AN INVESTIGATION OF CONSUMER ENGAGEMENT WITH INTERNET OF THINGS IN THE CONTEXT OF SMART METER IN-HOME DISPLAYS

Thesis for the degree of Doctor of Philosophy

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This thesis is the result of the author's original research. It has been composed by the author and has not been previously submitted for the examination, which has led to the award of a degree.

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Signed: Semih Sagmanli

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Abstract

Consumer interaction with smart Internet-of-Things (IoT) technologies has recently been getting a lot of scholarly attention in marketing. Yet, existing research has primarily focused on the factors influencing their acceptance/adoption whereas research on consumer engagement (CE) with IoT products at the post-adoption stage remains embryonic. Drawing from Technology Acceptance Model and Social Presence Theory, and via a two-phase empirical study consisting of exploratory interviews and a large-scale survey, this thesis investigates CE with IoT technologies at the post-adoption stage.

Specifically, this research: i) reviews and critiques existing literature on the conceptualisation, dimensionality, measurement, and drivers of CE with IoT technologies, ii) explores CE with IoT technologies in the context of energy consumption, as well as individuals' perceptions of the main consumer-related (both general and context-dependent) and technology-related drivers of their engagement, and of their relative significance, and iii) investigates how these drivers directly and indirectly influence distinct dimensions of CE with IoT technologies in the context of energy consumption.

Findings from the qualitative phase reveal that consumers are mainly driven by three types of general and context-specific motivations (susceptibility to normative influence, attitude to money, and green environmentalism) when engaging with their smart energy in-home devices, while their perceptions of the technology's ease-of-use (i.e., perceived ease of use) and usefulness (i.e., perceived usefulness) appear important in the engagement with smart energy in-home devices. The results of the quantitative study confirm that the three motivations indirectly influence engagement with smart meter in-home displays (IHD), as perceived usefulness of technology mediates this relationship, while perceived ease-of-use of technology is a direct antecedent of consumer-IHD engagement.

The study contributes to CE literature via unveiling the role of different consumer-related and technology-related antecedents on engagement with IoT technologies while also highlighting the specific relationship between these antecedents and the specific dimensions of IoT engagement. Additionally, it also offers practical recommendations in relation to the factors which need to be manipulated in order to enhance consumer-IoT engagement, which becomes particularly important in contexts such as energy consumption, as it can ultimately lead to behaviour change.

This thesis is dedicated to all of the people who make a positive impact in our world

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Contents

Table of Abbreviations

Abbreviation	***Definition***
Aesth	Aesthetics
ATM	Attitude to Money
CLF	Common Latent Factor
CMB	Common Method Bias
CFI	Comparative Fit Index
CFA	Confirmatory Factor Analysis
CE	Consumer Engagement
CA	Cronbach's Alpha
EFA	Exploratory Factor Analysis
ESSL	Extraction Sums of Squared Loadings
FMCG	Fast Moving Consumer Goods
FocA	Focused Attention
GPS	Global Positioning System
GE	Green Environmentalism
GHG	Greenhouse Gas
IHD	In-home Display
IT	Information Technology
IoT	Internet of Things
KMO	Kaiser-Meyer-Olkin
LOR	Length of Relationship
LOE	Level of Education
LOI	Level of Income
NGOs	Non-governmental Organisations
OBC	Online Brand Community
PEOU	Perceived Ease of Use
PU	Perceived Usefulness
RO	Research Objective
RMSEA	Root Mean Square Error of Approximation
SPT	Social Presence Theory
SEM	Structural Equation Modelling
SNI	Susceptibility to Normative Influence

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Tables

Chapter 1: Introduction to the Thesis

1.1 Introduction to the chapter

Understanding consumer engagement (CE) with different objects, including technology, has recently become an important research topic for many marketing scholars (e.g., Viswanathan et al., 2017; Kamboj et al., 2020). This thesis aims to identify how individuals interact with smart products in a CE framework while exploring the significant relationship between factors influencing consumer-technology engagement with a specific focus on Internet of Things (IoT) technologies.

The purpose of this chapter is to provide detailed information about the background of this research, discuss the gaps in the literature and why this research is needed, explain the main research aim and objectives, shed light on the specific research context, underline how the researcher approached this study methodologically, clarify the theoretical and managerial value of the thesis and finally, outline the overall structure of the thesis.

To start with, the next section focuses on the background of this study.

1.2 Background

During the last two decades, especially after computer-mediated technologies began to play a more important role in individuals' daily routines and actions (e.g., Mann, 2002; Sayago et al., 2011; Rae et al., 2015), technology manufacturers, scientists and researchers started to place more emphasis on understanding how individuals interact with different computer-mediated products (e.g., Rautaray and Agrawal., 2015; Dewar et al., 2017; Cook et al., 2019).

Similar to individuals' goals and motivation, technology, in general, has a strong potential to influence individuals' actions as many technologies help their users to complete various tasks more quickly, conveniently, and easily (e.g., Koyuncu and Bhattacharya, 2004; Mankins, 2016; Rosenbloom et al., 2016; Brown and Wollersheim, 2019). While computers, mobile phones and many other computer-mediated devices can offer individuals more accessible and more convenient lives, it is crucial to understand why individuals interact and engage with specific technologies (e.g., Kaufmann, 2010; Kostkova et al., 2016).

Not surprisingly, computer-mediated Internet of Things (IoT) products have been widely investigated by researchers in many different fields, including engineering (e.g., Vangelista et al., 2015; Zambonelli, 2017; Radanliev et al., 2019; Gawali and Deshmukh, 2019), psychology (e.g., Feng et al., 2011; Alhogail, 2018; Palmatier and Martin, 2019) and business (e.g., Jara et al., 2012; Gong, 2016; Feretti and Schviavone, 2016; Said and Salem, 2019). Most of these studies have discussed the importance of the IoT technologies in individuals' everyday behaviour and actions while investigating the potential ways

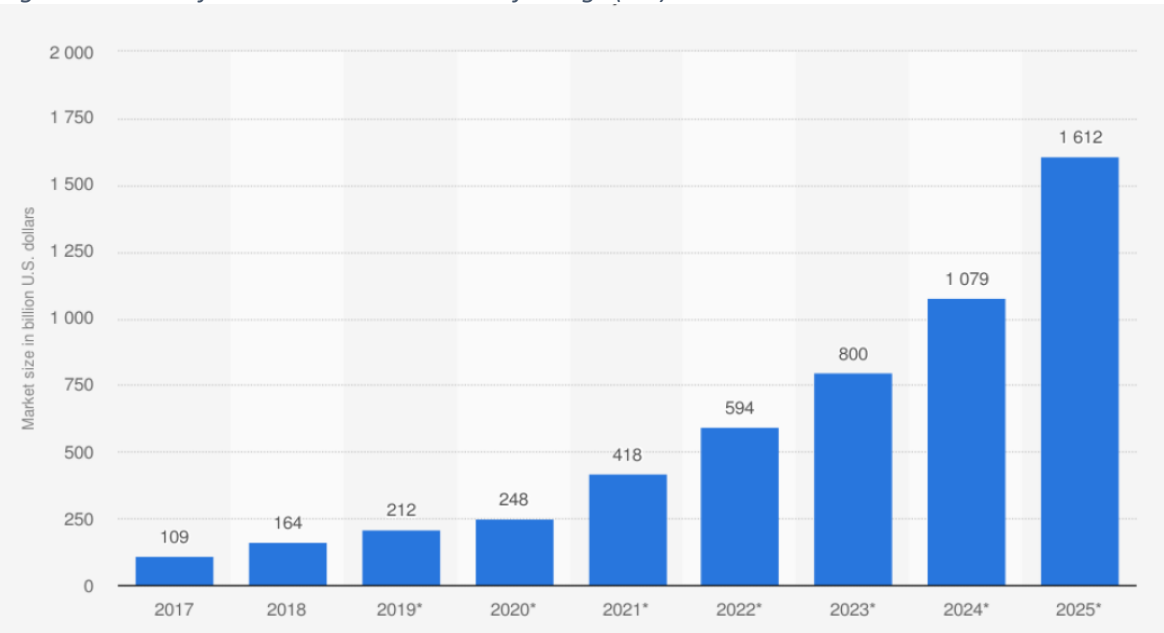
to improve individuals' perceptions of IoT technologies. Still, there has been limited discussion about the importance of certain influencing factors (e.g., motivations) on consumer-IoT engagement.

Elaborating on this, although there are many definitions for the IoT most of them are about the technical details of these technologies. Therefore, previous research has not addressed the specific human interaction with the IoT technologies in detail (Koreshoff et al., 2013). Because of this reason, consumers' role in the overall IoT framework and the importance of consumer-IoT engagement still require significant attention from the researchers for the development of the IoT technologies. In other words, as Koreshoff et al. (2013) discussed, research on IoT should focus more on understanding the different factors that affect the interconnection of physical objects in the IoT framework and individuals' engagement with these devices. Furthermore, Nizetic et al. (2020) underlined that further research is required to investigate the positive and negative outcomes of IoT technologies and how consumer use and engagement with these technologies could help the advancement of IoT products. In this respect, lack of research in IoT engagement may prevent the IoT to deliver various significant benefits (El-Haddadeh et al., 2019).

IoT, also called the Internet of Everything, is a technology concept for machines and devices capable of interacting with each other (Lee and Lee, 2015). IoT is also described as a things-connected network, where specific devices (i.e., things) are connected to each other via smart and wireless sensors (Pretz, 2013). IoT technologies, which are known as smart and embedded devices, are physical components with the ability to be detectable and can also interact and communicate with the environment and other smart objects. They are considered smart as they have the capability to perform intelligently under specific conditions through autonomous behaviours. In this sense, information delivery in the Smart City context (Jara et al., 2014) can be given as an example of an IoT technology, whereby different kinds of sensors gather data to increase the efficiency of operations in the city. Accordingly, as the new-generation Internet grows the harmonious interaction between societies, smart things, and humans under the vision of IoT technologies (Gou et al., 2013), understanding human-IoT engagement becomes a more important subject.

Additionally, by the end of 2025, there will be more than 75 billion IoT-connected devices worldwide (Statista, 2019), and many researchers argue that the market size of IoT technologies will continue to grow over the coming years. For instance, Liu (2019) estimated that the IoT market size could reach around 1.6 trillion U.S. dollars by 2025 (Figure 1.1).

Figure 1.1: Size of the Worldwide Internet of Things (IoT) Market

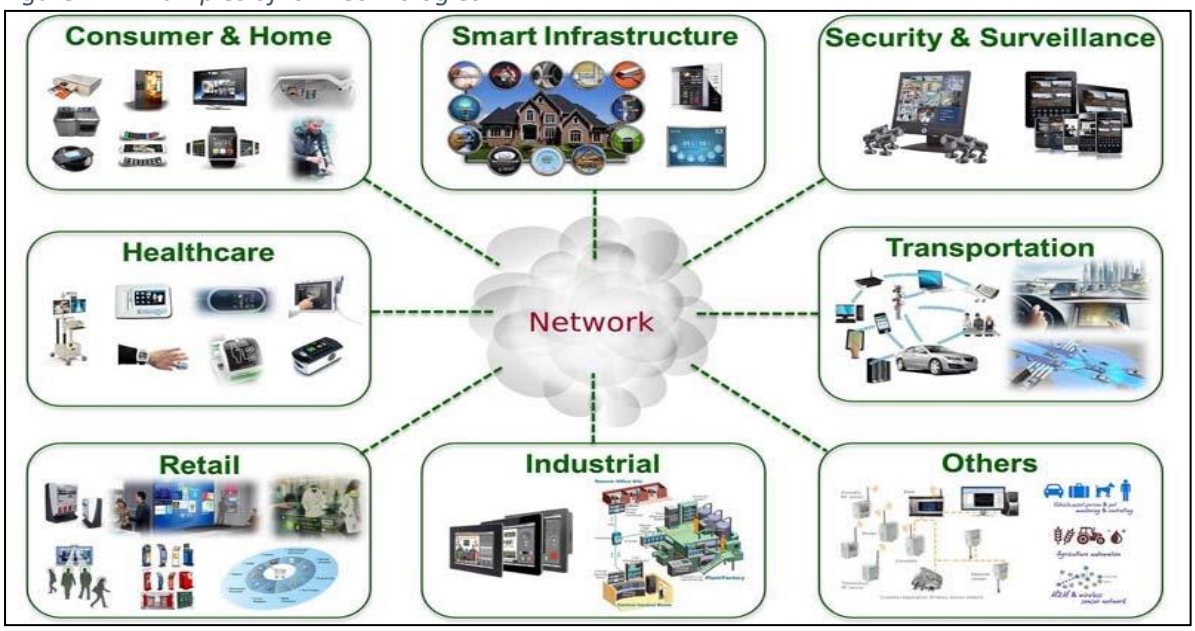


Source: Liu, 2019

IoT technologies commonly integrate physical objects with Information Technology (IT) in the form of software and hardware. Because of this, the primary thing-based physical function of an object can be improved with further IT-based digital services, which can be achieved on a local basis as well as at a global level (Wortmann and Flüchter, 2015). Integrating networking, computation, sensors, and devices into various objects have led to the rapid development of IoT technologies during the last decade (e.g., Coughlan et al., 2012; Khattak et al. 2019; Qui et al. 2020).

Today, several IoT technologies have a presence in individuals' daily lives. The most common examples of IoT technologies commercially available for individual use are smart wearables (e.g., Wei, 2014; Ko and Kim, 2019), connected cars (e.g., Glancy, 2015; Coutinho and Boukerche, 2019) and smart homes (e.g., Chan et al., 2009; Raja and Mandour, 2019). From education and health services to consumer goods and transportation, IoT technologies have a wide range of applications in the modern world (Figure 1.2).

Figure 1.2: Examples of IoT Technologies



Source: Sensors, 2015

Considering the benefits and applications of these technologies, it has been argued that IoT technologies can be very persistent, they can allow anonymity, reach, and manage an unlimited amount of data, and can use a paramount set of modalities to generate a smooth, continuous, and convincing experience (Ijsselsteijn et al., 2006). For example, IoT technologies have the potential to gain access to areas where they would not be welcomed in individuals' homes (e.g., bathroom, bedroom, etc.) thanks to their increasingly embedded, all-present and pervasive nature. IoT also has the potential to automate large parts of daily life and usher in entirely new forms of shopping behaviour, raising questions, opportunities as well as challenges for brands and traditional marketing activities (e.g., Lannon, 2015).

Moreover, IoT technologies are continuously developed for consumer applications (e.g., smart home). In other words, they have the potential to help individuals to complete their daily activities more easily and enjoy the benefits that the technology can bring to them. In the future FMCG context, for example, it has been contended that consumers will not write their requirements on a piece of paper when a household product is running low but will tap the empty package on a wireless sensor and automatically add the product to an online shopping list (Bayler, 2015).

These billions of smart devices are intended to improve individuals' performance, security, health, well-being, and quality of life in general, thanks to the interconnection of items, individuals and information. Hence, IoT technologies may provide significant opportunities to governments, service providers and consumers. A summary of some key benefits is provided in Table 1.1 below.

Table 1.1: Benefits of IoT Technologies

Governments	• *Easier to Monitor and Control Things* • *Improved Healthcare Services* • *Easier to Contact Members of Society* • *Increased Public Safety* • *More Sophisticated Education Systems* • *Cheaper Information Delivery to Individuals*
Companies	• *Increased Productivity* • *Reduced Business Costs* • *Easier Access to and Delivery of Information* • *Better Communication with Consumers* • *More Effective Automation* • *Improved Time and Resource Management*
Individuals	• *Faster Feedback on Activities* • *Better Understanding of Overall Behaviour* • *More Control in the Process* • *Easier to Contact Providers and Give Information*
Society	• *Smarter Cities for More Efficient Lifestyles* • *Cheaper Education and Transportation Systems* • *Improved Accessibility for Individuals*

Table constructed by the author based on Dlodlo and Kalezhi, 2015; Hammi et al., 2017; Elijah et al., 2018; Kankanhalli and Charalabidis, 2019

In short, it can be contended that IoT technologies will continue to have a significant role in individuals' everyday lives in the future. In order to understand how improved human interaction and engagement with IoT can provide information on individuals' behaviour, identifying the reasons behind individuals' engagement with IoT is valuable for researchers. Thus, the current study was undertaken with the purpose of further exploring the human-IoT relationship and investigating different factors that have the potential to affect consumer engagement (CE) with IoT technologies. In this respect, the following section highlights the research gap in the IoT technology literature and argues why this research is required.

