactless because I don't have to put my finger on the POS. Speed and convenience is one, hygiene since the Covid pandemic in another one.	Hygiene	Performance Expectancy	Instrumental Factors	Extrinsic
SVP1	Obviously you take the pandemic, that's something everybody understands. Don't touch it, get away from people, keep the distance, putting your card in the reader. That's the right thing to do	Hygiene	Performance Expectancy	Instrumental Factors	Extrinsic
CEO1	I mean, I, I think the, I mean the big elephant in the room is COVID. So I think COVID has accelerated contactless usage enormously whereby now people have to use contactless.	Hygiene	Performance Expectancy	Instrumental Factors	Extrinsic
CEO2	And now the third one obviously was the pandemic which was kind of giving a reason to use contactless payments as well for hygiene reasons.	Hygiene	Performance Expectancy	Instrumental Factors	Extrinsic
D1	So I think the main thing there is convenience and allowing for fast throughput,	Speed	Performance Expectancy	Instrumental Factors	Extrinsic
D3	You know, in addition to that, you don't have to queue for as long, you know, it's really quick, it's really easy, it's really convenient.	Speed	Performance Expectancy	Instrumental Factors	Extrinsic
D4	...obviously for consumers, the need of the speed is clearly something that can actually push customers to accept more and more contactless,	Speed	Performance Expectancy	Instrumental Factors	Extrinsic
CEO1	The whole selling point of technology is speed.	Speed	Performance Expectancy	Instrumental Factors	Extrinsic
VP2	I want to pay quickly. I don't care about if the payments exactly this way or that way, I want to move on.	Speed	Performance Expectancy	Instrumental Factors	Extrinsic
D1	And on the side of that, the benefit on the operational side is I push more people through	Speed	Performance Expectancy	Instrumental Factors	Extrinsic
VP1	So we'll come back to that in a second, but for both of these merchants, for them, speed of throughput is absolutely critical.	Speed	Performance Expectancy	Instrumental Factors	Extrinsic
CEO3	Well, I think for a merchant, it would be a clearly a need for speed as well, so if they can have, you know, obviously the integration of cards at the POS that if you can also, you know, go quicker with simply a touching and you don't have to just to get a consumer having fishing insert the card and also insert the PIN code and going quickly at the cashier and the till is a factor,	Speed	Performance Expectancy	Instrumental Factors	Extrinsic
VP2	I think on the merchant side, it's definitely the speed.	Speed	Performance Expectancy	Instrumental Factors	Extrinsic
EVP2	And I think on the merchant side, you know, it's quicker if it's implemented properly.	Speed	Performance Expectancy	Instrumental Factors	Extrinsic
VP2	I guess that's obvious, it's like very quick, very convenient, very secure in the sense that...	Security	Performance Expectancy	Instrumental Factors	Extrinsic
VP1	The factor that influences this decision is an individual's concern with fraud.	Security	Performance Expectancy	Instrumental Factors	Extrinsic
D4	...as soon as they're not afraid of the security, they see the value of having it available on their card.	Security	Performance Expectancy	Instrumental Factors	Extrinsic
D5	This is definitely the security aspect. Even if you talk to people, you realize that some people are still concerned about security.	Security	Performance Expectancy	Instrumental Factors	Extrinsic
VP2	But more importantly, a lot of times we see this whole security discussion happening. It seems to be very key in the adoption of contactless where we've gotten rid of the whole discussion around security.	Security	Performance Expectancy	Instrumental Factors	Extrinsic
D1	So if somebody comes into my store, I don't need them to sign the receipt. I don't need to then them to enter a PIN. I don't need to inconvenience them in any way or form and they can just buy and walk out. That is ideal, right?	Customer Service	Performance Expectancy	Instrumental Factors	Extrinsic
D2	Probably making it easier for a cardmember to pay and just simplifying the journey.	Customer Service	Performance Expectancy	Instrumental Factors	Extrinsic
C2	But also it strengthens, and it puts the card as the centrepiece of the customer relationship. And that's super important. That will continue to be important.	Customer Service	Performance Expectancy	Instrumental Factors	Extrinsic
CEO2	It's just saying: "Hey, I give consumers, I give consumers an option. If consumers prefer to pay, that's great. If not, so be it."	Customer Service	Performance Expectancy	Instrumental Factors	Extrinsic
EVP1	Clearly if you then see a lot of players being... both on the mobile side as well on the card side, enabling consumers with this capability then you want to offer that and offer that new speed and that convenience into your stores as well.	Customer Service	Performance Expectancy	Instrumental Factors	Extrinsic

Ref	Items	Theme	Aggregate dimension Level 1	Aggregate dimension Level 2	Aggregate dimension Level 3
D1	I think an ancillary benefit potentially is that, you know if it's really convenient in the purchase experience, right, potentially, right, I might be able to, you know upsell or cross-sell to the consumer.	Increased Sales	Performance Expectancy	Instrumental Factors	Extrinsic
VP1	It's only upside, I would say, for them it generally will incentivize impulse purchases and also maximize throughput for those businesses that need it.	Increased Sales	Performance Expectancy	Instrumental Factors	Extrinsic
D3	Cause with the ability to be able to pay without a physical sort of cashier being present as such, it really opened up the opportunity to then have self-service checkouts. So I think that piece will, or partially attended checkouts. So I think that's also driven a change in merchant behaviour, which means that they've, they've actually managed to kind of save on costs. So for them it's all about how cheap the technology is and how it's enabled them to kind of reduce the operational overhead. So that for me is one of the key benefits as I think through.	Self-servicing	Performance Expectancy	Instrumental Factors	Extrinsic
VP2	...that they get kind of more quicker the lanes cleared out and less cash in the system. And all this, they don't have to count so much money in the evening out of the till.	Cash Reduction	Performance Expectancy	Instrumental Factors	Extrinsic
VP1	But if I say contextualizing this in the UK, where individuals are used to free financial services, so we get free banking, we get free payment cards. We don't pay fees. Then you've got very low appetite to pay fees for things like this in my view, and also because everyone will be offering it.	Free Offering	Price Value	Instrumental Factors	Extrinsic
D2	The UK specifically is a market where you've got thousands of free cards where you don't have to pay for it.	Free Offering	Price Value	Instrumental Factors	Extrinsic
VP2	So like again for consumers to pay extra I think the propensity to pay for, for banking services in general kind of it's rather low.	Free Offering	Price Value	Instrumental Factors	Extrinsic
D1	There's such a big driver to drive to consumer to pay specifically for contactless. I think it's the overall value that they get from the credit card product that is provided to them, you know insurance, travel insurance, rental car insurance, so all of those services in a package is the one that consumers are prepared to pay a premium for, and then when it's loyalty, there's obviously normally a higher premium that's connected to that.	Other Features	Price Value	Instrumental Factors	Extrinsic
C2	If you would, if you were to put some extra kind of benefit around it, you do double miles, but, but then you're talking about small volume transactions, right? So again, probably not, I think not actually. I think it's an interesting question, but I think sometimes we in industry look at ways to be able to find extra revenue streams and we actually lose sight of what the main objective is.	Other Features	Price Value	Instrumental Factors	Extrinsic
VP2	Yeah. I mean, loyalty points, things like that. So, you know, merchants, if they are willing to do that. From the merchant perspective, obviously things like, interchange and those things could... The pricing model behind the technology might also be influential in adopting it basically. So like also some marketing of this, that this is like a pricing difference between say a contact card and a contactless card. In some markets we noticed in the early days that acquirers were having competition within the merchant groups to say, if you promote, we'll give you certain benefits because it was beneficial to some acquirers and so on, so there's like of all kinds of those things, which also help with the adoption.	Rewards/ Discounts	Price Value	Instrumental Factors	Extrinsic
SVP2	So not having an efficient payment system costs consumers, and they don't realize then when you add in kind of reward programs and everything, and, you know, people don't realize where the economics sit.	Rewards/ Discounts	Price Value	Instrumental Factors	Extrinsic
D1	Various markets have different cost factors, right, to consider. One is obviously the reader cost, the physical hardware cost, right? Hopefully we address that by, you know, asking all of the terminal vendors to incorporate contactless as a standard offering in their terminals, right? But you know, how did they now recover that investment? Right? So there is an uptick in the cost for those terminals to the merchant, right? What's the return on investment for the merchant, right?	Return on Investment	Price Value	Instrumental Factors	Extrinsic
D2	And so they probably want to know what is that difference in price points, are those transactions going to cost me less?	Return on Investment	Price Value	Instrumental Factors	Extrinsic
D4	They do need to be convinced that there is a use case for it, it is an upgrade of their own POS and surely they have to actually pay more to get the new upgrade and through the relationship with their acquirer or, or supplier of POS.	Return on Investment	Price Value	Instrumental Factors	Extrinsic
CEO2	It depends on who is paying for terminals? Ultimately the cost of re-terminalisation is a factor, if you have to. And the second one is, if incentives are not given from the way... - and that depends country by country - the way fees are... or ultimately the merchant discount rate is structured. But the moment merchant discount rate is at least equal, and you find a way to subsidize re-terminalisation, it's a no-brainer. Merchants do not resist.	Return on Investment	Price Value	Instrumental Factors	Extrinsic
VP2	And also there is an expectation that it is cost-effective and depending on the country and the region where you are, there are other ways of payment especially in the physical world, in the form of cash.	Return on Investment	Price Value	Instrumental Factors	Extrinsic
D1	Because you don't want to stop or be bumped by people from behind when you need to enter through into a transit environment.	Other Shoppers	Social Influence	External factors	Extrinsic
C2	One, you want to be in and out quickly because it's not necessarily the best environment to be in, but I was always conscious that actually, I'm delaying the guy behind me.	Other Shoppers	Social Influence	External factors	Extrinsic
SVP1	Sometimes you look at them and watch them, a little clumsy, a little nervous, but a big percentage, I would call it social pressure, but they look left and right and say: 'If this guy can do it, I can do it'.	Other Shoppers	Social Influence	External factors	Extrinsic



Ref	Items	Theme	Aggregate dimension Level 1	Aggregate dimension Level 2	Aggregate dimension Level 3
D2	My daughter, for example, she's 30 this year. She's proud about the fact that she never has cash in her pocket. She's always either using her phone, her wallet on the phone, or she's got her card with her. And so she would from a peer perspective, people of that age, she'd be shouting about how convenient it is.	Peers, Friends, Relatives	Social Influence	External factors	Extrinsic
D3	So if you see your friend has all the latest tech and gadgets and all of that stuff, you're going to want to follow that. So I think those are kind of the factors you see other people doing it and then you do it yourselves.	Peers, Friends, Relatives	Social Influence	External factors	Extrinsic
VP2	But I think if their friends had it and I'm still saying: "Look, I go and use this card everywhere", then they would probably ask for one.	Peers, Friends, Relatives	Social Influence	External factors	Extrinsic
C2	I'm not sure necessarily people do it just because they see their peers doing it or the competitors doing it.	Peers, Friends, Relatives	Social Influence	External factors	Extrinsic
VP2	Social pressure, I guess you could kind of think on the merchant side, probably you could take the social pressure also from as an aspect of feedback from the consumers, or eventually then also as a smaller merchant, particularly, well, maybe larger as well. I mean, like if they look, if you have multi-lane supermarket and you don't accept contactless than the neighbour does, it probably does put some pressure on you to make a move as well.	Peers, Friends, Relatives	Social Influence	External factors	Extrinsic
VP1	So using new technologies, and I've looked into this quite a lot you need a trigger point. So it's either you're at Pret, the person at the till serving you is saying: 'well, why don't you just tap, right?'	Cashier	Social Influence	External factors	Extrinsic
C2	...we forget sometimes consumers can be really seriously led by the merchant. So if the cashier directs you to use contactless and your card is contactless enabled and it's within the transaction limit, I would say nine times out of 10, you will use contactless.	Cashier	Social Influence	External factors	Extrinsic
VP2	It depends on how we call social pressure because sometimes merchants are very keen on using this technology because they know its speed. So they also see the adoption. They also put a bit of pressure on the consumer to use it. So social pressure could be many different aspects.	Cashier	Social Influence	External factors	Extrinsic
D3	So there is a bit of social pressure that, but also consumers sometimes when they go to the merchant and they say, do you have contactless? If not, there is that pressure as well.	Cashier	Social Influence	External factors	Extrinsic
D3	So I think it's the bigger players really that are influencing the technology that we see.	Social Norms	Social Influence	External factors	Extrinsic
D4	...they might actually share these types of information within their own groups via social media. You do see a lot of people now sharing fake news or wrong information there, and that actually reinforced the belief and something.	Social Norms	Social Influence	External factors	Extrinsic
CEO2	So you need to change social norms, or you need to say: "Hey, there is new technology", or there is a new, other reason why you would, and here the new other reason is pandemic or social norm, it is accepted.	Social Norms	Social Influence	External factors	Extrinsic
SVP2	But once again, from an acceptance perspective, once you've got a small vocal minority expecting to use it, merchants are then almost obligated to provide it.	Social Norms	Social Influence	External factors	Extrinsic
D1	But I think the threshold that we would look at is the 80/20 rule, right? If you could cover 80% of, you know, where those transactions happen in the environment, then you are there if you ask me. That other 20% is potentially where I don't often use my card, right? Oh, I don't often go to pay by the way. If I could cover that 80% of the market environment where the transactions are generated, than...	Anchor Merchant	Network Externalities	External factors	Extrinsic
VP1	The piece that's really important in terms of the rollout of these technologies is you need to have an anchor merchant because there's usually an incentive from those merchants onto individuals to adopt something. So the way contactless worked, and the reason why it was successful, just in case you want to know, contactless had some anchor merchants, it was TFL in the UK, at least I'm speaking about the UK because TFL suddenly rolled out the ability to use your card.	Anchor Merchant	Network Externalities	External factors	Extrinsic
C2	I remember whenever I used to be back for a holiday or vacation or seeing family, you would see contactless in places like Pret A Manger, some of these quick service restaurants in the airport, maybe in a few kind of kiosks, quick service places, elsewhere in the UK, but not really very mass. And, and the tipping point in the UK was basically the London Olympics, in 2012. When Transport for London announced that they were going to move everything over to contactless, they were going to move not just for..., to have the oyster card, which is the contactless card for the public transport system in London, but they were going to open that up to contactless or contactless cards. And that was a major kicking point, not just for the London Underground, but I really believe actually the buses in London, because buses are a little bit like a parking meter. You don't carry change. You're always scrambling around for a couple of bucks here and there. And that was a major step forward in terms of opening up the contactless environment. And, and then it just flourished and really bloomed from that point onwards.	Anchor Merchant	Network Externalities	External factors	Extrinsic
CEO1	I believe that in UK, we are at that tipping point whereby normally you see the mass adoption of new technology at roundabout 15% adoption, in the UK we're roundabout 15% adoption, particularly London underground. They're in the high teens of adoption now for mobile phones being used to tap in and out of the underground network.	Anchor Merchant	Network Externalities	External factors	Extrinsic