1.3 Research Gap and Rationale for the Research

Starting from the early 2000s, many studies have focused on Internet of Things (IoT) technologies and their implications. However, most of these studies mainly cover areas such as object identification and tracking (e.g., Vogt, 2002; Cha and Kim, 2005), object networking (e.g., Gorlatova et al., 2010; Tschofenig et al., 2015), enhancement of IoT technologies (e.g., Kortuem, 2013; Amon et al., 2014), sensing data visualization (e.g., Chui et al., 2010; Swan, 2012; Gubbi et al., 2013), security concerns and privacy control (e.g., Riahi et al., 2013; Goudar et al., 2014; Sicari et al., 2015). However, while IoT technologies have recently received substantial scholarly attention, in marketing such research remains in an embryonic stage. There are still plenty of research questions that remain unanswered, such as:

1) How can consumer engagement (CE) be defined in the context of IoT technologies?

2) What are the different consumer-related and technology-related characteristics/factors that have the potential to directly or indirectly influence the strength of consumer-IoT engagement?

3) How do consumer-related characteristics, technology-related factors and various elements of CE with IoT technologies interact with each other?

As a result, there are a number of research gaps that need to be addressed in order to understand the specific connections between individuals and IoT technologies.

In this respect, although some studies have been undertaken in the last decade to shed light on the significant connections between individuals and smart IoT devices (e.g., Arnone et al., 2011; Guo et al., 2013; Kim et al., 2013; Ghanem and Mander, 2014; Ullah et al., 2018; Letheren, 2019), many of these studies have mainly focused on technology acceptance and adoption. For instance, on the consumer side, research has been mostly restricted to exploring adoption barriers (e.g., Canhoto and Arp, 2017). Accordingly, a number of academics (e.g., Kim, 2016; Ng and Wakenshaw, 2017) in the marketing discipline have argued that further research is needed to explore CE with IoT technologies at the post-adoption stage and to answer different questions such as 'how will individuals interact with IoT products?' (e.g., Verhoef et al., 2017), 'how extensive use of IoT technologies will impact the relationship between consumers and IoT products?' (e.g., Riggins and Wamba, 2015) and 'what factors influence CE with different engagement objects (i.e., firm, brand, IoT device, etc.)?' (Nguyen and Simkin, 2017).

Moreover, even though a small number of studies have talked about consumer-IoT engagement (e.g., Alexandru et al., 2018; Tiwari et al., 2018), none of them has focused on investigating the potential impact of various important factors (e.g., individual or external factors, etc.) on the strength of CE with

IoT devices. Elaborating on this, these studies have not explored certain factors (e.g., consumer-related and technology-related characteristics) influencing CE and why individuals continue to use a particular smart IoT product and engage (or not engage) with that product to potentially obtain beneficial outcomes.

Thus, more research is required to investigate how different types of internal, consumer-related characteristics and external factors such as technology-related drivers can be used to prompt individuals to strengthen their engagement with IoT devices. Based on the assumption that IoT devices will continue to play an important role in individuals' lives, the need to better understand how consumers interact with them becomes imperative. Accordingly, the originality of this thesis lies in the fact that it explores how individuals' overall motivational characteristics and technology-related factors affect CE with IoT technologies via drawing from theories of human motivation and technology-interaction perspectives [i.e., Technology Acceptance Model (TAM) and Social Presence Theory (SPT)]. Elaborating on this, the specific relationship between factors that have the potential to influence consumer-IoT engagement can be better investigated based on the TAM and the SPT as these theories have been adopted by previous research to explore consumer-technology interaction in different contexts (see Section 3.3 and 3.4).

In conclusion, existing studies have not addressed significant questions related to consumer-IoT engagement and the importance of different internal (e.g., consumer motivation) and external factors (e.g., technology) that have the potential to influence IoT engagement. For this reason, this study's overall research aim is to fill the gaps as mentioned earlier by exploring the role of various motivational (e.g., social, financial, etc.) factors on the relationship between consumers and specific IoT products (i.e., smart meter in-home display (IHD)) at the post-adoption stage of consumer-technology interaction. The reasons for investigating the specific IHD context are explained in Section 1.5. Before that, the following section sets out the overall aim and research objectives of this study.

1.4 Research Aim and Objectives

Drawing from a consumer engagement (CE) perspective and consumer-technology interaction theories [e.g., Technology Acceptance Model (TAM) and Social Presence Theory (SPT)], the overall research aim of this study is to explore the influence of consumers' motives and characteristics, together with consumers' overall perception of technology-related characteristics on the level of CE with IoT technologies. To address the overall research aim highlighted above, a number of research objectives were set. Specifically:

RO1: To explore the main consumer-related (both general and context-dependent) drivers of IoT interaction and of their relative significance on consumers' engagement with IoT technologies in the context of energy consumption.

In business literature, many studies have underlined that different consumer-related factors have the potential to influence consumer-technology interaction. Accordingly, for the purpose of investigating actual consumers' experiences and engagement with an IoT technology (i.e., smart meter in-home display (IHD)) in a specific context (i.e., energy), an exploratory/qualitative phase with these consumers will be conducted following a comprehensive literature review. In addition, the exploratory phase will reveal more insight into the factors that consumers think influence their engagement with their IHD, adding to the factors identified via the literature review.

RO2: To explore the main technology-related drivers of IoT engagement and of their relative significance on consumers' engagement with IoT technologies in the context of energy consumption.

Similar to the consumer-related drivers, business literature has explained that various technology-related factors may influence the specific relationship between consumers and smart products. In this respect, after reviewing the existing studies discussing the potential impact of technology-related drivers on consumer-technology interaction, the current study will explore a variety of technology-related drivers that have the potential to influence consumer-IoT engagement in the context of smart meter IHD.

RO3: To investigate the interaction between consumer-related (both general and context-dependent) and technology-related drivers when influencing distinct dimensions of consumer engagement with IoT technologies in the context of energy consumption.

After identifying both consumer-related and technology-related factors influencing consumer-IoT engagement, the interplay between these drivers and their influence on the distinct dimensions of IoT engagement will be investigated. In this respect, a conceptual framework with hypotheses related to consumer-related and technology-related drivers' direct and indirect influence on CE with IoT technologies in the smart meter IHD context will be tested.

1.5 Research Context

As discussed earlier in section 1.2, Internet of Things (IoT) devices offer many benefits to individuals. In many aspects of everyday life, individuals use these specific smart products to make behavioural decisions (e.g., Petrov et al., 2018). However, since IoT has many applications in diverse contexts, human engagement with IoT will differ. Hence, the selection of a specific context is needed.

In terms of consumer applications, one of the most prominent contexts is home-related and energy-focused technologies (Gartner, 2019). According to Gartner (2019), the utility sector (both residential and commercial) will continue to be the largest IoT technology user by 2020. Around 1.4 billion IoT products will be added to the utility segment. Moreover, the UK government's focus on better energy consumption and the overall discussion on climate change signify the importance of these technologies (e.g., Zhou and Brown, 2017; Yang et al., 2019). As a result, 'Smart Meter' technologies and 'Smart Meter In-Home Displays (IHD)' was chosen as the main context for this research.

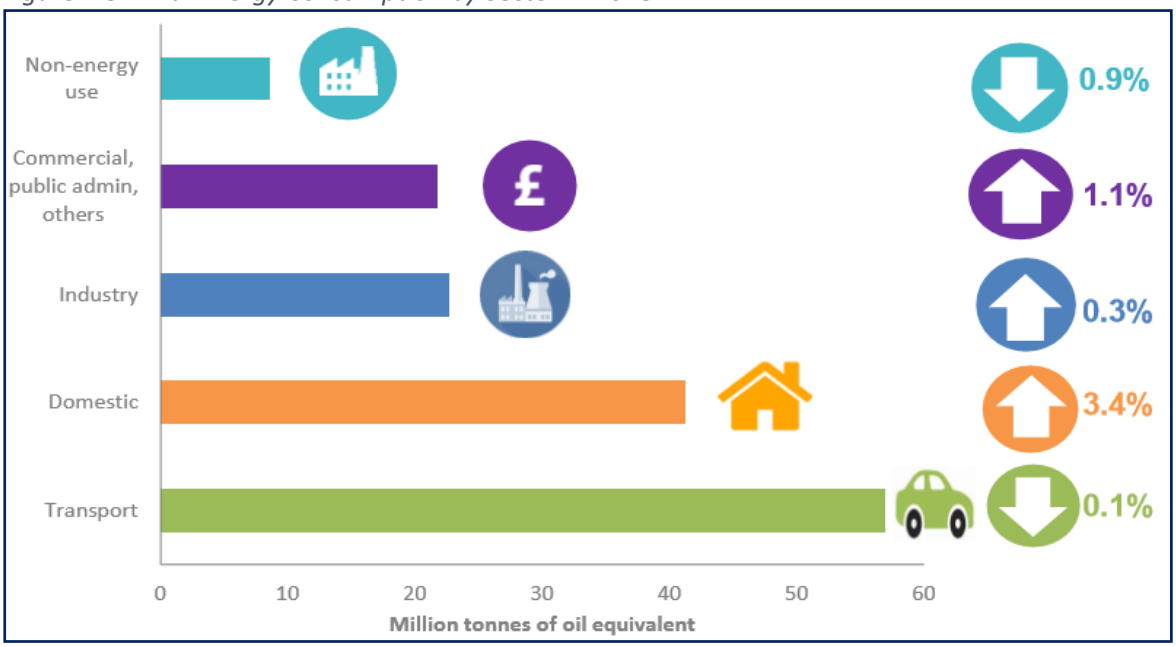
Smart meter technologies are still relatively new on the UK market. The government and many non-governmental organisations (NGOs) and utility companies have been putting a considerable amount of effort into understanding the relationship between these technologies and the domestic energy consumption activities of householders (Department for Business, Energy and Industrial Strategy, 2018). On the other hand, while the British Government has been trying to influence its citizens to interact and engage more with their IHD, it has also aimed to generate value co-creation experiences for both providers and consumers by installing smart meters and an IHD into the individuals' homes. Elaborating on this, both consumers and technology providers can create value by reducing the overall energy consumption.

Similar to other IoT products, most of the articles and studies in the case of smart meter technologies have mainly discussed the technical and technology-related aspects (e.g., Benzi et al., 2011; Depuru et al., 2011; Zheng et al., 2013; Rastogi et al., 2016) of these devices. Therefore, rather than discussing technical details, this study aims to explore the relationship between IoT technologies, consumer-related (i.e., motivational) and technology-related factors influencing consumer engagement (CE) with IoT technologies focusing on the smart meter IHD.

Before explaining smart meter technologies in detail, it is crucial to understand British domestic consumers' household energy consumption behaviour. In the UK, domestic energy consumption makes up around 25% of the country's total energy consumption (Department for Business, Energy and Industrial Strategy, 2019). Additionally, Figure 1.3 shows that the percentile increase in annual domestic energy consumption was the highest compared to other sectors such as transport and industry. However, Wood and Newborough (2003) argued that household energy consumption could

be decreased by using more efficient domestic appliances, lighting and heating systems, and promoting energy-conscious actions and behaviour. Gill et al. (2010) also underlined the importance of human actions and behaviour in changing actual domestic energy use. They showed that energy-efficiency behaviours accounted for 50% and 35% of the heat and electricity consumption variance between very similar homes.

Figure 1.3: Final Energy Consumption by Sector in 2018



Source: Department for Business, Energy and Industrial Strategy, 2019

In order to change householders' energy consumption activities and reduce domestic energy use, feedback information is thought to be a very effective tool, and efficiently delivered feedback information might be a significant source of potential energy efficiency gain (Lutzenhiser, 1993; Yohanis, 2012). Thus, it is important for researchers to recognise the importance and impact of information and feedback on consumers' attitudes towards energy consumption.

Certain IoT technologies have the potential to help domestic energy consumers understand their actual use and energy consumption with minimal effort. Smart meter technologies (see Figure 1.4 for an example of a smart meter) provide real-time, continuous and tailored feedback to domestic energy consumers (Martiskainen and Coburn, 2011).

Figure 1.4: Example of Smart Meter

Source: ITV, 2017

Since smart meters provide real-time information on energy use, individuals may manage their energy use and save money. Moreover, individuals do not need to manually submit meter readings or wait for someone to come and read their meter because smart meters work as an IoT product and directly send the energy usage data to the energy providers and the IHD (Figure 1.5 demonstrates an example of smart meter IHD). Thus, by providing feedback about energy consumption via these real-time displays (Appendix A), smart meters enable low-cost metering and communication systems while encouraging individuals to change their activities towards adopting more sustainable consumption patterns (Erdmann et al., 2004).

The IHD is usually considered one of the most innovative and essential parts of smart meters. The IHD's functionality and the information displayed allow consumers to track their energy consumption much more easily than traditional energy meters. In the short term, when faced with their energy consumption data, consumers may be more likely to turn off the lights or electrical devices and adopt measures that can potentially encourage energy-saving behaviour. Over the long term, smart meters may also help consumers to take advantage of off-peak deals, such as discounted price electricity at night (Citizens Advice, 2019).

Figure 1.5: Example of Smart Meter In-Home Display (IHD)

Source: Scottish Power, 2019

To conclude, domestic energy consumption behaviour and the smart meter IHD were selected as the specific context of this research because in the near future, almost all of the homes in Britain will have their IHD installed, and there is a high potential of coming into regular contact with them. Moreover, policymakers have also been proactively pushing engagement with the device as stronger engagement with the IHD may lead consumers to reduce energy consumption (e.g., Burchell et al., 2016).

1.6 Research Approach

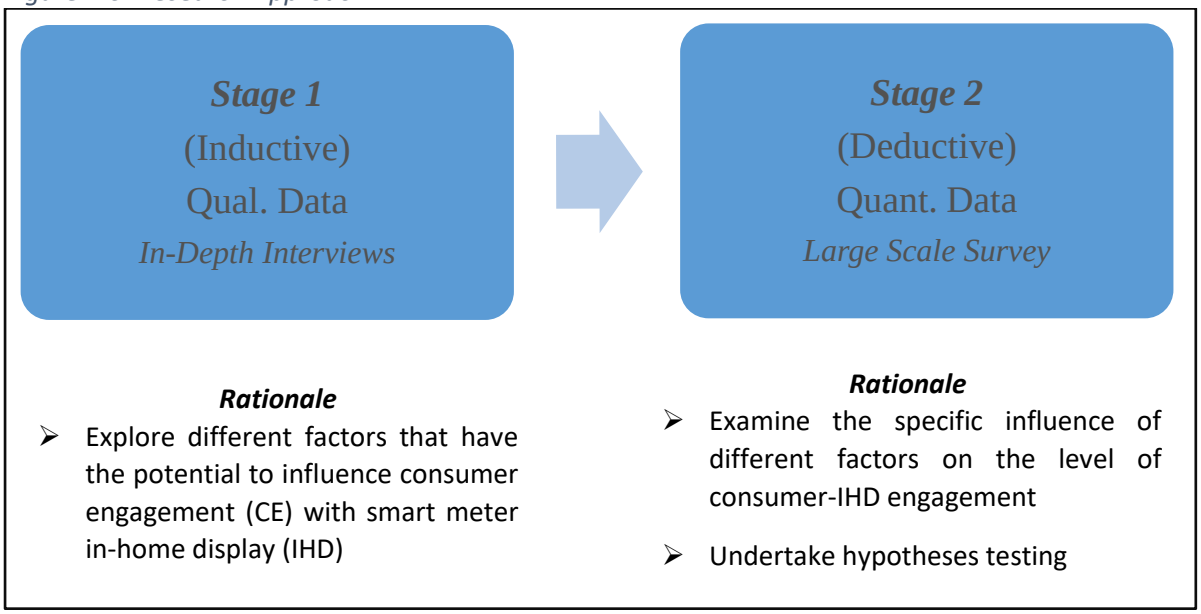
In addition to selecting an apposite research context, finding the correct research approach is also one of the main research decisions that researchers need to make in order to address the research objectives and provide valuable theoretical and managerial contributions.

In terms of theories informing this thesis, this research aims to explore consumer-IoT engagement through a wider human-technology relationship microscope. For that reason, two significant technology interaction theories were adopted in this study. First, the Technology Acceptance Model (TAM) (Section 3.3) was chosen as it is one of the critical theories that have been applied to explain the relationship between humans and technology. Second, the Social Presence Theory (SPT) (Section 3.4) was adopted to comprehend the importance of technology's potential social role and its influence on consumer-technology engagement.

In order to achieve the research aim and objectives, this study adopted a multi-phased empirical design. While the first stage of this study adopted an inductive research approach to explore further the significant variables that can affect individuals' engagement with their smart meter in-home displays (IHD), the second stage adopted a deductive research approach in order to understand the

relationship between the factors influencing consumer engagement (CE) with IHD devices and test the specific research hypotheses. Figure 1.6 below illustrates the research phases and the rationale of each phase.

Figure 1.6: Research Approach



For the conceptual framework and hypotheses development, face-to-face, in-depth interviews were undertaken in the first phase with domestic smart meter users to identify the different consumer-related and technology-related elements that can potentially change consumers' overall opinion of an IHD and, therefore, affect their engagement with these devices. In other words, this approach was adopted to explore consumers' engagement with IoT technologies in the context of energy consumption (Section 1.4).

Following the identification of different factors influencing the level of IHD engagement and the development of the conceptual framework with a set of hypotheses, a large-scale survey was undertaken in the second phase of the research. The main purpose of this stage was to collect sufficient data to confirm or reject the proposed hypotheses and address the third research objective, which focuses on quantitatively investigating the direct and indirect influencing factors on CE with IHD (Section 1.4).

The following section discusses the theoretical and practical value of the thesis.

1.7 Theoretical and Managerial Value of the Thesis

This study intends to contribute to the literature around consumer-technology interactions by uncovering the impact of motivational and technology-related factors on consumer engagement (CE) with smart Internet of Things (IoT) products.

First, this research focuses on the post-adoption stage of CE with IoT technologies, unlike previous studies (e.g., Schewe and Stuart, 2015; Hastall et al., 2017; Nelson et al., 2019) that aim to mainly explore the human-technology interaction in the acceptance and adoption stages of consumer-technology interaction in the context of IoT products. In this sense, one of the purposes of this research is to identify various factors that impact consumer-IoT engagement at this post-adoption stage. Second, it reveals how different factors, such as consumer characteristics and motivations, together with technology-related factors, interplay and influence CE's dimensions with technology. Accordingly, more emphasis is put on exploring the interaction between consumers' motivations and perception of technology which would potentially influence the strength of CE with IoT. Third, this study also aims to expand different concepts (e.g., social persuasion) that have been usually adopted in previous studies conducted to explain consumers' motivation to use and engage with different technological products and examine how different human-technology interaction theories [e.g., Technology Acceptance Model (TAM), Social Presence Theory (SPT)] can be adopted in the context of IoT technologies to understand CE with these technologies. Finally, this research adds to the consumer marketing literature regarding consumer-technology interactions. In order to understand the consumer-IoT engagement phenomenon and the specific relationship between factors that are assumed to influence engagement, a theoretical framework is applied through the general CE and consumer-technology interaction lenses (Section 7.2).

In terms of managerial contribution, this thesis provides companies and policy makers with a better understanding of how to increase consumer interaction, continuous use, and engagement with IoT technologies. Hence, this study is designed with the intention of helping managers and companies, as well as governments, to encourage consumers to build stronger relationships with the IoT products they provide. Accordingly, promoting the continued use of IoT technologies and improving CE with these technologies can be considered the primary managerial value of this study. Additionally, this study also has the potential to assist policy makers in understanding the different types of consumer motivation that can lead to stronger engagement with IoT technologies, specifically in the context of smart meter in-home displays (IHD) (Section 1.5).

1.8 Thesis Structure

Including the introduction, this thesis consists of nine chapters. The literature review is divided into two chapters. While Chapter 2 discusses existing knowledge in areas relating to consumer engagement (CE), engagement with different focal objects and antecedents of CE, Chapter 3 will focus on consumer interaction and engagement with technology, various theories of human-technology interaction and technology-related factors influencing CE with technology.

The Initial Conceptual Framework Development chapter (i.e., Chapter 4) sets out a general framework for consumer-Internet of Things (IoT) engagement and conceptualises the influence of both consumer-related motivations and technology-related antecedents to CE with IoT.

Chapter 5 (i.e., the Methodology chapter) explains the details about the qualitative and quantitative data collection procedures such as sample selection for interviews and online survey, design of discussion guide and questionnaire, data collection, and data analysis approaches.

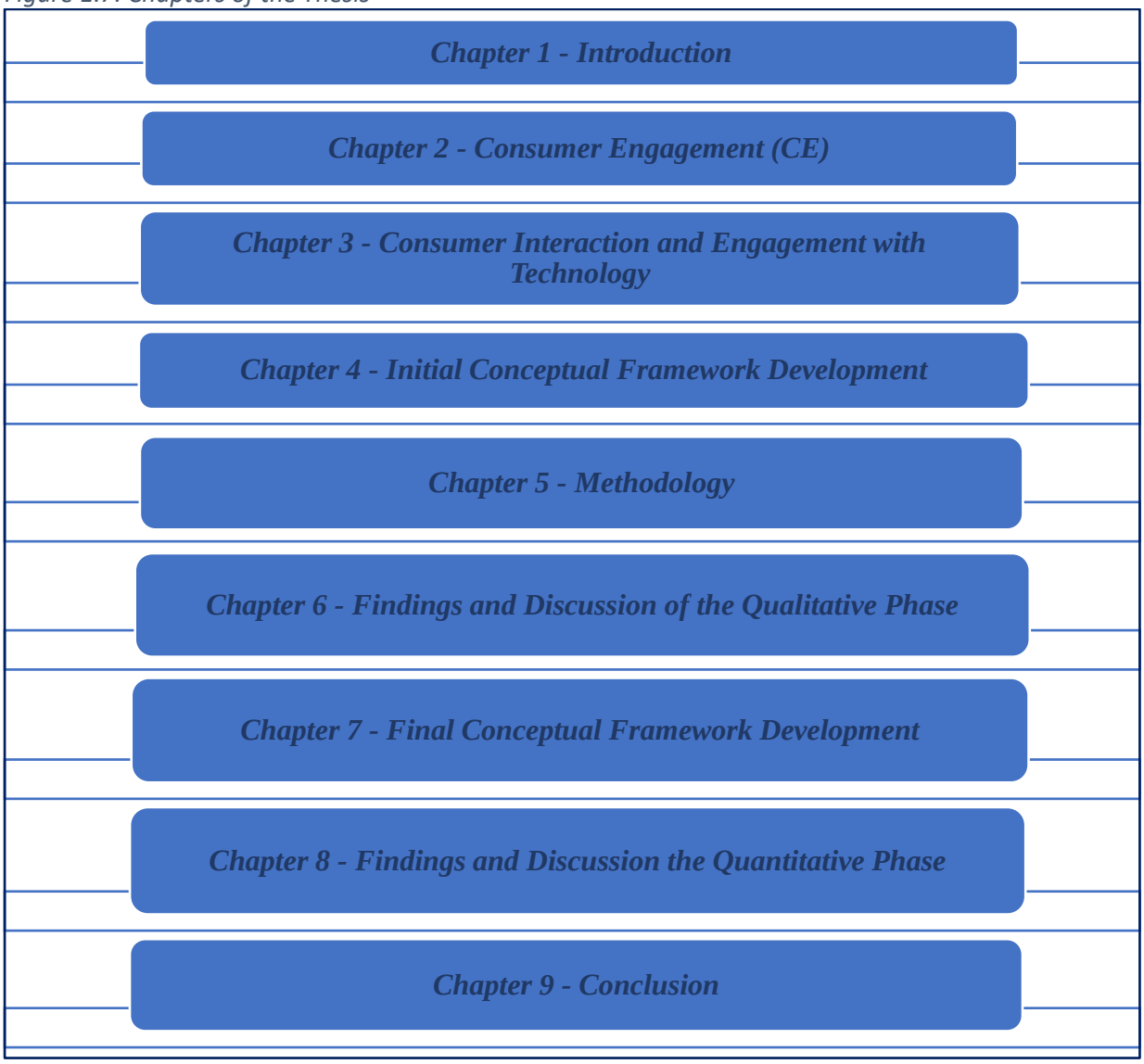
Chapter 6 primarily explains the findings of the exploratory phase of the study. After clearly exploring the factors that have the potential to influence CE with specific IoT technologies [i.e., smart meter in-home display (IHD)], the final version of the conceptual framework and a set of hypotheses are illustrated in the Final Conceptual Framework Development chapter (Chapter 7).

In Chapter 8, all the hypotheses proposed in Chapter 7 are tested, and the findings from the quantitative phase are discussed in depth.

Chapter 9 provides a discussion of this thesis's conclusions and the theoretical and managerial contributions of this research. Furthermore, limitations of the study and suggestions for future research are also outlined in this chapter.

Before moving to the next chapter and reviewing the relevant literature, Figure 1.7 sets out the structure of this thesis.

Figure 1.7: Chapters of the Thesis



Chapter 2: Consumer Engagement (CE)

2.1 Introduction

This chapter aims to investigate how consumer engagement (CE) has been defined by researchers in various business fields, especially in marketing. While reviewing the existing research on CE, this chapter also sheds light on other significant elements of the overall CE process, including consequences and benefits, conceptualisation and dimensionality of engagement, and the types of actors in engagement. Additionally, this chapter also focuses on antecedents of CE and explains the importance of consumer motivations together with object-related antecedents on engagement. The first section introduces the concept of CE and provides an overview of the existing research on CE.

2.2 Consumer Engagement (CE)

2.2.1 Overview of Existing Research on Consumer Engagement (CE)

During the last couple of decades, CE has gained a lot of interest from a growing number of scholars because of the potential benefits and positive consequences it may provide. Although CE has been sometimes regarded as producing a high level of loyalty (e.g., Dwivedi, 2015; So et al., 2016; Rasoolimanesh et al., 2019, Parihar et al., 2019), it includes other types of beneficial elements other than loyalty (Libai, 2011; Kabadayi and Price, 2014) such as a higher number of purchases and frequent interactions. As Sedley (2010) underlined, one of the most significant consequences and benefits of CE is "repeated interactions that strengthen the emotional, psychological or physical investment a customer has in a brand" (p.7). Hence, some of the benefits CE may bring are a stronger competitive advantage (e.g., Sedley, 2008), positive word-of-mouth (e.g., Chan et al., 2014), higher brand relationship quality (e.g., Habibi et al., 2016), more sales and revenues (e.g., Neff, 2007), and eventually, increased profits (e.g., Voyles, 2007). Furthermore, consumers may also benefit from certain consequences of CE, including loyalty points and discounts (e.g., Rehnen et al., 2017).

Previous research has adopted different approaches to studying CE. Extant research has focused on the investigation of areas such as subject and object of engagement (e.g., Shernoff et al., 2014; Moura, 2018; Bilro et al., 2019; Abdul-Ghani et al., 2019; Lawry and Bhappu, 2021), different products and services included in the process of engagement (e.g., Barger et al., 2016; Hepola et al., 2017; Lima et al., 2019), the dimensionality of CE (e.g., Hollebeek, 2011; Henderson et al., 2017; Mirbagheri and Najmi, 2019; Bowden and Mirzaei, 2021) and antecedents of CE (e.g., Reitz, 2012; Brodie et al., 2013; Leckie et al., 2016; Rather, 2019; Glavee-Geo et al., 2019).

First, considering the objects and subjects of engagement, CE and other related concepts (e.g., user engagement, employee engagement, student engagement, etc.) have been adopted and used broadly in different fields of academia, including political science (e.g., Kane, 2008), sociology (e.g., Mondak

et al., 2010), and psychology (e.g., Achterberg et al., 2003; Bryson and Hand, 2007), as well as organisational behaviour (e.g., Greenwood, 2007; Catteeuw et al., 2007). Hence, different types of subjects and objects have been identified as the main actors of CE. Engagement literature in management and business studies has also discussed more specific customer/consumer-related engagement concepts such as 'health' or 'patient activation' (e.g., Ricciardi et al., 2013; Mittler et al., 2013), 'media' (e.g., Calder and Malthouse, 2005), 'service development' (e.g., Claycomb et al., 2001), 'advertising' (e.g., Phillips and McQuarrie, 2004) and 'brand engagement' (e.g., Sprott et al., 2009; Hollebeek et al., 2014) during the last decade. Furthermore, in the marketing literature, CE has been primarily studied in three areas: services marketing (e.g., Jaakkola and Alexander, 2014; Naumann et al., 2017), retail (e.g., Vivek et al., 2014; Piligrimiene et al., 2015), and social media (e.g., Chu and Kim, 2011; Dessart et al., 2015; Goddard et al., 2018). In addition to the various engagement objects, including brands and social media, a number of studies have also shed light on the importance of technology as an object in CE. According to Schols and Smith (2016), CE with high-technology products may occur when consumers believe that using the specific product is beneficial for them (Section 3.3 discusses the role of technology as an object of CE in marketing in more detail).

Second, some studies have investigated the potential dimensions of CE from conceptual, qualitative or quantitative perspectives. In this respect, despite the fact that a number of marketing studies have considered CE as a unidimensional concept (e.g., Scott and Craig-Lees, 2010; Gummerus et al., 2012), the majority of the engagement studies in the marketing literature (e.g., Patterson et al., 2006; Brodie et al., 2011; Kuo and Feng, 2013; Wirtz et al., 2013 Habibi et al., 2014; Claffey and Brady, 2019) have highlighted that CE has more than one dimension, and therefore it is multi-dimensional (Section 2.2.2 discusses the different dimensions of CE in more detail).

Finally, a significant amount of marketing literature has focused on explaining the antecedents of CE (e.g., Tsai and Men, 2013; Casalo et al., 2017; Flaherty et al., 2019). In this respect, while some studies have identified consumers' emotions (e.g., Blanco-Arcas et al., 2016), personality traits (e.g., Islam and Rahman, 2017), community and social interaction (e.g., Chan et al., 2014; Dessart, 2017) and customer involvement (e.g., Hollebeek et al., 2014; Leckie et al., 2016) as key antecedents, some other studies (e.g., Van Doorn et al., 2010; Hollebeek, 2011; Parrish et al., 2020; Bailey et al., 2021) have underlined the importance of motivations for consumers to engage with the target engagement objects. Therefore, not only product-related but also human-related factors on the strength of engagement can be further investigated as it has been argued that a certain level of human commitment is required to strengthen consumer interaction with brands, services, firms or companies and generate engagement (Kabadayi and Price, 2014).

In summary, CE has been mainly reviewed from the perspectives of subject/object, dimensionality and antecedents of engagement in marketing literature. Although the concept of engagement is still at an early stage in marketing, many studies have put a significant amount of focus on exploring this important topic. However, defining the dimensions and understanding the benefits and consequences of CE, studying the specific objects and subjects in the engagement process, exploring different factors (i.e., antecedents), generating CE and investigating how CE should be conceptualised and operationalised still require more attention in engagement studies. Accordingly, considering the technology engagement, most previous studies reviewing consumer-technology interaction have not examined consumer-IoT interaction and discussed the potential dimensions of this concept in detail. For that reason, more attention has to be given to understanding the specific dimensions of CE with IoT technologies in addition to the antecedents, benefits and consequences of consumer-IoT engagement.

Before discussing technology engagement in detail, the following section highlights the conceptualisation of CE and discusses different assumptions about engagement's dimensionality in detail before talking about actors (i.e., subjects and objects) of engagement and antecedents of CE.

2.2.2 Conceptualisation and Dimensionality of Consumer Engagement (CE)

Many studies in the last decade have focused on defining consumer engagement (CE). To conceptualise CE, identifying the different definitions used by researchers is important. Furthermore, there are different perspectives in the marketing literature about the definition of CE and the ideal number of dimensions that are supposed to signify CE (e.g., Dessart et al., 2015; Naumann et al., 2017).

According to the Oxford Dictionary (2019), 'to engage' has a number of meanings, and most of these meanings signify a behavioural aspect (van Doorn et al., 2010), such as to take part, to employ, or to attract. Besides, different definitions have been provided to clarify the concept of engagement in previous literature. In this sense, Table 2.1 below demonstrates the definitions of CE given in key marketing studies. The definitions given in Table 2.1 might be considered as 'less restricted' (Frank et al., 2004; Jennings and Stoker, 2004) compared to the definitions given by the Oxford Dictionary, as they describe engagement as "emotional" connection or involvement (London et al., 2007). Therefore, even though the majority of the general definitions of engagement highlight this concept from a behavioural perspective, conceptualising CE with a behavioural approach only may not be enough. In many cases, other elements such as emotions and many other psychological factors, thoughts, and individuals' willingness to participate in the process may play important roles in understanding and explaining CE.