Ref	Items	Theme	Aggregate dimension Level 1	Aggregate dimension Level 2	Aggregate dimension Level 3
SVP2	I think certainly in the UK, or particularly in London, once it was starting to be used on public transport, that then drove further adoptions. So it's driving those habits. It really differed by market. So like I remember going to Sweden and no, the payment limits were much higher in Australia. So using it everywhere in Australia was quite normal. And then in other, like in the US they, they just thought it was bizarre. So it really varied by market. And I kind of think this is where you can only drive adoption in kind of groups.	Anchor Merchant	Network Externalities	External factors	Extrinsic
C1	Number one is of course creating the two sided availability of the proposition	Acceptance	Network Externalities	External factors	Extrinsic
D4	This is when it could be a bit dangerous. There is a specific threshold in the number of merchants that is required for people to adopt it. I think people could be as soon as, they're not afraid of the security, they see the value of having it available on their card. And if indeed the merchant accepts if they might use it or not, and if he doesn't, don't go to the shop because they don't accept contactless.	Acceptance	Network Externalities	External factors	Extrinsic
CEO1	And that's all to do with the chicken and the egg is how many terminals are capable for contactless payments. And that determines how many consumers see the advantage of using it and for the merchants is how many consumers have it, which gives them the need to offer it. So you need to have a critical mass for mass adoption. And you had that, you need the two key elements. You need to have a high degree of penetration in terms of most of the consumers of contactless cards, and then you need a high penetration amongst merchants for contactless.	Acceptance	Network Externalities	External factors	Extrinsic
VP2	That's an interesting question because , because when you go to a new market, we always have this whole chicken and egg situation: do we put out terminals first, or do we put out cards first? So there's a lot of that happening and in a lot of the markets, it could go either way to be honest, but a lot of the times, I believe we tend to put up pressure on the acquirer side.	Acceptance	Network Externalities	External factors	Extrinsic
EVP2	And you could bring in all the parties together somehow, so that, you know, one could meet the other. And so like everything if you don't have enough, like if it's very good, but you can only use it very seldomly, like it doesn't have the critical mass to basically bring enough value to consumers. And you could argue vice versa on the merchant site. So I think then obviously there was success both in..., I think there' were different paths to success with it or to scale with it.	Acceptance	Network Externalities	External factors	Extrinsic
VP1	So really within our industry, what we normally as [Payment Scheme] do, for example, or many of these, you talk to the acquirers who have the relationship with the merchants, you talk to the issuers, and if there's work to be done on both sides, issuers you say: 'well, no, I'm waiting to see how many merchants you get on board'. The merchants you say, they're saying, 'well, no, I'm waiting for you to see how many issuers you get on board.' And then you've got yourself a challenge.	Diffusion	Network Externalities	External factors	Extrinsic
D3	So from a contactless perspective, you'll hear in the industry, it's very chicken and egg, right? Like, you know, is it terminals or cards that drive the adoption of contactless. But to me it's not really chicken and egg, it's actually both. You need both. But the first thing that the payments industry needed to do is focus in, on getting the terminals there, making sure that, you know, from a technology perspective, there was enough coverage within the geographic region that we're focusing in on. So that, when you get these cards you're able to utilize them. The other key piece is making sure that the cardholder and the merchant know how to utilize the technology. So those were kind of two key factors.	Diffusion	Network Externalities	External factors	Extrinsic
D4	So I, I wouldn't be surprised that some of the retailers it's important to have a sense that there is a use case and demand from consumers to use contactless, before they say "Let's make sure I do accept contactless".	Diffusion	Network Externalities	External factors	Extrinsic
CEO1	And that's all to do with the chicken and the egg is how many terminals are capable for contactless payments. And that determines how many consumers see the advantage of using it and for the merchants is how many consumers have it, which gives them the need to offer it. So you need to have a critical mass for mass adoption. And you had that, you need the two key elements. You need to have a high degree of penetration in terms of most of the consumers of contactless cards, and then you need a high penetration amongst merchants for contactless.	Diffusion	Network Externalities	External factors	Extrinsic
EVP2	And you could bring in all the parties together somehow, so that, you know, one could meet the other. And so like everything if you don't have enough, like if it's very good, but you can only use it very seldomly, like it doesn't have the critical mass to basically bring enough value to consumers. And you could argue vice versa on the merchant site. So I think then obviously there was success both in..., I think there' were different paths to success with it or to scale with it.	Diffusion	Network Externalities	External factors	Extrinsic
D2	I would say for is the fact that it's easy and the fact that you can just tap and you don't necessarily have to put in your PIN number and it's just easy. You don't have to, you don't have to sign anything.	No PIN	Effort Expectancy	Effort-related Factors	Intrinsic
D5	I think also as a consumer that, you know, talking to people, that people feel that it's much convenient way to pay especially if you don't have to type your PIN.	No PIN	Effort Expectancy	Effort-related Factors	Intrinsic
SVP2	So, certainly from a lot of the research that was done and kind of just observing there was the having to put your PIN in. People didn't expect that.	No PIN	Effort Expectancy	Effort-related Factors	Intrinsic
C1	So contactless as a technology is I think completely non obvious to most consumers. They don't know what to do with it. They wouldn't understand what it is so that, you know, having that sort of technical availability that enough people, enough consumers have the ability to pay and enough merchants can accept it.	Familiarisation	Effort Expectancy	Effort-related Factors	Intrinsic