Table 2.1: Definition of Consumer Engagement (CE) in Key Marketing Studies

Author(s)	***Definition***
Patterson et al. (2006)	"the level of a customer's physical, cognitive, and emotional presence in their relationship with a service organization"
Bowden (2009)	"a psychological process that models the underlying mechanisms by which customer loyalty forms for new customers of a service brand as well as the mechanisms by which loyalty may be maintained for repeat purchase customers of a service brand"
Sprott et al. (2009)	"an individual difference representing consumers' propensity to include important brands as part of how they view themselves"
Van Doorn et al. (2010)	''customers' behavioural manifestations that have a brand- or firm-focus, beyond purchase, resulting from motivational drivers''
Vivek et al. (2010)	"the intensity of an individual's participation and connection with the organization's offerings and activities initiated by either the customer or the organization"
Mollen and Wilson (2010)	"a customer's cognitive and affective commitment to an active relationship with the brand as personified by the website or other computer-mediated entities designed to communicate brand value"
Brodie et al. (2011)	"a psychological state that occurs by virtue of interactive, cocreative customer experience with a focal agent (e.g., a brand) in focal service relationships"
Hollebeek et al. (2014)	"a consumer's positively valenced brand-related cognitive, emotional and behavioral activity during or related to focal consumer/brand interactions"
Dessart et al. (2015)	"a cognitive, affective, and behavioral commitment to an active relationship with the brand"
Dessart and Pitardi (2019)	"a concept that is spurred by the storytelling nature of the brand/product because the different story elements encouraged emotional, cognitive, and behavioral responses"
Ferreira et al. (2020)	"a construct that varies according to the subject (*who*, e.g., customer and consumer), focal object (*what*, e.g., brand, product and advertising) and context (*where*, e.g., retail, services and online)"

Table created by the author

Furthermore, it can be argued that there is no commonly accepted CE definition in marketing as many marketing scholars have distinct approaches to conceptualising CE. However, most of the authors have agreed that specific elements (e.g., cognitive, emotional or behavioural) may trigger the actual engagement activity of customers. Moreover, engagement is a highly context-bound concept (e.g., Payne et al., 2017; Sanchez and Martinez, 2020) and occurs differently in specific contexts such as engagement with a beverage brand, social media channel or health application.

However, CE cannot be restricted to individuals' purchase habits and behaviours; it is a combination of different behavioural activities towards a product, company or business in addition to purchase behaviour (Tarute et al., 2017). Hence, in order to understand this concept better and provide more generic definitions, researchers may put more attention on consumer-company interaction-related activities in both purchase and post-purchase stages (Vivek et al., 2012).

Moreover, previous research has adopted different views about CE in terms of intensity and dimensionality. Considering the intensity of CE, researchers have either treated CE as on a continuum from negative-valenced to positive-valenced (and often only focusing on one) or have treated CE as on a continuum from 'non-engaged' to 'highly-engaged'. Elaborating on this, while CE can be negatively valenced in certain situations and contexts such as services marketing (e.g., Leventhal et al., 2014; Heinonen, 2018), Brodie et al. (2011) argued that non-engaged and highly engaged are usually the two extremes of CE. Accordingly, positive CE implies that consumers are more likely to put in a higher level of cognitive, emotional and behavioural effort to increase the strength of a relationship between themselves and the engagement objects (Naumann et al., 2017).

In terms of dimensionality, as discussed in Section 2.2.1, many studies treat CE as a unidimensional construct and others as a multidimensional. Specifically, according to Brodie et al. (2011), more than 40% of engagement studies have defined engagement as unidimensional and mainly shed light on only one dimension among emotional, cognitive and behavioural. For instance, Verhoef et al. (2010) specified customer/consumer engagement as a unidimensional concept that is mainly based on the behavioural dimension since behavioural activities usually generate it. Moreover, Liu et al. (2018) divided CE into three main categories: 'Behavioural Manifestation', 'Psychological State' and 'Psychological Process' (Table 2.2). Table 2.2 illustrates that the behavioural element alone has the potential to lead researchers to define and conceptualise CE in certain situations. However, while the studies that have adopted the behavioural state approach have focused mainly on the behavioural dimension only, studies considering CE as a psychological state or process have adopted a multidimensional CE approach.

Other than the studies conceptualising CE as a behavioural state, studies conceptualising CE as an emotional state have argued that the strength of CE has the potential to indicate the degree of a consumer's rational and emotional bonds with an engagement object (e.g., brand). Therefore, CE is argued to cover different emotional feelings such as determination and strong interest in a product or brand (McEwen, 2004).

Table 2.2: Categories of Consumer Engagement (CE)

Categories	***Author***	***Study Type***	***Dimensions***
1) Behavioural Manifestation	van Doorn et al. (2010)	Conceptual	Single: Behavioural
	Jakkola and Alexander (2014)	Conceptual	
	Harmeling et al. (2017)	Conceptual	
2) Psychological State	Brodie et al. (2011)	Conceptual	Multi: Cognitive, Emotional, Behavioural
	Vivek et al. (2012)	Conceptual	
	Hollebeek et al. (2014)	Empirical	
	Dessart et al. (2015)	Conceptual	
3) Psychological Process	Bowden (2009)	Conceptual	Multi: Cognitive, Emotional, Behavioural

Adapted from Liu et al. (2018)

Additionally, the unidimensional aspect may usually fail to explore the breadth of the engagement concept even though it is much simpler to explain a single dimension than the multidimensional aspect. Considering the distinct approaches to CE conceptualisation, it is clear that marketing scholars have defined CE as a concept consisting of behavioural, emotional or cognitive activities (e.g., Patterson et al., 2006; Vivek et al., 2014). As Dessart et al. (2016) stated, it is crucial to understand how engagement is formed with different cognitive, emotional and behavioural elements. In this sense, various studies highlight the importance of using multiple dimensions in measuring consumer engagement (Dessart et al., 2016). For that reason, many researchers in marketing have contended that CE has at least two dimensions (see Section 2.2.1).

In this respect, for many authors (e.g., Patterson et al., 2006; Bowden, 2009; Mollen and Wilson, 2010; Vivek et al., 2010; Cheung et al., 2011), CE is a psychological/emotional state of mind that is characterised by certain psychological and emotional aspects, or process to increase customer interaction. Likewise, many other engagement definitions (e.g., Bowden, 2009) have argued for the significance of emotion together with cognition to generate the process of engagement in addition to

behaviours. For example, Kahn (1990) describes engagement as the set of task activities undertaken to strengthen individuals' physical, emotional, and cognitive connections to their job. In this respect, the emotional state approach has also argued that CE is a combination of different elements, including emotions, cognition and behaviours (e.g., Franzak et al., 2014; Dessart et al., 2015).

In multi-dimensional CE studies, while cognitive, emotional and behavioural dimensions have been the most commonly adopted dimensions in CE studies, marketing researchers have described all of these three dimensions differently. Hollebeek et al. (2014) have argued that when the specific engagement object is a brand, then the emotional dimension can also be articulated by the term **'affection'**, while the behavioural dimension can be considered as a set of consumer behaviours that are caused by the engagement object to facilitate consumer-object interaction. As mentioned earlier in this section, the behavioural dimension is directly related to the literal meaning of the term "to engage". Considering all of these dimensions, it can be disputed that CE is a consumer's experience and interaction beyond purchase with a company or brand (Van Doorn et al., 2010).

In addition to Hollebeek et al. (2014), Kuvykaite and Tarute (2015), and Patterson et al. (2006) have two of the most precise descriptions for the cognitive and emotional dimensions of consumer engagement. They described the cognitive dimension as a consumer's level of concentration with the engagement object (i.e., consumer's focus on the object of engagement) and the emotional dimension as a set of emotional activities (e.g., feeling of happiness, enjoyment or any other type of feeling stimulation) that are related to engagement (i.e., consumer's non-physical, emotional bonds with the object of engagement) (Kuvykaite and Tarute, 2015).

Patterson et al. (2006), who were one of the first to explore the dimensionality of engagement, used different terms to refer to CE's cognitive, emotional and behavioural dimensions: *'absorption'*, *'dedication'*, and *'interaction'*. **Absorption** - the level of consumer focus on a focal engagement object – is required for the initiation and continuance of the overall CE process, as it is important for consumers to clearly understand the object of engagement. Therefore, absorption is a part of the cognitive dimension of CE. Moreover, consumers have to build a powerful, non-physical bond with the object of engagement to continue interacting with it. Accordingly, the emotional dimension of engagement is described as **dedication,** a consumer's feeling of belonging to the focal engagement object. Finally, while consumers have to communicate with the engagement object (i.e., vigour), there should also be a certain level of cooperation between the subjects and objects of engagement (e.g., interaction) for CE to take place. So, **interaction** can be discussed to be the part of behavioural dimension.

Additionally, some authors (e.g., Abdul-Ghani et al., 2011) have described different dimensions of CE as *'utilitarian'*, *'hedonic'* and *'social'* benefits. According to them, **social benefits** are mainly about social exchange and how different consumers in the marketplace provide certain benefits (i.e., social approval, resource exchange, social reinforcement, etc.), and they are important elements in successful business relationships. In this respect, social benefits show similarity with the behavioural dimension. Similar to the emotional dimension, **hedonic benefits** are the ones that are related to the enjoyment, satisfaction and happiness of consumers. Finally, **utilitarian benefits** guide consumers to undertake actions such as purchasing products by helping them to focus on specific choices, similar to how the cognitive dimension affect individuals' decision making in different environments. Therefore, even though Abdul-Ghani et al. (2011) defined CE engagement scales using different names, two dimensions (i.e., hedonic and utilitarian) play almost identical roles to the emotional and cognitive dimensions. Furthermore, social benefit, like the behavioural dimension, primarily focuses on the actual interaction between engagement subjects and objects. In this sense, the social benefit dimension is very similar to vigour and dedication explained above.

Thus, it is important to note that although researchers (e.g., Patterson et al. 2006; Abdul-Ghani et al., 2011) have defined the dimensions of CE under different names, some of the definitions used by different authors conceptually overlap. Table 2.3 highlights how differently named dimensions of CE overlap with each other.

Table 2.3: Conceptually Overlapping Dimensions of Consumer Engagement (CE)

Dimension of CE	***Overlapping Dimension(s)***	***Author(s) of Overlapping Dimensions***
Cognitive	*"Absorption"* "*Utilitarian Benefits*"	(Patterson et al., 2006) (Abdul-Ghani et al., 2011)
Emotional	*"Dedication"* *"Hedonic Benefits"* *"Affection"*	(Patterson et al., 2006; Cheung et al., 2011)) (Abdul-Ghani et al., 2011) (Hollebeek et al., 2014)
Behavioural	*"Interaction"* *"Social Benefits"*	(Patterson et al., 2006) (Abdul-Ghani et al., 2011)

Table created by the author

As stated earlier, although there are three main approaches (i.e., behavioural state, emotional state or motivational concept) to conceptualise CE, the conceptualisations and distinct dimensions are usually context-dependent.

In this respect, Brodie et al. (2011) clarified that while CE is usually multidimensional, different engagement dimensions are highly dependent on the engagement object together with context. Therefore, the significance of each dimension of CE fluctuates with the specific conditions, and this situation creates different complexity levels of CE. Since the type and number of dimensions usually depend on the context and focal engagement object, researchers still do not agree on which and how many dimensions to adopt in CE research (Dessart et al., 2016). Moreover, the dimensionality of CE is still a very controversial subject (Kuvykaite and Tarute, 2015), and there is a need to explore CE again when it is investigated in different contexts.

Before concluding this section, based on the existing literature and the strengths/limitations of existing definitions and conceptualisations, for the purposes of this thesis, CE is defined as "a multidimensional and highly context-dependent notion that is generally strongly influenced by individuals' mental/cognitive, emotional and behavioural commitment to specific objects". Furthermore, while the level/power of engagement can show distinct changes based on individuals' personal and situational differences, the personal motivations of consumers may also play a significant role in engagement taking place and in determining the level of CE.

At this point, it is really important to underline that engagement differs from another important term, continued use. In this respect, Koohang et al. (2022) defined continued use as the extend in which a consumer will continue using a product or service. Accordingly, it plays a key role for companies to understand different factors that could lead their consumers to use the target product again (Hussein and Hassan, 2016). CE, on the other hand, is one of the important variables that affects continued use. In many cases, there is a higher change of continued use to take place if there is a strong engagement between the consumer and the product (e.g., Gulotta et al., 2016, Hussein and Hassan, 2016; Bitrian et al., 2021). However, strong engagement does not automatically bring continued use since it depends on other variables as well (e.g., Gulotta et al., 2016; Flaherty et al., 2019).

In conclusion, while a number of studies (e.g., Higgins and Scholer, 2009; Pham and Avnet, 2009) have defined consumer engagement in a more general perspective, most studies (e.g., Patterson et al., 2006; Bowden, 2009; Mollen and Wilson, 2010) have primarily constructed their definitions based on the customer interaction from a company, service provider, or brand-based perspective. Most of the studies in the marketing literature have mainly ignored CE with engagement objects such as technology when making definitions about engagement. Nevertheless, in order to understand CE in a specific context (i.e., IoT technologies), it is critical to identify the role of technology as an object in the overall CE process. Therefore, the following section talks about the types of actors in CE and identifies different subjects and objects of engagement.

2.2.3 Types of Actors in Consumer Engagement (CE)

In the consumer engagement (CE) process, there is always a subject and an object. Accordingly, different factors can be subjects or objects of CE, and all of these subjects and objects can be categorised as the actors generating CE. In marketing literature, while the customer has been the main subject of interest, different elements such as brands (e.g., Malhotra et al., 2013; Pancer et al., 2019) and products (e.g., Abbasi et al., 2019; Lehtinen et al., 2019; Xu and Liu, 2019), have been the main objects examined.

Engagement with brands, as well as products, services, or companies, is a dynamic process. Bowden (2009) contended that CE with brands might show differences depending on the type of consumer (i.e., first-time buyers/consumers vs repeated purchasers/users). Therefore, even consumers themselves play different roles in the engagement system. Moreover, each actor has to play a role to reach expected CE goals (Kothandaraman and Wilson, 2001). Considering this, the social role can be identified as one of the key factors influencing engagement. Hence, the importance of the social role and the social interaction between consumers and various objects of engagement might be taken into account in order to explore the CE (e.g., Ashley and Tuten, 2015; Carlson et al., 2019; Kesgin and Murthy, 2019; Xue et al., 2020) in many contexts such as technology engagement.

Accordingly, during the last decades many marketing scholars have been discussing Actor Engagement or AE as an important factor to influence the success of CE and other important business metrics such as value co-creation. Brodie et al. (2019) and Storbacka (2019) discussed that AE happens when multiple actors in a specific ecosystem connect with each other to contribute and exchange resources. In this sense, the first and second fundamental propositions (i.e., FP1 and FP2) provided by Brodie et al. (2019) argue that connectedness and the level of connectedness can be considered as important elements of AE and actors cannot be separated from their actions or connections in AE. Additionally, the third fundamental proposition (i.e., FP3) also underlines that the level of connectedness can directly affect the relationship between different actors.

Other than the importance of connectedness between actors, both humans and non-human actors (e.g., technology) can be actors in the AE framework. Therefore, certain elements of technology developments in technology have the high potential to influence the interaction between actors and AE (Storbacka et al., 2016).

In this respect, technology can be considered as another significant actor in CE literature. Until recently, most studies covering consumer-technology engagement have put more attention on computer-mediated applications, more specifically social media tools. Calder et al. (2009) argued that

CE with media in general and social media channels helps companies to get better usage, interest, interaction outcomes with the product or company in the end.

In addition to social media, other computer-based high-technology products (e.g., health technologies) can be the main actors in the engagement process together with consumers. Especially after the early 2010s, an increasing number of researchers have investigated the engagement between consumers and computer-assisted health technologies (Gauvin et al., 2010; Asimakopoulos et al., 2017; Arcia et al., 2019). In fact, in some of these studies, the term 'patient' has been replaced by the term consumer (e.g., Hibbard and Mahoney, 2010; Mittler et al., 2013). In addition to these, the prominent examples for objects in technology engagement have been products with a high level of artificial intelligence (e.g., Scholz and Smith, 2016), computer-mediated geography tools (e.g., Talwar et al., 2011) as well as education and gaming applications (O'Brien et al., 2018; Jasrotia et al., 2022).

Therefore, over the last two decades, computers and other high-technology products have become more important in CE processes and studies. Both practitioners and researchers have been interested in understanding and enhancing CE with technology (O'Brien et al., 2018). As Hassenzahl and Tractinsky (2006) argued, it is vital for product/service providers to build more engaging systems. Similarly, it should engage consumers for a technology to be successful (O'Brien and Toms, 2008).

In many cases, understanding engagement with computer-based technologies is one of the key elements for companies to achieve stronger engagements with their consumers. Accordingly, there is a strong correlation between the overall consumer engagement and certain factors influencing engagement in the context of HCI (i.e., user engagement) including technology-related variables such as interactivity and information quality (e.g., Busalim et al., 2019; Chen et al., 2021) and various benefits such as cognitive, hedonic and social (Verhagen et al., 2015). For this reason, it plays an essential role for researchers to explore how engagement with certain technologies such as the IoT (e.g., Kunz et al., 2017; Chen et al., 2021) may lead to more collaborative approaches for both consumers and companies, and stronger customer engagement in the long run. Moreover, user engagement in HCI indicates overall consumer engagement with the technology (Doherty and Doherty, 2018). In this respect, user engagement with various types of technology leads individuals to undertake actions in order to gain beneficial outcomes. For instance, engaging with smart phones to save time while completing a task or connecting with other people (Kim et al., 2013), internet-based health management programs to improve personal healthcare (Schubart et al., 2011; Nelson et al., 2016), anti-smoking website to stop smoking (Oh and Sundar, 2019), different learning tools to learn new things (Sahawi and Hassan, 2018; Lee et al., 2021) or personal finance apps to save money (French

et al., 2021). Based on these, it can be said that the intensity or strength of CE with technology in many areas is actually strongly connected to the how user-technology engagement is shaped.

Taking all of the above discussion into account, it can be further argued that, especially in the IoT engagement, different views on user engagement help researchers to better learn and understand consumer engagement.

Considering the measurement of technology engagement, it has been suggested to apply different multidimensional scales to measure the level of CE with technology more efficiently. As the cognitive, emotional and behavioural dimensions are highly context-bound, different dimensions have been offered to study consumer-technology engagement by a number of academics (e.g., Seymour, 2005; Wiebe et al., 2014; Pickering and Swinnerton, 2019).

Accordingly, some multidimensional scales were created to explore the specific engagement relationship between consumers and technological products. For instance, O'Brien and Toms (2008; 2010) have suggested that a number of consumer and technology-related (e.g., 'Motivation', 'Goals', 'Focused Attention', 'Aesthetics', 'Perceived Usability', etc.) dimensions can be used to explore the 'point of engagement' in consumer-technology contexts (see Section 5.9 for the discussion of these dimensions and the specific scale used in this study).

Thanks to its increasing presence in individual daily lives (e.g., Atzori et al., 2017; Gomez et al., 2019; Singh et al., 2020; Azbeg et al., 2021), the Internet of Things (IoT) also becomes an object of engagement. As previous literature has highlighted that CE is usually influenced by different factors depending on the specific object, it can be argued that there are also distinct factors influencing CE with technology. Therefore, because the IoT is a specific type of technology, it is essential to investigate consumer-IoT engagement in-depth and explore what it involves and what factors influence CE with IoT. Before moving onto consumer interaction and engagement with technology, the next section explains the antecedents of CE.

2.3 Antecedents of Consumer Engagement (CE)

2.3.1 Overview

Similar to the actors of consumer engagement (CE), various factors play key roles in the generation of CE (Table 2.4). More importantly, depending on the type of engagement and specific context, antecedents of CE may differ from more person-related elements such as emotions (e.g., Sinha et al., 2011, Kujur and Singh, 2018), personality (e.g., Goldsmith and Goldsmith, 2012; Machado et al., 2019), feelings of satisfaction (e.g., Sanders and Kirby, 2012; Vo et al., 2019) or social values (e.g., Hur and

Kim, 2017; Mikalef et al., 2017), to more object-related elements including brand interactions, quality and/or involvement (e.g., Schultz, 2017). Thus, CE is usually regulated by internal and external factors (e.g., Simon et al., 2016; Heinonen, 2018). Internal or 'micro-sociological' factors (e.g., emotions, personality) are the ones mainly coming from individuals' inner states, whereas external or 'macro-sociological' factors (e.g., brands, products) are the ones found in the physical environment of individuals (Moloney et al., 2010). Based on extensive research on different kinds of CE antecedents that previous literature has proposed, it can be identified that while some studies have underlined that CE is mainly developed by external variables such as brand experience (e.g., Ahn and Back, 2018; Kaur et al., 2020), others have stated that individuals' internal elements such as satisfaction, feelings or personal values (e.g., Marbach et al., 2019) are also key antecedents of CE. Hence, both internal and external antecedents have the potential to trigger the overall CE process.

Table 2.4: Important Studies with Antecedents of Consumer Engagement (CE)

Antecedents	Author(s)
Emotions	Blasco-Arcas et al. (2016) Martinez-Lopez et al. (2017)
Value; Usage Intensity	De Vries and Carlson (2014)
Perceived Interactivity; Community Value; Community Identification	Chan et al. (2014) Lin et al. (2020) Kaur et al. (2020)
Consumer Involvement	Leckie et al. (2016) Harrigan et al. (2018)
Obligations to Society; Social Values	Habibi et al. (2016) Mikalef et al. (2017)
Personality Traits	Marbach et al. (2016) Islam and Rahman (2017) Itani et al (2020)
Motivations	Tsai and Men (2013) Enginkaya and Yilmaz (2014) Banyte and Gadeikiene (2015) Todd and Melancon (2018) Siddiqui et al. (2019) Bhatnagar and Kumra (2020)

Table created by the author

Considering the internal antecedents of CE, it is widely argued that motivations of individuals can be highlighted as significant internal factors on individuals' engagement (e.g., Davis et al., 1995; Tempelaar et al., 2007; Etgar and Amichai-Hamburger; 2017; Nabi et al., 2019) and levels of different motivations may also show significant variances between individuals. Accordingly, Table 2.4 shows that consumer motivation has been widely highlighted as one of the most important antecedents of CE (e.g., Enginkaya and Yilmaz, 2014; Banyte and Gadeikiene, 2015; Todd and Melancon, 2018; Siddiqui et al., 2019). For that reason, further attention is required to examine the influence of motivations on CE in different contexts.

In this respect, many authors (e.g., Baldus et al., 2015) have also argued that motivation is a crucial element in exploring and conceptualising CE. In different contexts, such as health or education, motivations play a key role in improving individuals' intentions to engage with particular objects or activities (e.g., Mittler et al., 2013). Therefore, without motivation, it is not possible to have a strong engagement and obtain positive consequences, as explained in Section 2.2.1.

Additionally, while the effectiveness of specific actions and individuals' ability to implement those actions are part of general motivations, other motivational factors such as trust are usually context-specific motivations (e.g., Taylor, 2019). Similarly, some researchers (e.g., Baumeister, 2016) have also discussed that not all motivations are the same and motivations adapt to the local environment. For instance, Bauer et al. (2016) investigated the importance of various context-dependent and general motivations in learning environments. Therefore, consumer motivations can be divided into two groups: General and context-specific.

To summarise, similar to different factors, including emotions, personality, social values and involvement, motivation is one of the key antecedents of CE. Therefore, it is important to understand how different motivations lead individuals to interact with different focal engagement objects in various contexts. In this respect, general and context-specific (or context-dependent) motivations have emerged as influential factors in the engagement process and play an important role in exploring CE in-depth in different environments and contexts. Therefore, both general and context-bound motivations should be investigated to understand the influence of motivations on CE. In this respect, Section 2.3.2 and Section 2.3.3 outline general consumer-related and context-specific consumer-related motivations, respectively.

2.3.2 General Consumer-Related Motivations

In many situations, different types of motivations play important roles for individuals. Accordingly, Bagozzi and Dholakia (1999) argued that motivations generate consumer behaviour and individuals set their behaviour and actions when they purchase, use or consume something depending on their motivations. When activated, motivations are usually aimed at specific actions and behaviours such as buying a car or outcomes that can only be achieved via "instrumental acts" (p. 20), for example, aiming to save money by checking the energy display more often and reducing energy costs. Bagozzi and Dholakia (1999) added that some consumer motivations are not static as they change with the new experiences or events taking place in consumers' daily lives.

From losing weight (e.g., Wilson and Brookfield, 2009) to new product adoption and use (e.g., Bagozzi and Lee, 1999), motivations influence an individual's actions, which eventually helps them reach their objectives more effectively. For example, in a weight management context, Bagozzi and Edwards (1998) showed that different types of motivations were very helpful for individuals to start eating less, eating healthy, and losing weight. According to the authors, when a person has a certain level of motivation, then that person will become more likely to show specific coping reactions to unpleasant experiences or events.

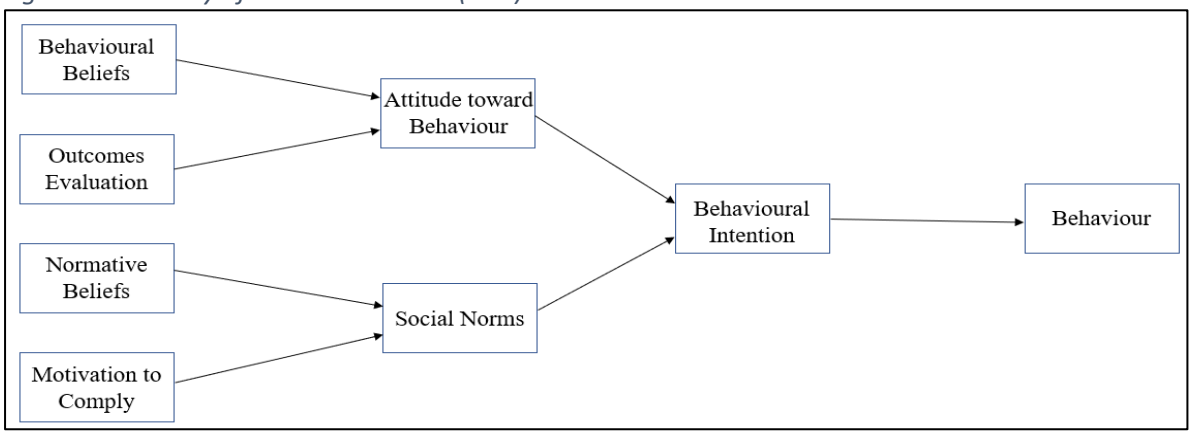
For most individuals, the social environment plays a key role in shaping an individuals' actions and behaviours (e.g., Michie et al., 2011; Gardner et al., 2016; Luca et al., 2019). Additionally, people are usually influenced by numerous social elements in their daily life, and their level of social motivation is one of the key factors guiding individuals to make decisions about engagement with different objects (e.g., Rohm et al., 2013; Kim and Drumwright, 2016; Osatuyi and Turel, 2019) in a number of contexts such as education, social media and health technologies. Thus, social motivation can be named as a general type of consumer motivation. Moreover, susceptibility to normative influence (SNI) has been underlined as an important social motivation influencing consumer interaction and engagement (e.g., Elliot and Fu, 2008; Lee and Lee, 2018; Ho and Ito, 2019; Oyibo and Vassileva, 2019). According to Terry et al. (1999), the social norm is people's perception of the others who are important to them thinking that they should perform the action or not. A good example of social norm is: "Most people important to me think I should exercise regularly". Therefore, in almost every aspect of everyday life, individuals' SNI may directly or indirectly influence their decision making and actual behaviours.

As social norms have the potential to play a very important role in individuals' actions, different theories have been developed to further investigate the influence of this concept. In this sense, Theory of Reasoned Action (TRA) and Theory of Planned Behaviour (TPB) are two of the most important

behaviour formation theories, and both of these theories have underlined that normative influence is one of the primary factors for individuals to be involved in specific actions (or not).

According to the TRA (Figure 2.1), human actions and behaviours are constructed by the individuals' behavioural intention, and behavioural intention is determined by 'attitude toward the behaviour' and 'social norms' (Chang, 1998). For that reason, perceived social norms strongly influence individuals' behavioural intention to actually undertake a behaviour and the motivation to perform more beneficial behaviours. In other words, even though a person is willing to do something or change his/her actions (i.e., when he has a favourable attitude toward that action), that person becomes less inclined to undertake that behaviour or action if it is against social norms (Hawkins et al., 2001). For instance, people may be less willing to express their opinions or feelings in a social network context because of potential social pressure from their friends or other important people in the social context (Marder et al., 2016; Marder et al., 2018). Behaviour is supposed to be generated by individuals' attitudes towards performing a specific action and understanding the social pressure placed on them to carry out this action (Sparks and Shepherd, 1992). Hence, individuals' relationships with other people in their social context influence the strength and direction of the motivation and guide them to perform a specific action (i.e., engagement with a particular object) or not.

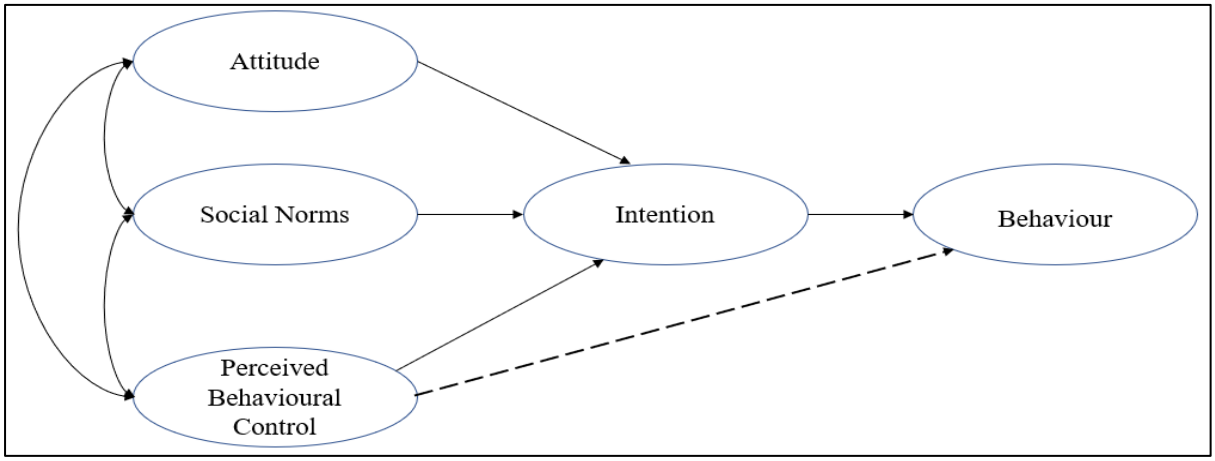
Figure 2.1: Theory of Reasoned Action (TRA)



Source: Fishbein and Ajzen, 1975

Like the TRA, Ajzen and Fishbein (2000) explained that, according to the TPB (Figure 2.2), three types of beliefs guide human action and behaviour. These beliefs are behavioural beliefs (beliefs about the potential consequences of the behaviour), control beliefs (beliefs about the factors that can influence the performance of the behaviour), and, more importantly, normative beliefs (beliefs about the norms and expectations of the others). Accordingly, normative beliefs produce social pressure (Ajzen and Fishbein, 2000).

Figure 2.2: Theory of Planned Behaviour (TPB)



Source: Ajzen, 1991

Social norms can be divided into injunctive norms, which focus on the individual's perception of other people's approval or disapproval, and descriptive norms that focus on the individual's perception of the activities or attitudes of other people (Norman et al., 2005). Fekadu and Kraft (2002) argued that it is more important for individuals to gain social approval under injunctive norms. In contrast, descriptive norms are based on the idea that it is wise to do if most of the important others are also doing it. Social norms, therefore, motivate people to compare themselves with others in their social context. When they compare themselves with others, individuals minimise the problem of being left alone in their social context by performing appropriate behaviours and undertake socially accepted actions.