Ref	Items	Theme	Aggregate dimension Level 1	Aggregate dimension Level 2	Aggregate dimension Level 3
D1	We don't understand the underlying complexity and intricacies of updating a contactless acceptance environment, right?	Complexity	Effort Expectancy	Effort-related Factors	Intrinsic
CEO3	Oh, it has to be done in parallel. So you need to work on the availability of the infrastructure and then you need to start promoting it. So marketing finally, the fact that you have acceptance, you have available technology to be used, and just after that comes another part, that is the perception of the consumers.	Marketing	Facilitating Conditions	Effort-related Factors	Intrinsic
EVP1	And so if you go to consumer segments that are a little bit less rapidly adopting these technologies, you need to better show it, educate it, in a simple ways. And try to see how you do that. And different countries have taken different approaches in positioning and marketing it.	Marketing	Facilitating Conditions	Effort-related Factors	Intrinsic
SVP3	I think the factor that I've pushed the adoption is around more awareness and brand, a company actually making specific communication campaigns.	Marketing	Facilitating Conditions	Effort-related Factors	Intrinsic
D5	So the issuing part was probably the first step of the contactless journey and the terminal acceptance aspect came... probably took a while to catch up in order to cover enough in order that contactless is now being used in most of the cases, or the majority of the transactions.	Bank Support	Facilitating Conditions	Effort-related Factors	Intrinsic
EVP1	And that is in the first place making it available to consumers and merchants is one, one piece that we need to, if you don't have it, you can't use it, neither the merchant neither the consumer.	Bank Support	Facilitating Conditions	Effort-related Factors	Intrinsic
C1	I must admit that I've heard very few merchants being all that excited about contactless payments. I think the merchant attitude that I have generally run into is that, whenever this is a part of my acceptance package, that's kind of okay, and I will use it so to speak, but the many cases with that relatively passive attitude now that does exclude of course, merchants who have very specific use cases	Bank Support	Facilitating Conditions	Effort-related Factors	Intrinsic
D4	but the idea for a merchant potentially to have the latest recommendation of networks as well and acquirers to avoid, to minimize their exposure to chargebacks, to use contactless to be able to avoid some of the chargebacks in some cases, depending on the networks.	Bank Support	Facilitating Conditions	Effort-related Factors	Intrinsic
D5	I think merchants are driven by the acquirers and by the standard renewal process of their machines. And typically they have been offered to use contactless POS at some point, once they're older, POS was getting too old probably. So for me, it's more part of, let's say the renewal process more than something that was triggered by the majority of the merchants.	Bank Support	Facilitating Conditions	Effort-related Factors	Intrinsic
VP2	So the acquirers put the terminals out to make sure the terminal support contactless. So it's sometimes hard to say that the merchant has much control on whether they will adopt contactless.	Bank Support	Facilitating Conditions	Effort-related Factors	Intrinsic
VP2	On the merchant side in a way, I mean, it kind of starts from the acquiring bank or then go all to the acquiring processor and the individual merchant. It might be even really hard for the individual merchant to kind of again, technology and supplier-wise to get that contactless ability, right? So in a way on the B2B side, it gets way harder than the B2C. And again, it's like if thinking, like for instance, how it was in the, let's say early days in the UK if a TSYS or FIS had not got the ability to process contactless transactions on the other end that whether on the issuing or acquiring side, that could be a big, big roadblock, of course.	Bank Support	Facilitating Conditions	Effort-related Factors	Intrinsic
CEO3	And the technology needed to be embedded into the cards, with again, another cost. So there was for me, I mean the availability of infrastructure. So that's really the adoption, first by the manufacturer of the devices, being on acceptance and the issuance.	Other Support	Facilitating Conditions	Effort-related Factors	Intrinsic
D1	All the other ancillary players that play in that merchant environment, if you think about, they might be a reseller that is involved in offering some special software for an integrated solution to a merchant, right?	Other Support	Facilitating Conditions	Effort-related Factors	Intrinsic
D4	They do need to be convinced that there is a use case for it, it is an upgrade of their own POS and surely they have to actually pay more to get the new upgrade and through the relationship with their acquirer or, or supplier of POS.	Other Support	Facilitating Conditions	Effort-related Factors	Intrinsic
M1	In the public domain, I am aware that payment schemes are mandating contactless, but certainly everybody seems to be going there naturally. I might assume that the terminal manufacturers just weren't making non-contactless anymore,	Other Support	Facilitating Conditions	Effort-related Factors	Intrinsic
SVP2	Going back, the original was because of incentives from the payments industry. And I remember certainly when I was at [Payment Scheme], they invested really heavily in pockets to drive adoption, both on the merchant and consumer side.	Other Support	Facilitating Conditions	Effort-related Factors	Intrinsic
VP1	Well, it depends on the liability shifts, obviously. What's in their contract. So if they, as long as they're protected in terms of fraud and they should be these days, because I've got chip and PIN and contactless, there's rules in place so that the merchant doesn't absorb any kind of fraud committed.	Liability Shift	Facilitating Conditions	Effort-related Factors	Intrinsic
CEO2	The fact that there is no liability obviously was another argument that you saw, no concern for the end-user.	Liability Shift	Facilitating Conditions	Effort-related Factors	Intrinsic
D1	So for me as a merchant, if I make your payment experience very convenient, I'm assuming that for translating, word of mouth, from an experience perspective, people would rather come to my store than another store that doesn't have contactless.	Word of mouth	Facilitating Conditions	Effort-related Factors	Intrinsic
VP1	So what will happen is at the till, the person's sitting there or standing there serving your croissant, will say: 'You can just tap your card rather than insert it, dip it.' And suddenly that person will create a trigger point for you to say, oh, that was easy. And then you do it again.	Habit	Habit	Effort-related Factors	Intrinsic