Accordingly, one important factor on SNI is the influence of friends and other significant people in the social context or interpersonal influence. In this sense, friends and the characteristics of friendships have a substantial impact on individuals' actions. Friends are important variables influencing individuals' intention to perform a specific action because they set the social environment for many people and increase the effectiveness of social norms that influence consumers' SNI. According to Piaget (1965), people can construct strong interpersonal relations in friendships. When a friend models a specific action in friendships, individuals feel more inclined - and even obliged in some situations- to act like their friends (Barry and Wentzel, 2006).

Bandura (1986) discussed that people could learn how to act properly by observing others. Still, in order to adopt an action or change existing ones, individuals have to be motivated by both internal and external cues. Strong emotional bonds in friendships (an important external cue) can encourage individuals to adopt the characteristics of their friends' actions. On the other hand, these strong emotional bonds increase the possibility for individuals in a friendship to mimic each other's activities.

Changing a person's actions to comply with other individuals' actions can be compatible with either informational theories or 'norm to conform' choices (Ayres et al., 2012). Therefore, realising other people's behaviour may give some information regarding the possibility of different alternatives and the advantages of those choices (Cooter et al., 2008).

In summary, approval from their social environment, especially from their relevant social group, is an important factor for individuals to feel socially safer, happier and more motivated. To get approval, individuals usually act in a compliance-gaining manner, and they are usually more willing to comply with the social norms derived from their social context and other group members. Additionally, in many circumstances, individuals are also highly interested in following other people's actions in their social environment to decide on their activities and actions. Accordingly, normative influence may be considered as an influential motivational factor in understanding consumers' general engagement intentions. In addition to this significant general consumer-related motivation, the following section sheds light on the context-specific consumer-related motivations.

2.3.3 Context-Specific Consumer-Related Motivations

As opposed to general motivations, specific motivations affect individuals' actions only in certain contexts and influence their engagement only with particular objects. In this respect, previous research has found different motivations in various settings, and researchers have mainly focused on investigating money-related, personality-related, health-related, work-related and education-related motives influencing engagement with certain objects. This section reviews these motives and settings.

First, in many areas of everyday life, financial motives guide individuals to undertake specific actions and behaviours or not. Before finalising decisions, people usually evaluate different alternatives and usually pick up the more financially beneficial ones. Elaborating on this, Maslow's hierarchy of needs (1943) is strongly related to evaluation's financial attitude. Humans' needs and actions are highly correlated with the budget, obsession with money, and financial assessment (Oleson, 2004). Additionally, Wernimont and Fitzpatrick (1972) also underlined that for individuals who pay more attention to extrinsic elements of life, money would be seen as more important – the primary functions of money will be considered as bringing security and joy in life while serving as a sign of power and achievement. For this type of individual, money greatly influences overall personal performance to perform specific actions. These people firmly believe that money rewards successful task completion. Hence, the concept of money can increase their performance efforts (Vohs et al., 2008). Supporting this, a number of scholars (e.g., Bonsu, 2008; Gilal et al., 2020) have contended that money-related elements are some of the most significant internal factors (i.e., motivators) that guide

consumers to modify their actions to undertake positive behaviour change. For example, Brandon and Lewis (1999) argued that consumers' overall perception of money is a significant determinant of their engagement with pro-environmental actions. According to Abelson (1987), how individuals interpret their relation to their possessions is an expression of their general views and beliefs. Past experiences usually structure these views and beliefs about money and significantly influence their current behaviour. Besides, it can also be expected that people who had experienced financial hardship may differ in their money-related motivations compared to individuals who had not experienced any financial problems in their lives (Reddy, 1987).

Second, in addition to money-related motives, especially in environmental settings, various personality-related motives have the potential to affect individuals' engagement behaviour with specific actions and objects. In this sense, 'altruism', which was conceptualised in Schwartz's moral norm activation model (Schwartz, 1970), is an important topic receiving a significant amount of research attention. Accordingly, McMakin and colleagues in their study (2002) found that participants in their experiment were mainly motivated by the desire to do the right thing (i.e., engaging more with the environment-friendly activities) and provide good examples for their children. Their findings also supported the proposition that some aspects of the social-psychological model, especially egoistic and altruistic motives were important factors for participants to undertake sustained actions. Besides, participants' responses were consistent with early research highlighting that altruistic motives play a significant role in promoting 'environmentally responsible behaviour' (Stern et al., 1993). In a similar experiment, it was found that participants were more likely to score altruistic motives significantly higher on a survey questionnaire even though environmental motives such as 'biospheric' values were also important for them (Howell, 2013).

In addition to altruism, other personality-related motives (e.g., happiness, satisfaction, etc.) may play a key role in leading individuals to engage more with the desired objects or activities. Accordingly, a number of researchers (e.g., De Young, 2000; Kaplan, 2000) have believed that the promotion of favourable behaviours in different contexts (e.g., environment) should be done through personality-related motivations such as pleasure and satisfaction with the action, rather than external motivations such as rewards, as the former can generate more powerful and continuous engagement than when action or behaviour is performed for external motives (Crompton, 2008).

Third, in health behaviour settings, consumers' characteristics are usually generated by health-related motivations. In this respect, health motivation is defined as consumers' arousal to engage in positive health-related actions and activities (MacInnis et al., 1991). Individuals' level of health motivation influences favourable health behaviours (e.g., preventive behaviours) such as changing exercise

routine or diet, performing stress management more effectively and searching for health information (e.g., Moorman and Matulich, 1993; Loebnitz and Grunert, 2018; Gall et al., 2019). It was also discussed that different elements, including health knowledge, may change consumers' level of health motivation, and eventually, consumers' enthusiasm to undertake health-related actions (e.g., Choi et al., 2019; Stenhauser et al., 2019). Moreover, in a recent study, Ferrer et al. (2018) argued that a psychological element, risk perception, is an important factor to anticipate motivations to implement actions against a potential health issue. Thus, it can be argued that in health-related contexts, different context-bound elements can influence consumer motivation and engagement.

Fourth, individuals' (i.e., employees) fulfilment of needs such as authenticity has been underlined as an important context-specific that can change individuals' overall work-related motivation. According to Green Jr. et al. (2017), while their safety and security are important indicators for employees to feel motivated at work, environments that provide more potential to fulfil needs are usually considered primary elements for work-related motivations. Similarly, van den Broeck et al. (2019) highlighted that employees' need satisfaction motivates them to feel more engaged with their tasks and jobs at work.

Finally, in an education context, competence (e.g., Linnenbrink-Garcia et al., 2016), attributions about success (or failure) (e.g., Lazowski and Hulleman, 2016) and autonomy (e.g., Ulstad et al., 2016) are the key factors that strongly affect individuals' level of motivation to engage with education-related activities and objects. In some cases, beliefs about competence or perceived competence and autonomy support work together to increase individuals' educational motivation and lead them to have better learning consequences (Ulstad et al., 2016).

In conclusion, it has been widely discussed by the engagement literature that many different psychological or external elements can be a part of context-specific motivations. Hence, it is important to investigate each context and the potential motivations that can influence CE in that context in detail. Based on the discussion of both general and context-specific consumer-related motivations as antecedents of CE and previous literature (e.g., Hollebeek et al., 2014; Dessart et al., 2015; Ferreira et al., 2020) on CE, the researcher provides his definition for CE:

"Consumer engagement (CE) is the cognitive, emotional, and behavioural commitment to an entity, where that entity can be a product, service, brand or company. Accordingly, while the interaction between a consumer and the focal engagement object is usually set based on motivations, various personal and environmental variables may also play key roles to improve and strengthen CE on different dimensions depending on the nature of the engagement object"

The following section summarises Chapter 2.

2.4 Summary

In the last couple of decades, in various business-related areas, especially in marketing, consumer engagement (CE) and engagement-related topics have become important research topics. Understanding the concept of CE plays a key role for both providers and consumers to get positive outcomes from the overall engagement process. In this respect, this section summarises key insights that inform this study.

First, various academic fields, including social sciences and business studies, have investigated the concept of CE. Hence, while the subject of engagement is the consumer (or the individual) himself/herself in most of these studies, the object of engagement may change depending on the study's specific context. In marketing literature, the main focus has been engagement in retail, social media and services marketing contexts.

Second, although previous studies have covered different definitions and conceptualisations of CE, a clear definition of CE and engagement specific products, including technology, are still missing. Thus, to explore CE and technology engagement in more depth, it is significant to review different definitions and conceptualisations of this topic covered by previous research and the dimensionality of engagement and various engagement subjects.

Third, different antecedents have the potential to influence the engagement process. Considering the antecedents to engagement, previous research has shown various motivations such as susceptibility to normative influence (SNI), health motivation or financial motivation being important antecedents of engagement. What is also clear from previous literature is that both general and context-specific motivations influence individuals' engagement with the object of engagement. For this reason, different types of motivations need to be taken into consideration when seeking to investigate CE.

Other than motivations, object-related factors also have the potential to affect the level of CE with objects. Accordingly, in the context of technology engagement, technology-related factors have the potential to influence CE. Therefore, the next chapter highlights CE with technology and explains the importance of technology as the object of engagement and technology-related antecedents to technology engagement while discussing a number of human-technology interaction theories [i.e., Technology Acceptance Model (TAM) and Social Presence Theory (SPT)] in detail.

Chapter 3: Consumer Interaction and Engagement with Technology

3.1 Introduction

This chapter investigates how consumer engagement (CE) with technology is generated. First, the manner in which technology is conceptualised as the object of engagement and the dimensionality of consumer-technology engagement will be explored. Second, the Technology Acceptance Model (TAM) will be discussed as it is one of the most commonly used theory by researchers to understand the relationship between humans and technology. Accordingly, a number of technology-related antecedents [e.g., Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) of technology] to CE with technology will be investigated together with their significance on the strength of engagement. In the final part of this chapter, Social Presence Theory (SPT) will also be explained.

3.2 Technology as the Object of Consumer Engagement (CE): Conceptualisation & Dimensionality

Considering consumers' increasing interaction with new technologies in different settings, including web technologies (e.g., Mollen and Wilson, 2010; Xiao et al., 2022), online brand communities (e.g., Brodie et al., 2013; Kharouf et al., 2020), wearables (e.g., Piwek et al., 2016; Canhoto and Arp, 2017; Kim and Chiu, 2019; Ferreira et al., 2021), mobile phones and applications (e.g., Kim et al., 2013; Mehrotra et al., 2017; Fadda et al., 2018; Wang, 2020; Oppong-Tawiah et al., 2020) and smart technologies (e.g., Priporas et al., 2017; Foehr and Germelmann, 2019; Ameen et al., 2022), consumer engagement (CE) with technology has attracted much research interest. Accordingly, understanding the human-technology interaction/engagement concept can be very useful for researchers as well as technology designers to improve the level of CE with different types of technology. Moreover, as Fan et al. (2017) discussed, technology developers and suppliers are now placing more attention on understanding how consumers become more engaged with the technologies they offer, rather than seeing if these consumers are purchasing their technology. The strength of consumer-technology interaction depends on a range of factors but is primarily related to the individuals' level of motivation as well as the perception of technology (e.g., Venkatesh, 2000; Kim and Baylor, 2008; Mahdum et al., 2019), as discussed below.

In simplest terms, consumer-technology interaction can be conceptualised as a motivation-triggered activity, and similar to how people behave and act in many situations in their everyday lives, motivations guide individuals to use a specific technology or not (e.g., Stafford, 2005; Khairuddin et al., 2016; Youn et al., 2020). Accordingly, in many areas of everyday life, motivations have the potential to directly influence individuals' engagement with different technologies. For example, Kim et al. (2013) underlined that individuals continue to use and engage with their phones to create more value

for themselves. Thus, motivation to use a smartphone positively impacts consumers' level of intention to engage with that smartphone, while motivations to use a smartphone also positively impact consumers' perceived value from the engagement.

Yet, there are two main types of consumer-technology interactions: explicit and implicit. In explicit interaction, individuals give a direct command to computers or computer-mediated technologies to do what they want them to do. In implicit interaction, on the other hand, computers or computer-mediated technologies understand individuals' behaviour in certain actions. In this respect, as opposed to explicit interaction, new technologies (e.g., IoT technologies) provide more implicit interaction options and act proactively, which is essentially important to strengthen the consumer-technology interaction (Schmidt, 2000). Therefore, consumer-technology (or consumer-computer) interaction is a theme that is adopted to evaluate and construct more (implicit) interactive technological systems for individuals to use (Sinha et al., 2010). For this reason, the strength of interaction between individuals and technology usually depends on its specific features.

In particular, in order to improve the interaction between consumers and specific technology, that technology must be able to perform different tasks and functions or offer a high level of functionality to its users for performance optimisation (Marsden and Hollnagel, 1996). Similar to functionality, interactive technologies are usually considered as the ones that have the potential to been seen as useful by their users. In fact, most of the time, people decide to use a specific technology only if they think that the technology has a high level of 'usability', which helps them undertake specific tasks easily, efficiently and effectively. Therefore, a particular technology also has to carry the usability feature for individuals to interact with it. Any technological device can be regarded as 'worthless' if individuals do not find it highly usable (Sinha et al., 2010). According to Sinha et al. (2010), the functionality and usability of technology can assist users in achieving specific objectives more efficiently, and the duty of interactive technology is to reduce the level of effort required to undertake a task. Hence, both the functionality and usability of technology are essential elements for individuals to engage with that technology. It is also imperative for individuals to put enough amount of focus to perform a specific activity. In this sense, many modern technologies include different features to help individuals concentrate on a target activity for a period of time, such as a GPS device that tells a driver which way to go or reduce his/her speed. Besides, new technologies usually incorporate cognitive, motivational, and experiential components, making individuals highly involved or 'absorbed' in a specific task (Koehn et al., 2017). Thereby, other than functionality and usability, different concepts such as 'focused attention' or 'task absorption' (Herrington et al., 2003) have been underlined as important elements in understanding why individuals undertake 'technology dependence behaviour' (Fan et al., 2017) and continuously use a technology.

Similar to engagement with other types of objects, CE with technology is usually based on multiple dimensions (e.g., emotional, cognitive, and behavioural), and all these dimensions play important roles in understanding the relationship between consumers and different technologies (Letheren et al., 2019). In other words, when it comes to conceptualising human-technology engagement, existing research predominantly adopts a multi-dimensional view of CE. For instance, Letheren et al. (2019) analysed the cognitive, emotional and behavioural dimensions of technology engagement. The authors discussed that while the cognitive dimension focuses on consumers' overall opinion about using a specific technology, the emotional dimension aims to understand what consumers feel when using that technology. The behavioural dimension seeks to explore whether individuals would use that technology or not. In another study, Li et al. (2018) also adopted the cognitive, emotional and behavioural dimensions to conceptualise technology use and explore CE with different technologies, including mobile health and social network applications. Similarly, Violante et al. (2019) argued that the cognitive, affective (i.e., emotional), and behavioural dimensions have the potential to explain how CE is generated in virtual environments such as virtual supermarkets. Tarute et al. (2017) also framed their engagement questions to explore consumers' emotional, cognitive and behavioural engagement with a mobile application.

In addition to these three highly individual-related dimensions (i.e., emotional, cognitive and behavioural), some studies have adopted product-related dimensions to investigate technology engagement. For instance, Alhuwail et al. (2018) employed different characteristics, namely, accessibility, usability, presence and content of hospital websites, to evaluate CE with these websites to get more information related to health. Furthermore, in certain contexts, especially in social media, individuals' engagement with online media tools and websites are usually measured by specific characteristics such as the shareability of the website or an online post (Tafesse, 2016).

Furthermore, a number of studies have used motivation-based questions and dimensions to evaluate CE with technology. For example, in their research, Martinez-Lopez et al. (2017) asked questions to highlight individuals' motivation to be involved in online communities and technologies, and thus their engagement with technology.

Even though technology-related and motivation-based dimensions play an important role in examining CE with technology, previous literature has not used motivational and technology-specific dimensions to assess technology engagement. Hence, in order to explore the influence of motivations and technology-related factors on CE with technology, a different dimensionality is required rather than the more commonly adopted ones in the marketing literature.

In conclusion, technology has the potential to be a significant object of CE. In this respect, while different functions and characteristics of technology can directly or indirectly influence the strength of consumer-technology engagement, these characteristics may play a more important role in influencing the engagement when individuals are also motivated to use a specific technology. For this reason, even though the marketing literature has adopted different dimensions to evaluate individuals' engagement with various objects, including brands, products or services, these dimensions are not enough to thoroughly investigate the connection between motivations, technology characteristics and the level of technology engagement. For that reason, it is key to understand and further explore different dimensions of consumer-technology engagement and the potential impact of the motivations and technology itself on engagement. Moreover, to investigate the relationship between IoT technologies, personal motivations, and IoT engagement, it is important to find a better-fit scale to evaluate the specific dimensions of consumer-IoT engagement.

As technology-related factors are essential to explore consumer-technology interaction and engagement, the next section sheds light on technology-related antecedents to CE with technology.

3.3 Technology Acceptance Model (TAM) and Technology-Related Antecedents to Consumer Engagement (CE) with Technology: Perceived Usefulness (PU) & Perceived Ease-of-Use (PEOU)

Understanding human-technology interactions can be beneficial for researchers as well as technology designers in order to improve the strength of CE with different types of technologies, including Internet of Things (IoT) devices. Based on the widely adopted Technology Acceptance Model (TAM), this section reviews two significant technology-related antecedents [i.e., perceived usefulness (PU) and perceived ease of use (PEOU) of technology] that has the potential to influence consumer-technology engagement. In addition to the importance and definition of PU and PEOU of technology, this section also talks about the influence of PU and PEOU of different high-technology products on consumer interaction and engagement with a specific product.

Harrison and Davies (1998) described individuals' behaviour and activities as the result of a continuous and rational mental mechanism of the overall decision-making progress. In order to understand what can influence this rational process and ultimately lead individuals to change their activities in the context of technology interaction, it is principally important to carefully examine different aspects of technologies that are part of everyday life. In this sense, different characteristics and elements of technology have the potential to work as the main variables that construct individuals' overall behaviour system and guide them to undertake positive actions (Hargreaves, 2011). Moreover, many characteristics of technology may generate favourable circumstances for people as individuals'

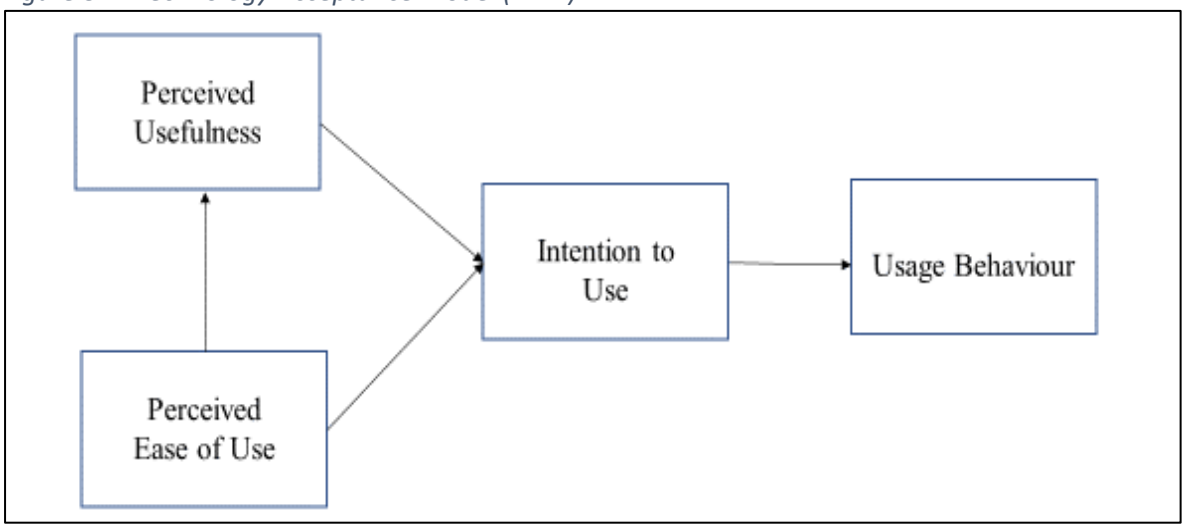
integration with various technologies highly relies on their perception of the technology characteristics. In other words, technology factors and positive 'judgement' about these factors can guide individuals to be more favourable towards the technology.

Technology characteristics may also help individuals decrease uncertainty on decision making, adapt to the technological adjustments more easily, identify different potential positive changes, and decide how to obtain more beneficial outcomes (Hambrick, 1982; Daft et al., 1988). Besides, a positive perception of technology characteristics can decrease the level of complexity of using technology and engagement with the technology (e.g., DeSanctis and Poole, 1994; Kim et al., 2009; Singh et al., 2019).

Together with the level of complexity of using technology, the usefulness of technology is another important concept that has been discussed in the literature (e.g., Laes and Couder, 2014; Henderson et al., 2015; Wolverson et al., 2019; Tavitiyaman et al., 2020; Hanham et al., 2021) as a factor affecting consumers' relationship with technology in general. In many circumstances, engagement with a specific technology depends on consumers' initial overall impression of that technology and whether consumers get some form of benefit from continuously using the product or not (Quesenbery, 2003).

In this respect, in order to understand people's attitude to new technologies, Davis developed his TAM in 1989. In his original model, Davis (1989) underlined that two factors, PU and PEOU of technology, can influence individuals' 'resistance' to accepting new technologies and using them (Figure 3.1). Elaborating on this, regarding the usefulness and complexity of technology, PU and PEOU of technology are considered to be two essential technology characteristics that may change a consumer's overall attitude towards technology and the strength of CE with technology. Accordingly, while PU of technology is the degree to which a person believes that using a particular technology would enhance that person's performance, PEOU is the degree to which a person believes that using a specific technology would be free from effort (Davis, 1989). PEOU of technology can also be defined as to what level a person considers using a particular technology needs a minimum level of effort (Edmunds et al., 2012).

Figure 3.1: Technology Acceptance Model (TAM)



Source: Davis, 1989

For a specific technology's enhancement and increased usage, the social context surrounding that technology can be considered one of the most important factors, and the overall attitude of individuals towards technology is an integral part of that social environment (Frewer et al., 1998). Therefore, both PU and PEOU of technology can be used as a very effective tool to improve individuals' overall attitude to the technology and enhance information exchange processes between policymakers/suppliers and consumers.

In many cases, the technology has the potential to provide different benefits to the consumers, such as improved communication systems (e.g., Kim and Baek, 2018), increased interactivity (e.g., Ko et al., 2005; Yim et al., 2017), and increased ability to participate in different channels including social media (e.g., Wu, 2016) and online community (e.g., Islam and Rahman, 2017). Hence, PU of technology can also be considered a more comprehensive concept consisting of multiple components, including controllability, responsiveness, and communication of technology (Fan et al., 2017). It is often regarded as a solid indicator to measure the strength of CE with technology.

In a similar vein, PEOU of technology includes different items such as effort expectancy (Kim and Baek, 2018), helpfulness of technology (Henderson et al., 2015), and technological issues (Hardiker and Grant, 2011), and all these aspects may also affect individuals' relationships with technology. Thus, it is important to understand how PEOU of technology can significantly influence a consumer's perception of a particular technology and shape the interaction between a consumer's attitude to that technology as well as inclination to continue using it.

Furthermore, Davis (1989) argued that when everything else is kept equal, users are more willing to accept a particular object and use it more regularly if it is perceived as easier to use than the other alternatives. Similarly, the complexity of technology (or negative PEOU) may have an adverse impact

on consumer acceptance and use of a specific technology (Tornatzky and Klein, 1982). Hence, higher PEOU may also strengthen consumer interaction with technology and prompt individuals to undertake more beneficial actions.

Additionally, consumer behaviour literature has commonly argued that the human mind and behaviour are not static concepts. People change their minds, actions and behaviour all the time. In terms of technology acceptance and usage, the situation is not different. In this respect, PEOU of technology has been found to be one of the most effective elements to positively increase the level of intention to use technology (e.g., Venkatesh and Davis, 1996; Venkatesh, 2000) and enhanced consumer integration/experience with the system (Venkatesh, 2000). In other words, it can be argued that PEOU may influence consumer willingness to engage more with technology.

In consumer-technology interaction studies, the connection between PU and PEOU of technology and consumers' intention to use and engage with technology has been reviewed in many areas. In the context of assistive technology use, for example, Batavia and Hammer (1990) underlined that consumers are less willing to use any type of assistive product (e.g., wheelchair, hearing aids, etc.) if the device is hard to learn how to use or if the device is challenging to use regardless of the level of PU of that device. Likewise, Thickett (2006) argued that PEOU is a very important factor, especially for the engagement of older people with technology.

In short, the TAM and its significant components, PU and PEOU of technology, cannot be ignored when exploring consumers' engagement with technology in almost every area of everyday life. For this reason, CE with technology requires further attention to explore the particular influence of PU and PEOU of technology on the level of CE with technology and, more specifically, with IoT technologies and devices.

The following section talks about another human-technology interaction theory, namely the Social Presence Theory (SPT) that support the TAM to explain engagement with technology in the IoT framework.

3.4 Social Presence Theory (SPT) and Human-Technology Interaction

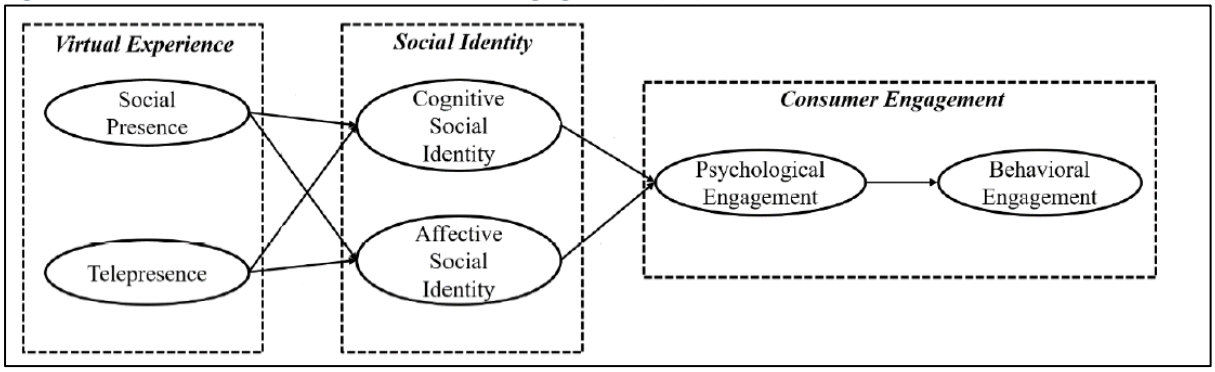
In addition to the Technology Acceptance Model (TAM) that is explained in the previous section, different theories might be important to explore human-technology interaction to a wider extent. Accordingly, in relation to human-technology interaction, Social Presence Theory (SPT) can be highlighted as one of the key theories that scholars have adopted to explore consumer interaction and engagement with technology. Additionally, the SPT can be considered as an important theory because it has underlined that technology has the potential to play a social role, and this role may strengthen the relationship between humans and technology.

Elaborating on this, different social technology interaction theories view both human and non-human actors (i.e., mainly technology) as the creators of knowledge that is the basis of everyday social life (Shaw-Garlock, 2010). Therefore, the interaction between different actors is key to setting a solid relationship between them.

In some cases, individuals cannot interact with others; instead, they have to use technology to feel that others surround them. In this respect, social presence can be actual existence or just the imagined presence of other individuals. Thus, in some situations, individuals feel the social influence of others even though they are not physically present near them (Swinth and Blascovich, 2002). As Horvath and Lombard (2010) stated, social presence occurs when a specific type of technology makes individuals feel that they are communicating with other people. In this respect, a technological product can generate social presence when individuals treat it as something with personality or the product acts like a person (Moon and Nass, 1996).

As an example, Figure 3.2 below illustrates the influence of social presence on promoting consumer engagement (CE) in an online community context. Elaborating on this, the social presence of an online community has the potential to change the actual engagement of a consumer in that community via influencing the social identity and belonging of the consumer.

Figure 3.2: Social Presence and Consumer Engagement (CE) in Online Communities



Source: Chuang, 2020

Recently, social presence has been found to be effective in the interaction between consumers and a variety of high-technology products. Accordingly, while social presence may have a positive influence on CE with different products (e.g., Algharabat et al., 2018), it also has the potential to have a positive impact on the functionality of a specific technology and CE with that technology (e.g., Fortin and Dholakia, 2005). Furthermore, it was also found that display technologies with more social cues and social presence aspects may increase individuals' engagement with those technologies (Erp and Toet, 2015; Tsai et al., 2021) as social presence may increase the positive features of technology such as perceived quality of that technology (e.g., Lowenthal, 2010; Richardson et al., 2017; Yoganathan et al., 2021) or the level of enjoyment of using that technology (e.g., Algharabat and Shatnawi, 2014; Chen et al., 2021).

Summarising the SPT, social presence gives individuals the ability to interact with others when they are not physically but psychologically nearby (Fulk et al., 1987). In this context, the level of human-technology interaction can be enhanced by the social presence (Kruikemeier, 2013; Hollebeek et al., 2021; Mallmann and Macada, 2021). As a result, while social presence is a very efficient framework to lead users to interact with technology, it is also named one of the main elements in strong CE processes (Algharabat and Shatnawi, 2014; Busalim et al., 2021; McLean et al., 2021). Moreover, although the SPT sheds light on the fact that technology itself and the characteristics of the technology are very important factors for CE with technology, other elements such as the context in which engagement happens, social environment and certain motivational elements have the potential to directly or indirectly influence the strength of engagement between individuals and technology. Accordingly, the SPT can be further investigated to understand the relationship between various motivations, technology-related factors and consumer-technology engagement in the context of IoT technologies.

Next, the summary of this chapter is given.

3.5 Summary

Thanks to rapidly developing technologies in different contexts, consumer engagement (CE) with technology has received scholarly attention in many fields, including marketing. In this sense, various theories have been proposed by researchers to explain consumer-technology engagement in detail. Accordingly, most of these theories agree that technology can be considered an important actor in the overall engagement process and has the potential to be the main object of engagement. Additionally, thanks to technology's potential to directly or indirectly influence a person's social

situation and help consumers live a more convenient life, interaction and engagement with technology become very important.

Therefore, many studies covering CE have focused on conceptualising consumer-technology interaction and engagement and evaluating different dimensions to understand the relationship between different factors influencing CE with technology and the strength of technology engagement. Accordingly, first, based on the Technology Acceptance Model (TAM), it can be argued that both perceived usefulness (PU) and perceived ease of use (PEOU) of technology can influence a consumer's interaction with technology not only at the adoption stage but also at the post-adoption stage as well. Second, the Social Presence Theory (SPT) might be helpful to explain the relationship between a consumer and high-technology products, including IoT technologies and smart meter in-home displays (IHD). Hence, together with different types of consumer motivations (e.g., social, financial, etc.), PU and PEOU of technology have been identified as two factors that may affect the actual consumer-technology engagement in the context of IoT technologies.

Based on this, the next chapter develops an initial conceptual framework that illustrates how different factors are connected in the technology engagement system in relation to IoT technologies.

Chapter 4: Initial Conceptual Framework Development about Consumer Engagement (CE) with the Internet of Things (IoT)

4.1 Introduction

In addition to the overview and conceptualisation of consumer engagement (CE) in Chapter 2 and the general discussion of CE with different types of technologies in Chapter 3, this chapter sheds light on the engagement process between individuals and Internet of Things (IoT) products. In this respect, an initial framework about IoT engagement together with different factors influencing CE with IoT is presented in this chapter. While highlighting the factors that have the potential to affect the strength of consumer-IoT engagement, the influence of each of these factors is also conceptualised in the following sections.

Accordingly, the influence of general and context-specific consumer-related motivations, as well as technology-related antecedents to CE with IoT, are conceptualised in Section 4.2.

4.2 Motivations, Technology-Related Antecedents and Consumer Engagement (CE) with Technology

In many situations, even though individuals have a significant opportunity to integrate with various engagement objects and interact with different technology products, certain internal (e.g., motivations) and external influencers (e.g., technology-related factors) lead individuals to have stronger interactions and engagement with technology. In this respect, both internal and external influencers help people to comprehend the fact that they have a set of skills, abilities and capabilities to use their value-generating power to improve the technology engagement experiences and enhance the overall engagement process (e.g., Gangale et al., 2013; Gatautis et al., 2016; Asimakopoulos and Asimakopoulos, 2017; Pahore et al., 2018).

Accordingly, a consumer's participation in the overall technology engagement process may positively increase depending on his or her engagement intention with focal engagement objects offered by companies or service providers. Moreover, undertaking different activities can also boost a consumer's engagement intentions with technological objects. Thus, the concept of human-technology interaction and its implications hold high potential to work as significant facilitators to aid individuals to have stronger engagements with the aimed technologies (e.g., O'Brien and MacLean, 2009; Henrie et al., 2015, Franke et al., 2019; Moriuchi et al., 2021).