Ref	Items	Theme	Aggregate dimension Level 1	Aggregate dimension Level 2	Aggregate dimension Level 3
D3	So for them, they're definitely going to try and influence your behaviour and create a payment method that you are ultimately locked into it.	Habit	Habit	Effort-related Factors	Intrinsic
VP2	... it's quite important to build that habit because they might have all good intentions, but if they're not in the habit of using it, then they might not use it.	Habit	Habit	Effort-related Factors	Intrinsic
CEO2	And the moment people start to use it once or twice, you see that there is an adoption curve, just because then they realize the benefits of it. It's just great.	Habit	Habit	Effort-related Factors	Intrinsic
VP2	So it started becoming a virtuous circle where the positive experience would make more people, the same people repeat more, do more contactless transactions or more people see, then replicate themselves. And that started growing.	Habit	Habit	Effort-related Factors	Intrinsic
VP2	...the cost of migrating to contactless was I think quite significant because it's also there were, at that time, not even a very large extent of the issuers were not even on chip yet. Right. So going from magstripe to contactless was kind of considered, I guess, a quantum leap at the time, and of course required big changes, not only the Opex in terms of changing the cards or deploying the incremental reader for the terminal, but all the work that needed to be done on the network or in the backend systems and so on. And that of course was quite a large ticket.	Compatibility	Habit	Effort-related Factors	Intrinsic
D1	I think people [see] payment just as part of the daily lifestyle. So they want to focus on the nice stuff, payment is just a grudge thing. So why do I need to be inconvenienced during my beautiful experience of buying a nice watch or buying a nice jeans or whatever? At the end of the day, the payment just needs to be part of the lifestyle experience." (D1)	Lifestyle	Hedonic Motivation	Affective Factors	Intrinsic
D1	I think the convenience factor is top of mind for me.	Convenience	Hedonic Motivation	Affective Factors	Intrinsic
D3	...it's really quick, it's really easy, it's really convenient. You know, all of those fun, fun things,	Convenience	Hedonic Motivation	Affective Factors	Intrinsic
D5	So convenience, definitely is the main factor.	Convenience	Hedonic Motivation	Affective Factors	Intrinsic
CEO2	But the ultimate benefit obviously is convenience.	Convenience	Hedonic Motivation	Affective Factors	Intrinsic
VP2	Cards got to the consumers. I mean, I guess there is evidence and also myself as a consumer, of course, like tapping is way nicer than... and more convenient than dipping and all that.	Convenience	Hedonic Motivation	Affective Factors	Intrinsic
VP1	The other one obviously is around your comfort level with technology. Are you an early adopter or late adopter of any new technologies? If you're comfortable with chip and PIN, you've always used it.	Cards	Personal	Affective Factors	Intrinsic
VP2	...should I say the consumer, sort of early adopters and then fast followers and the like kind of segmentation that they'd maybe be a number of people who really, really are keen on getting, again, something new into their hands and would eventually pay as well.	Cards	Innovativeness	Affective Factors	Intrinsic
D4	I would say that's, that's it, a third one could be as well for people who actually want to use more and more mobile to pay. You do see the younger generations not necessarily moving into classic and such a, they might actually different cards, but they actually considered it, convert them to wallets like Curve or a wallet like Stock Card and they will use their phone to pay, so they will use things like Apple Pay or Google Pay or Samsung Pay.	Cards	Innovativeness	Affective Factors	Intrinsic
D3	It's really made to an open the door for, you know, internet of things. So each of these little pieces has been like a little cog, a little step closer to a slightly different technology central for the ultimate cardholder. So personally I think from a contactless perspective know, like I've always had, it always had a really special place in my heart because I think it's such a fantastic technology, you know, from a cardholder perspective, you know, it's something that's really, it has really driven innovation, but it's also driven, you know, ultimately a big change and a big shift in how people do payments today.	Other form factors	Innovativeness	Affective Factors	Intrinsic
CEO3	I mean, people would like to adopt the technology and to be the first, the first ones. And that's what I've seen with some of the partners I was working with in Europe. I can name it. I mean, for example, in Turkey it was the, they didn't really care about making convenience, so making additional revenues, they just wanted to be the first ones to get to market. So I would say you will always have some merchants or cardholders who want to differentiate themselves and to be the disruptive ones, the ones who adopt it, are... I'm not saying the geeks, but at least who wants to differentiate themselves. And they will they will just request it and they will just be the first ones and they will be...	Other form factors	Innovativeness	Affective Factors	Intrinsic
SVP1	The fit of the product features with what people want at any given point in time that something. You will always have the 15% that will never use it, you will always have the 15% that will use it no matter what.	Resistance	Innovativeness	Affective Factors	Intrinsic

## Appendix B: Interview Guide

Thank you for agreeing to participate in this interview. The purpose of this research is to determine the factors that could influence the adoption of contactless proximity payments by consumers and by merchants. So there are no right or wrong answers to any of the questions, I am interested in your own opinions, observations and experiences.

Your participation is entirely voluntary, and you may terminate the interview at any moment. You can also withdraw your participation after the interview, please inform us within a month from the interview if you wish to do so.

The interview should take approximately 30 to 45 minutes to complete. With your permission, I would like to audio record the interview to allow for further analysis. All responses will be kept confidential. This means that your anonymised interview responses will not be shared and any information included in the reporting will not identify you as the respondent.

Are there any questions about what I have just explained?

I will now start the recording

- 
- Can you describe your previous experience with contactless payments?
  - What factors influence the adoption of contactless payments by consumers?
  - What factors influence the acceptance of contactless payments by merchants?
  - What are the advantages and the disadvantages of contactless payments for consumers?
  - What are the advantages and the disadvantages of contactless payments for merchants?

- What would facilitate or hamper the adoption of contactless payments by consumers?
- What would facilitate or hamper the acceptance of contactless payments by merchants?
- What, in your opinion, makes contactless payments useful to consumers?
- What, in your opinion, makes contactless payments useful to merchants?
- What do consumers have to do in order to pay contactless? How easy are those?
- What do merchants have to do in order to accept contactless payments? How easy are those?
- Are other people influencing whether or not a consumer uses contactless payment technology? Who and why?
- Are other people influencing whether or not a merchant installs contactless payment technology? Who and why?
- What support do consumers need to use contactless payment technology? Are there any factors helping or inhibiting the use of contactless payments?
- What support do merchants need to accept contactless payments? Are there any factors helping or inhibiting the use of contactless payments?
- Does contactless payment technology improve the user experience of paying? Why or why not?
- Does contactless payment technology improve the user experience of the cashier? Why or why not?
- Would consumers be willing to pay a premium for a contactless card or NFC wallet functionality? In what form and how much?
- Would merchants be willing to pay a premium for accepting contactless payments? In what form and how much?
- Is it important that consumers get used to pay contactless? Why or why not?

- Is it important that merchants get used to accept contactless payments? Why or why not?
- Is the number of merchants accepting contactless payments important to consumers? What proportion of merchants should accept contactless payments in order to convince the consumer?
- Is the number of consumers with contactless cards or wallets important to merchants? What proportion of consumers should carry a contactless card or NFC wallet in order to convince the merchant?

Is there anything else that you would like to comment on that I haven't already asked you about?

For the record, do you agree that your answers will be used as described in the Participant Information Sheet?

Thank you very much for your time and the information you shared today. I will now stop the recording.

# Appendix C: Consumer Questionnaire

## Introductory page:

As a consumer using contactless payments, you are being invited to participate in an academic research study on contactless payments. I am interested in your opinions and experiences with this technology.

This online survey would take approximately 6 minutes of your time to complete. Your responses will be kept anonymous and you can skip any question you are not comfortable with. You give your consent to participate by proceeding, but you can withdraw it at any point during the survey or later if you wish to.

Further information about the academic research and how your privacy will be protected can be found [here](#).

I appreciate you taking the time to complete this survey,

**Bruno Carpreau, MSc, MBA**

*Doctoral Researcher, Newcastle Business School - Northumbria University*

bruno.carpreau@northumbria.ac.uk

## Page 1:

<b>Please select:</b>	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
Among my peers, I am usually the first to try out new technologies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using contactless technology for payments is natural to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For paying, using contactless technology is an obvious choice for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People who influence my behaviour think that I should adopt contactless technology for paying	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



From my observations, the number of consumers using contactless payments is large	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contactless payment technology fits well with my lifestyle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I use contactless technology for paying frequently	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My intentions are to continue using contactless technology for payments more than alternative means (cash, cheques, chip & PIN, etc.).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have the knowledge necessary to use contactless payment technology (e.g. information from my bank)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe that contactless technology enables me to conduct payments more securely than other forms of payment (e.g. cash, cheques, chip & PIN)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting familiar with contactless payment technology is easy for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Page 2:**

<b>Please select:</b>	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
Experience with contactless payment technology is satisfactory	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contactless payment technology is compatible with other devices I use (e.g. smartphone).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Help is available when I have difficulties with contactless payment technology (e.g. from my bank)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I intend to continue using contactless payment technology rather than discontinue its use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like to experiment with new technologies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using contactless payment technology is enjoyable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I use contactless technology for paying a lot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
From my observations, the number of merchants accepting contactless payments is large	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using contactless payment technology is entertaining	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My experience with contactless payment technology is better than what I expected	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe that contactless technology enables me to conduct payments in a more hygienic way than other forms of payment (e.g. cash, cheques, chip & PIN)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Page 3:**

<b>Please select:</b>	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
At the current price, contactless payment technology provides good value	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe that contactless technology enables me to conduct payments more quickly than other forms of payment (e.g. cash, cheques, chip & PIN)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using contactless payment technology is clear and understandable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I could, I would like to discontinue my use of contactless technology for payments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contactless technology is easy to use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would prefer using contactless technology instead of alternative modes of payment (e.g. cash, cheques, chip & PIN)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I heard about a new technology, I would look for ways to experiment with it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have the resources necessary to use contactless payment technology (e.g. contactless card, mobile phone)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I made the correct decision in using contactless technology for payments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contactless payment technology is compatible with most aspects of my life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In my opinion, many consumers frequently use contactless payments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Page 4:**

<b>Please select:</b>	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
The service level provided by contactless payment technology is better than what I expected	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People whose opinions that I value prefer that I adopt contactless technology for paying	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using contactless payment technology is fun	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In my opinion, many merchants accept contactless payments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overall, most of my expectations for using contactless payment technology are confirmed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am pleased with using contactless technology for payments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Contactless payment technology is a good value for the money (e.g. through offerings, rewards, discounts, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using contactless technology for payments has become automatic to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contactless payment technology is reasonably priced	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People who are important to me think that I should adopt contactless technology for paying	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Page 5:**

Please select:	Under 10%	10–19%	20–29%	30–39%	40–49%	50–59%	60–69%	70–79%	80–89%	more than 90%
What percentage of all your payments is carried out using contactless technology?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For a consumer to consider adopting contactless technology, what minimum percentage of merchants accepting contactless payments is required?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
For how many years have you been using contactless technology for accepting payments?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	18-24	25-34	35-44	45-54	55-64	Above 65	Prefer not to say
What age range group do you fit into from the following?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Male	Female	Other	Prefer not to say
What gender do you identify as?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Doctorate degree	Master's degree	Bachelor's degree	Associate degree	Trade/technical/vocational training	High school diploma or equivalent	Some high school	Other	Prefer not to say
Please select the highest level of education that you have attained:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Full-time employment	Self-employed	Part-time employment	Full-time freelancing	Unemployed	Student	Inability to work	Prefer not to say
Which of the following best describes your current employment status?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Do you have any further comments you would like to add? (optional)	
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## Final Page

Thank you for your participation in this survey on contactless payment technology.

Your participation is entirely voluntary, your responses will be kept anonymous and you can withdraw your consent to participate if you wish to. Further information about the academic research project and how your privacy will be protected can be found [here](#).

## Appendix D: Merchant Questionnaire

### Introductory page:

As a merchant accepting contactless payments, you are being invited to participate in an academic research study on contactless payments. I am interested in your opinions and experiences with this technology.

This online survey would take approximately 7 minutes of your time to complete. Your responses will be kept anonymous and you can skip any question you are not comfortable with. You give your consent to participate by proceeding, but you can withdraw it at any point during the survey or later if you wish to.

Further information about the academic research and how your privacy will be protected can be found [here](#).

I appreciate you taking the time to complete this survey,

**Bruno Carpreau, MSc, MBA**

*Doctoral Researcher, Newcastle Business School - Northumbria University*

bruno.carpreau@northumbria.ac.uk

### Page 1:

<b>Please select:</b>	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
Among my peers, I am usually the first to try out new technologies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using contactless technology for accepting payments is natural to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For accepting payments, using contactless technology is an obvious choice for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People who influence my behaviour think that I should adopt contactless technology for accepting payments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

From my observations, the number of consumers using contactless payments is large	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contactless payment technology fits well with my work style	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I use contactless technology for accepting payments frequently	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My intentions are to continue using contactless technology for accepting payments more than alternative means (cash, cheques, chip & PIN, etc.).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have the knowledge necessary to use contactless payment technology (e.g. information from my bank)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe that contactless technology enables me to accept payments more securely than other forms of payment (e.g. cash, cheques, chip & PIN)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting familiar with contactless payment technology is easy for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Page 2:**

<b>Please select:</b>	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
Experience with contactless payment technology is satisfactory	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contactless payment technology is compatible with other devices I use (e.g. cash register).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Help is available when I have difficulties with contactless payment technology (e.g. from my bank)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I intend to continue using contactless payment technology rather than discontinue its use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like to experiment with new technologies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using contactless payment technology is enjoyable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I use contactless technology for accepting payments a lot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
From my observations, the number of merchants accepting contactless payments is large	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using contactless payment technology is entertaining	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My experience with contactless payment technology is better than what I expected	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe that contactless technology enables me to accept payments in a more hygienic way than other forms of payment (e.g. cash, cheques, chip & PIN)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Page 3:**

<b>Please select:</b>	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
At the current price, contactless payment technology provides good value	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe that contactless technology enables me to accept payments more quickly than other forms of payment (e.g. cash, cheques, chip & PIN)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using contactless payment technology is clear and understandable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I could, I would like to discontinue my use of contactless technology for accepting payments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contactless technology is easy to use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would prefer using contactless technology instead of alternative modes of payment (e.g. cash, cheques, chip & PIN)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I heard about a new technology, I would look for ways to experiment with it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have the resources necessary to use contactless payment technology (e.g. payment terminal with NFC reader)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I made the correct decision in using contactless technology for accepting payments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contactless payment technology is compatible with most aspects of my operations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In my opinion, many consumers frequently use contactless payments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Page 4:**

<b>Please select:</b>	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
The service level provided by contactless payment technology is better than what I expected	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People whose opinions that I value prefer that I adopt contactless technology for accepting payment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using contactless payment technology is fun	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In my opinion, many merchants accept contactless payments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overall, most of my expectations for using contactless payment technology are confirmed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am pleased with using contactless technology for accepting payments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Contactless payment technology is a good value for the money (e.g. through liability shift)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using contactless technology for accepting payments has become automatic to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contactless payment technology is reasonably priced	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People who are important to me think that I should adopt contactless technology for accepting payments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Page 5:**

Please select:	Under 10%	10–19%	20–29%	30–39%	40–49%	50–59%	60–69%	70–79%	80–89%	more than 90%
What percentage of all your payments is carried out using contactless technology?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For a merchant to consider adopting contactless technology, what minimum percentage of customers with a contactless card or phone is required?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
For how many years have you been using contactless technology for accepting payments?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	18-24	25-34	35-44	45-54	55-64	Above 65	Prefer not to say
What age range group do you fit into from the following?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Male	Female	Other	Prefer not to say
What gender do you identify as?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Doctorate degree	Master's degree	Bachelor's degree	Associate degree	Trade/technical/vocational training	High school diploma or equivalent	Some high school	Other	Prefer not to say
Please select the highest level of education that you have attained:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



	Full-time employment	Self-employed	Part-time employment	Full-time freelancing	Unemployed	Student	Inability to work	Prefer not to say
Which of the following best describes your current employment status?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Do you have any further comments you would like to add? (optional)	
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## Final Page

Thank you for your participation in this survey on contactless payment technology.

Your participation is entirely voluntary, your responses will be kept anonymous and you can withdraw your consent to participate if you wish to. Further information about the academic research project and how your privacy will be protected can be found [here](#).

## Appendix E: Interview Participant Information Sheet

**Name of Researcher:** Bruno Carpreau

**Name of Supervisor:** Dr Mahmoud Abdelrahman and Dr Firas Masri

**Project Title:** Technology Acceptance in Two-Sided Platforms: The Adoption and Use of Contactless Proximity Payments by Consumers and Merchants

### **What is the purpose of the research?**

The purpose of the research is to identify the drivers for the adoption of contactless payment technology by both consumers and merchants, and how the behaviours of one group influence the intent and the behaviours of the other group. The results of the interviews will be used to design a questionnaire that will be used for a quantitative survey among consumers and merchants.

### **Why have I been selected to take part and what are the exclusion criteria?**

The interviews will be conducted with individuals who have professional experience with payment technology, whether working with consumers, with merchants, or with both.

### **Do I have to take part in the research?**

Participation in this research is completely voluntary. It is up to you whether you would like to take part in the study. This information sheet is to help you make that decision. You are completely free to decide whether to take part, or to take part and then leave the study before completion.

### **What will happen if I take part?**

You will be invited to participate in an online interview. The interview will be organised for a mutually suitable time and be conducted by phone or by a video call. The interview will be recorded to assist with our data analysis. The interview is expected to last up to 30 minutes in duration.

### **How do I give my consent to participate?**

You give us your consent by attending on the phone or by video call and by completing and returning the consent form.

### **How will my data be stored, and how long will it be stored for?**

All information and data gathered during this research will be stored in line with the Data Protection Act and will be destroyed 12 months following the conclusion of the study. If the research is published in a scientific journal it may be kept for longer before being destroyed.

During that time the data will be stored in a local electronic repository, protected by passwords, and only the researcher will have access to the information provided.

The data may be used by the researcher only for purposes appropriate to the research question, but at no point will your personal information or data be revealed. Your personal data will not be identifiable in any analysis or published results. Your name will not be

written on any of the data we collect; your name will not be written on the recorded interviews, or on the typed up versions of your discussions from the interview, and your name will not appear in any reports or documents resulting from this study.

### **What is the legal basis for processing personal data?**

The legal basis used to process your personal data will be Legitimate Interests.

### **What will happen to the results of the study?**

The results of the research project will be published in a doctoral thesis at the Newcastle Business School (Northumbria University), towards the end of 2023. If you are interested in receiving an electronic copy of the thesis, please contact the researcher at [bruno.carpreau@northumbria.ac.uk](mailto:bruno.carpreau@northumbria.ac.uk).

Additionally, findings might be reported in scientific journals or presented at research conferences, however the data will be anonymised and you or the data you have provided will not be personally identifiable.

### **Will I receive any financial reward for taking part?**

There are no financial rewards to take part in this research.

### **How can I withdraw from the project?**

If you wish to withdraw your data then contact the researcher at [bruno.carpreau@northumbria.ac.uk](mailto:bruno.carpreau@northumbria.ac.uk) within 1 month of taking part, quoting the code number that was allocated to you (this can be found above on this participant information sheet). After this time it might not be possible to withdraw your data as it could already have been analysed.

### **Who has reviewed this research?**

This research project, submission reference 28301 in the Northumbria University's Ethics Online system, has been reviewed in order to safeguard your interests, and has been granted approval. If you require confirmation of this, or if you have any concerns or worries concerning this research, or if you wish to register a complaint, please contact the Chair of the Faculty of Business and Law Research Ethics Committee, Dr Russell Warhurst at [russell.warhurst@northumbria.ac.uk](mailto:russell.warhurst@northumbria.ac.uk) stating the title of the research project and the name of the researcher.

### **What are my rights as a participant in this study?**

You have a right of access to a copy of the information comprised in your personal data; you have a right to have inaccurate personal data rectified; and you have a right to object to decisions being taken by automated means.

To obtain a copy of the personal data that we may hold about you, you can make a Subject Access Request via post, email or through the submission of an electronic form at the following URL: <https://www.northumbria.ac.uk/about-us/leadership-governance/vice-chancellors-office/legal-services-team/gdpr/gdpr---rights-of-the-individual/right-to-subject-access/>. If you are dissatisfied with the University's processing of personal data, you have the right to complain to the Records and Information Officer at Northumbria University, Duncan James, at [dp.officer@northumbria.ac.uk](mailto:dp.officer@northumbria.ac.uk). You can find out more about how we use your information at: [www.northumbria.ac.uk/about-us/leadership-governance/vice-chancellors-office/legal-services-team/gdpr/gdpr---privacy-notices/](https://www.northumbria.ac.uk/about-us/leadership-governance/vice-chancellors-office/legal-services-team/gdpr/gdpr---privacy-notices/) or by contacting the researcher at [bruno.carpreau@northumbria.ac.uk](mailto:bruno.carpreau@northumbria.ac.uk).

Yours sincerely,

A handwritten signature in black ink, reading "Carpreau Bruno". The signature is written in a cursive style with a large, sweeping initial "C" that loops around the first part of the name.

Bruno Carpreau, *MSc, MBA*

**Email:** [bruno.carpreau@northumbria.ac.uk](mailto:bruno.carpreau@northumbria.ac.uk)

**Mobile:** +32 498 58 53 59

## Appendix F: Survey Participant Information Sheet

**Name of Researcher:** Bruno Carpreau

**Name of Supervisors:** Dr Mahmoud Abdelrahman and Dr Firas Masri

**Project Title:** Technology Acceptance in Two-Sided Platforms: The Adoption and Use of Contactless Proximity Payments by Consumers and Merchants

### **What is the purpose of the research?**

The purpose of the research is to understand why consumers and merchants opt for contactless payments.

### **Why have I been selected to take part and what are the exclusion criteria?**

The surveys will be conducted with UK consumers, who regularly make purchases at small and medium-sized retail outlets, and with owners and/or operators of small and medium-sized retail outlets.

### **Do I have to take part in the research?**

Participation in this research is completely voluntary. It is up to you whether you would like to take part in the study. This information sheet is to help you make that decision. You are completely free to decide whether to take part, or to take part and then leave the study before completion.

### **What will happen if I take part?**

You will be invited to participate in an online survey lasting up to 10 minutes to complete.

### **How do I give my consent to participate?**

You give us your consent by agreeing to the consent statement prior to starting the survey.

### **How will my data be stored, and how long will it be stored for?**

All information and data gathered during this research will be stored in line with the Data Protection Act and will be destroyed 12 months following the conclusion of the study. If the research is published in a scientific journal it may be kept for longer before being destroyed.

During that time the data will be stored in a local electronic repository with a cloud-based back-up, protected by passwords, and only the researcher will have access to the information provided.

The data may be used by the researcher only for purposes appropriate to the research question, but at no point will your personal information or data be revealed. Your personal data will not be identifiable in any analysis or published results. Your name will not be written on any of the data we collect; your name will not be written on the recorded interviews, or on the typed up versions of your discussions from the interview, and your name will not appear in any reports or documents resulting from this study.

### **What is the legal basis for processing personal data?**

The legal basis used to process your personal data will be Legitimate Interests.

### **What will happen to the results of the study?**

The results of the research project will be published in a doctoral thesis towards the end of 2023. If you are interested in receiving an electronic copy of the thesis, please contact the researcher at [bruno.carpreau@northumbria.ac.uk](mailto:bruno.carpreau@northumbria.ac.uk).

Additionally, findings might be reported in scientific journals or presented at research conferences, however the data will be anonymised and you or the data you have provided will not be personally identifiable.

### **How can I withdraw from the project?**

If you wish to withdraw your data then contact the researcher at [bruno.carpreau@northumbria.ac.uk](mailto:bruno.carpreau@northumbria.ac.uk) within 1 month of taking part. After this time it might not be possible to withdraw your data as it could already have been analysed.

### **Who has reviewed this research?**

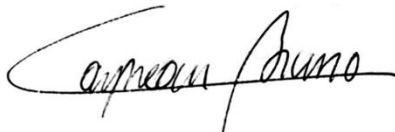
This research project, submission reference 28301 in the Northumbria University's Ethics Online system, has been reviewed in order to safeguard your interests, and has been granted approval. If you require confirmation of this, or if you have any concerns or worries concerning this research, or if you wish to register a complaint, please contact the Faculty of Business and Law Research Ethics Director, at [russell.warhurst@northumbria.ac.uk](mailto:russell.warhurst@northumbria.ac.uk) stating the title of the research project and the name of the researcher.

### **What are my rights as a participant in this study?**

You have a right of access to a copy of the information comprised in your personal data; you have a right to have inaccurate personal data rectified; and you have a right to object to decisions being taken by automated means. To obtain a copy of the personal data that we may hold about you, you can make a Data Subject Access Request via post, email or through the submission of an electronic form at the following URL:

<https://www.northumbria.ac.uk/about-us/leadership-governance/vice-chancellors-office/legal-services-team/gdpr/gdpr---rights-of-the-individual/right-to-subject-access> . If you are dissatisfied with the University's processing of personal data, you have the right to complain to the University Data Protection Officer, at [dp.officer@northumbria.ac.uk](mailto:dp.officer@northumbria.ac.uk). You can find out more about how we use your information at: <https://www.northumbria.ac.uk/about-us/leadership-governance/vice-chancellors-office/legal-services-team/gdpr/> or by contacting the researcher at [bruno.carpreau@northumbria.ac.uk](mailto:bruno.carpreau@northumbria.ac.uk).

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Carpreau Bruno', written in a cursive style.

Bruno Carpreau, MSc, MBA

Email: [bruno.carpreau@northumbria.ac.uk](mailto:bruno.carpreau@northumbria.ac.uk)

## Appendix G: Consent Form

**Name of Researcher:** Bruno Carpreau

**Name of Supervisors:** Dr Mahmoud Abdelrahman and Dr Firas Masri

**Project Title:** Technology Acceptance in Two-Sided Platforms: The Adoption and Use of Contactless Proximity Payments by Consumers and Merchants

	Please check box
I confirm that I have read the information sheet dated..... for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	<input type="checkbox"/>
I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.	<input type="checkbox"/>
I understand that the information collected will be used to support other research in the future, and may be shared anonymously with other researchers.	<input type="checkbox"/>
I agree to take part in the above study.	<input type="checkbox"/>

*This study and its protocol have received full ethical approval from Faculty of Business and Law Research Ethics Committee. If you require confirmation of this, or if you have any concerns or worries concerning this research, or if you wish to register a complaint, please contact the Chair of this Committee, Dr. Russell Warhurst at [russell.warhurst@northumbria.ac.uk](mailto:russell.warhurst@northumbria.ac.uk) stating the title of the research project and the name of the researcher.*

## Appendix H: Debrief Sheet

**Name of Researcher:** Bruno Carpreau

**Name of Supervisors:** Dr Mahmoud Abdelrahman and Dr Firas Masri

**Project Title:** Technology Acceptance in Two-Sided Platforms: The Adoption and Use of Contactless Proximity Payments by Consumers and Merchants

### **What was the purpose of the project?**

*The purpose of the research is to identify the drivers to adopt contactless payments by both consumers and merchants, and how the behaviours of one group influence the intent and the behaviours of the other group. The interview was instrumental in discovering all possible motivations of individuals for adopting contactless payments, and to structure them into more general categories. The results of the interviews will be used to design a questionnaire that will be used for a quantitative survey among consumers and merchants.*

### **How will I find out about the results?**

*The results of the research project will be published in a doctoral dissertation at the Newcastle Business School (Northumbria University), towards the end of 2023. If you are interested in receiving an electronic copy of the dissertation, please contact the researcher at [bruno.carpreau@northumbria.ac.uk](mailto:bruno.carpreau@northumbria.ac.uk).*

### **If I change my mind and wish to withdraw the information I have provided, how do I do this?**

*If you wish to withdraw your data then contact the researcher at [bruno.carpreau@northumbria.ac.uk](mailto:bruno.carpreau@northumbria.ac.uk) within 1 month of taking part, quoting the code number that was allocated to you (this can be found above on this debrief sheet). After this time it might not be possible to withdraw your data as it could already have been analysed.*



*The data collected in this study may also be published in scientific journals or presented at conferences. Information and data gathered during this research study will only be available to the research team identified in the information sheet. Should the research be presented or published in any form, all data will be anonymous (i.e. your personal information or data will not be identifiable).*

*All information and data gathered during this research will be stored in line with the Data Protection Act and will be destroyed 12 months following the conclusion of the study. If the research is published in a scientific journal it may be kept for longer before being destroyed. During that time the data may be used by members of the research team only for purposes appropriate to the research question, but at no point will your personal information or data be revealed. Insurance companies and employers will not be given any individual's personal information, nor any data provided by them, and nor will we allow access to the police, security services, social services, relatives or lawyers, unless forced to do so by the courts.*

*If you wish to receive feedback about the findings of this research study then please contact the researcher at [bruno.carpreau@northumbria.ac.uk](mailto:bruno.carpreau@northumbria.ac.uk)*

*This study and its protocol have received full ethical approval from Faculty of Business and Law Research Ethics Committee. If you require confirmation of this, or if you have any concerns or worries concerning this research, or if you wish to register a complaint, please contact the Chair of this Committee, Dr. Russell Warhurst at [russell.warhurst@northumbria.ac.uk](mailto:russell.warhurst@northumbria.ac.uk) stating the title of the research project and the name of the researcher.*

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