A large number of studies (e.g., Gangale et al., 2013; Abdullah et al., 2016; Moriuchi, 2019; Osei-Frimpong, 2019; Vander Shee et al., 2020; Geng et al., 2021) in the literature have highlighted both the direct and indirect influence of consumers' motivations and technology-related characteristics on

the strength of consumer engagement (CE) with various technologies. Nevertheless, this study adopts consumers' characteristics (i.e., motivations) as direct influencers on a consumer's perception of technology characteristics and indirect influencers on the strength of CE with technology. In contrast, a consumer's perceptions of technology-related antecedents are regarded as the direct influencers on the strength of consumer-technology engagement and, more specifically, IoT devices. This is because recent human-technology interaction studies (e.g., Sanchez-Oliva et al., 2010; Joo and Sang, 2013; Koo and Chung, 2014; Wang and Li, 2019; Bailey et al., 2021) have argued that different types of motivations have the potential to directly influence how a user/consumer perceive specific technologies, which in turn affects the process of technology engagement. In other words, in these studies, motivations were not found to directly impact the level of technology engagement but an indirect influence on engagement through their facilitating effect on technology-related influencers. However, most of these studies have ignored to evaluate the impact of different types of motivations in a single study and mainly focused on only one type of motivations. Therefore, this study explores the influence of different types of motivations (both general and context-specific) on a consumer's perception of technology-related antecedents and the indirect effect of motivations on the actual consumer-technology engagement. At the same time, the current study also focuses on assessing the direct influence of technology-related factors on the strength of CE with technology in the context of IoT technologies.

In summary, it is argued that both motivations and technology-related variables are potential factors impacting the strength of consumer-IoT interaction and engagement. Hence, the relationship between IoT engagement-affecting factors and the strength of engagement with these technologies requires further investigation. Before discussing the connection between motivations, technology-related antecedents to CE with IoT, and the strength of consumer-IoT engagement, the next section conceptualises the first of the three main factors influencing CE with IoT technologies, namely, general consumer-related motivations.

4.2.1 Conceptualising the Influence of General Consumer-Related Motivations on Consumer Engagement (CE) with the Internet of Things (IoT)

As stated earlier in Chapter 2, previous research covering consumer engagement (CE) has underlined the importance of personal motivations for CE with different objects. Previous studies have highlighted the potential significant influence of social motivations on the overall CE process. Based on this argument, motivations are expected to affect CE with the Internet of Things (IoT) technologies as well. As IoT is a type of technology, it has the potential to undertake a social role in individuals' everyday lives, according to the Social Presence Theory (SPT) discussed in Chapter 3. Interacting with

the social presence created in IoT technologies, a consumer's social motivations and susceptibility to normative influence (SNI) have the potential to change the strength of engagement with IoT technologies.

In the context of technology and IoT products, the impact of motivations on engagement may change dramatically depending on the social situation of the person who has an intention to engage with the technology. Additionally, similar to individuals' interaction with different technologies, including social media (e.g., Stibe et al., 2013; Perfumi et al., 2019) and health technologies (e.g., Poirier and Cobb, 2012; Beldad and Hegner, 2018), different social elements and SNI may change a consumer's engagement with IoT devices as well.

Considering the influence of SNI on the human-technology or IoT relationship, social norms have been found to be very effective influencers on the level of consumer-technology interaction in various areas as the end-user (i.e., consumer) of technology is an important part of a broader social network (Lamb and Kling, 2003). To start with, Sukumaran et al. (2011) underlined that normative influence affects individuals' engagement with computer-based technologies.

In many cases, individuals depend on social norms for guidance when they decide to (or not to) participate in computer-based programs such as social media (Oliveira et al., 2016), online blogs (Hsu and Lin, 2008), online classrooms (Farzan et al., 2011), or other types of educational technologies (Robinson, 2006). Accordingly, Teo (2009) highlighted that social norms (together with perceived usefulness (PU) and perceived ease of use (PEOU) of technology – Section 3.3) explained approximately 70% of the variance in pre-service teachers' attitude to use computer technologies. Similarly, social norms have been identified as a prominent determinant of individuals' intention to use and engage with social network technologies (Shin and Kim, 2008) and the concept of social commerce (Shin, 2013) together with technologies used to promote technology engagement.

In earlier studies (e.g., Tornatzky and Klein, 1982; Webster and Trevino, 1995), it was contended that individuals are more likely to adopt and use an innovation when the innovation is aligned with social norms and social influences. Similarly, more recent studies (e.g., Kulviwat et al., 2009; Ifinedo, 2016; Graf-Vlachy et al., 2018; Wolske et al., 2020) have shown that social influence has a direct, strong positive impact on a consumer's intention to adopt and use a specific innovation, which may lead the consumer also to have a higher intention to engage with that product. For instance, in workplace environments, social norms were the most important predictor (i.e., even more effective than PU and PEOU of technology) of workers' intention to use and engage with technology (Lucas and Spitler, 1999). In the context of mobile technologies, it was found that social influence also has a direct, positive influence on both users' attitude towards mobile phones and actual mobile phone use (e.g.,

Kaba et al., 2008). Accordingly, in parallel with what Moore and Benbasat (1991) argued, it can be contended that an innovation can be perceived as a tool to improve individuals' social status.

Moreover, considering positive behaviour change and undertaking more beneficial activities, Fischer (2008) put social norms as one of the variables that directly impact individuals' intention to involve in favourable activities in her norm activation framework. Similarly, some other studies (e.g., Tetlow et al., 2012; Harries et al., 2013) have found that normative influence and social norms marketing effectively prompt individuals to perform more desirable and beneficial actions. Additionally, a number of scholars have argued that it is very effective for individuals to undertake positive behaviour change when they compare their actions with other people (e.g., Pallak et al., 1980; Zhou and Yang, 2016). In other words, together with social norms and compliance with norms, the social comparison may directly influence individuals' behaviour and engagement with different IoT technologies that may potentially help individuals reach more beneficial outcomes.

Additionally, the social norms approach (SNA) research underlines that the influence of SNA campaigns is escalated by the use in communications from the most relevant reference groups (e.g., close friends, neighbours, or relatives) for a specific target group. In this respect, many studies (e.g., Triandis, 1977; Keirstead, 2006; Martiskainen, 2007; Jain et al., 2013) have argued that the influence of important individuals in a social context drive more beneficial activities. For example, in the context of energy consumption, it has been discussed that the comparisons of neighbours and giving information about social norms persuades individuals to engage in energy conservation actions (e.g., Schultz et al., 2007; Allcott, 2011). In these campaigns, association and recognition reach the highest level by using the term 'your neighbourhood', such as, '*your energy use was more than the average in your neighbourhood'* (Harries et al., 2013). The target audience's association and recognition can also be maximised by using visual objects such as photographs of relevant demographic or socio-economic groups (preferably of individuals who are recognised as coming from the same target group) (Harries et al., 2013).

For example, Home Energy Reports of Opower activate certain injunctive norms based on comparisons with neighbours (i.e., appropriate demographic groups). In these reports, each household is labelled as 'Great' if they manage to consume less than the 20th percentile of their neighbours, 'Below Average' if they consume more energy than the average, and 'Good' in case they are in between. Besides, while the 'Great' group gets two smiley face emoticons, the group labelled 'Good' gets only one smiley face emoticon, and the group who consumes more energy compared to their neighbours used to receive sad face emoticons at the beginning (Allcott, 2011). In a similar vein, based on the SPT (Section 3.4), it can be argued that the social presence of other individuals found in

a specific technology have the potential to influence the strength of engagement between a consumer and the technology especially when there is no direct social influence to use (or engage with) the technology.

In short, social motivations and individuals' SNI as a part of general consumer-related motivations may be key elements in influencing CE with IoT products similar to many other different types of technologies. Therefore, in many situations, specific variables (e.g., norms) in the social context and social motivation of a consumer may dramatically change the strength of IoT engagement.

Following the influence of general motivations, the influence of context-specific motivations to CE with IoT is discussed next.

4.2.2 Conceptualising the Influence of Context-Specific Consumer-Related Motivations on Consumer Engagement (CE) with the Internet of Things (IoT)

In Chapter 2, it was discussed that different motivational elements might influence a consumer's engagement with various objects in different consumption settings. This section discusses some examples of context-specific consumer motivations.

In some contexts, well-informed individuals who are highly sensitive to price are predicted to more actively undertake more favourable actions (Mah et al., 2012). In this sense, compared to other technologies, Internet of Things (IoT) technologies lead consumers to participate more in the active system of the specific IoT product and decision making (Ghanem and Mander, 2014). Thanks to the information on IoT technologies, consumers are enabled to efficiently obtain the necessary financial information and more effectively spend their money in different contexts (e.g., Pingle et al., 2016; Arshad et al., 2017; Suseendran et al., 2020). Therefore, consumers who are more interested in financial information or more concerned about money may have stronger engagement with various money-saving IoT products such as security systems (e.g., Patil et al., 2017), labour and inventory management (e.g., Tejesh and Neeraja, 2018), or farming equipment (e.g., Hasan, 2020).

In the context of medical IoT devices, health and fitness motivations may lead individuals to have stronger engagements with the specific device (e.g., Asimakopoulos et al., 2017). In this respect, engagement with certain IoT technologies such as Fitbit can be significantly influenced by a consumer's level of health motivation as these devices have the potential to help individuals to reach healthier lifestyles (e.g., Kerner and Goodyear, 2017; Ringeval et al., 2020). In many studies (e.g., Patel et al., 2015; Woldaregay et al., 2018), it has also been discussed that health motivations impact consumer engagement with various health-related products and apps, and eventually, generated positive health behaviour change.

Under context-specific environmental motivations and environment-friendly actions, green consumerism is a specific concept that explains why some people undertake certain activities to help the environment (e.g., Dagher and Itani, 2014; Tseng, 2016). Consumers with higher levels of green behaviour intentions are recognised as the ones who are strongly motivated to buy and consume products or services which do not endanger human lives or destroy the ecosystem (Tekade and Sastikar, 2015). Pro-environmental lifestyles also have the potential to lead individuals to accept and use specific technologies, including electric vehicles (Axsen et al., 2012). As a rule of thumb, it can be argued that the higher the level of environmental values and knowledge about the environment, the higher the level of consumer intention to undertake pro-environmental activities in their households. Hence, knowledge about greenhouse gas emissions or other activities that may negatively impact the environment and a consumer's engagement in pro-environmental activities, including household energy consumption reduction, are strongly related to each other (Pothitou et al., 2016).

Smart energy devices, the main context of this study, are specific types of IoT technologies that have special characteristics and unique purposes in the context of energy consumption. One of the key points in delivering more efficient energy systems is to reduce the cost of electricity consumption. From the consumers' perspective, dynamic pricing and personalised energy tariffs may positively influence individuals to pay more attention to their consumption activities (e.g., Faruqui et al., 2010; Ellabban and Abu-Rub, 2016). In this sense, consumers who use their energy readers more often and engage more with them are more likely to receive lower energy bills. Accordingly, smart energy products have the potential to provide value to a consumer thanks to their capacity to inform the consumer about their energy consumption. Additionally, with smart energy products, a consumer can also learn more about the consequences of their energy consumption (incl. financial ones) and any positive contribution they can make or have made to the environment.

In conclusion, specific motivations have the potential to become particularly relevant in different contexts. In this respect, a consumer's green behaviour intentions, health-related motivations or motives to gain positive financial outcomes (e.g., saving money) can be underlined as significant motivations affecting the strength of consumer engagement (CE) with different IoT technologies. However, because of the lack of research focusing on this important topic, context-specific motivations will be further identified via the exploratory qualitative phase in Chapter 6.

The following section discusses how the influence of technology-related antecedents is conceptualised in this study.

4.2.3 Conceptualising the Influence of Technology-Related Antecedents on Consumer Engagement (CE) with the Internet of Things (IoT)

Based on the discussion of the Technology Acceptance Model (TAM – Section 3.3), similar to technology in general, perceived usefulness (PU) and perceived ease of use (PEOU) of the Internet of Things (IoT) technologies can be considered as two of the most important technology-related factors that have the potential to affect a consumer's perception of IoT. In fact, although some other technology-related factors may also influence a person's adoption, intention to use or actual use of these technologies, many studies have found that both PE and PEOU of IoT has the potential to directly influence the consumer-IoT relationship (e.g., Gao and Bai, 2014; Dong et al., 2017; Grover et al., 2019).) In this respect, higher levels of perceived usefulness (PU) and perceived ease of use (PEOU) of IoT technologies usually lead to a higher level of confidence to use those technologies (Bouwman et al., 2012). Thus, when an IoT technology offers various benefits to its users, and it is easier to understand and use, it is more likely that consumers will be more inclined to accept that product in their daily lives and use it more frequently to have more convenient lives (Balaji and Roy, 2017). Supporting this, Evanschitzky and colleagues (2015) found that PU and PEOU of IoT products have the potential also to have a substantial influence on a consumer's continuous intention to use IoT technologies in future.

In addition to acceptance and continuous intention to use, the current research's purpose is to understand the potential direct influence of these two significant technology-related antecedents, PU and PEOU of technology, on consumer-IoT interaction and assess the extent to which these variables may directly change the strength of consumer engagement (CE) with particular IoT technologies.

Supporting this, CE is strongly related to the dimension of usability (Quesenbery, 2003); when a technological product is considered as useful to use, then a consumer is usually more willing to use that product more regularly (e.g., O'Brien and Toms, 2010; Wati et al., 2011; Park et al., 2014; Abbasi et al., 2017). Tarute et al. (2017) also argued that the usability of various technologies plays a significant role in encouraging stronger engagement to use those technologies further. For instance, Yoon (2018) contended that the PU of green information technologies positively impacts intention to use them.

From the initial adoption stage of acceptance to the post-adoption stage of engagement, consumers' relationship with IoT technologies depends on consumers PU of IoT. IoT technologies are considered more useful when they are believed to produce more favourable and beneficial outcomes for a consumer and allow the consumer to make more efficient decisions in their everyday lives (Toft and Thogersen, 2014). In other words, perceived benefits (i.e., elements of PU of technology) may positively affect consumers' use of various IoT devices (Kim et al., 2017). Additionally, for stronger CE

with a specific IoT technology to happen, there should be a higher level of intention to use that technology, and PU (together with PEOU) of IoT technologies should have the potential to positively influence individuals' intention to use IoT technologies (Park et al., 2014)

Other than PU of IoT technologies, Ellabban and Abu-Rub (2016) contended that a consumer is more likely to accept IoT products as long as it is easy and not complicated to use the smart grid technology while it provides additional benefits (e.g., clear information about energy consumption, a wide range of settings for a higher level of personalisation together with default settings of various options, useful and user-friendly interface, etc.) (e.g., Ellabban and Abu-Rub, 2016). Thus, similar to many other technologies (e.g., Thickett, 2006; Jahangir and Begum, 2008; Ellabban and Abu-Rub, 2016; Yim et al., 2017; Litterbach et al., 2017), PEOU of IoT technologies is a significant technology characteristic for a consumer to continue using it for a more extended period.

As explained above, many studies in different settings have shown the importance of PU and PEOU of a specific technology and the relationship between a consumer and that technology. From a similar perspective, this research investigates the importance of PU and PEOU of IoT on the strength of engagement with these technologies in addition to the acceptance, intention to use and continuous use of these technologies that have been explored by previous research. Adding to that, understanding the influence of PU and PEOU of IoT may potentially play a very important role for the identification of different interactions in the overall IoT engagement framework and why technology-related factors are critical to assess the strength of engagement. Accordingly, to the researcher's knowledge, the current study is the first to show different types of general and context-specific consumer-related motivations as the factors directly influencing the technology-related antecedents simultaneously, therefore indirectly affecting the overall consumer-IoT engagement relationship. In this respect, even though technology-related factors are assumed to directly impact consumer-IoT engagement, the strength of the engagement may highly fluctuate depending on consumers' levels of different types of motivations. Thus, since the human/consumer-technology interaction literature focuses mainly on the direct effect and ignores to shed light on the indirect impact of these very important consumer-related motivations on technology characteristics, this study conceptualises them as the variables that have the potential to influence technology-related antecedents to CE with IoT, and eventually the strength of IoT engagement.

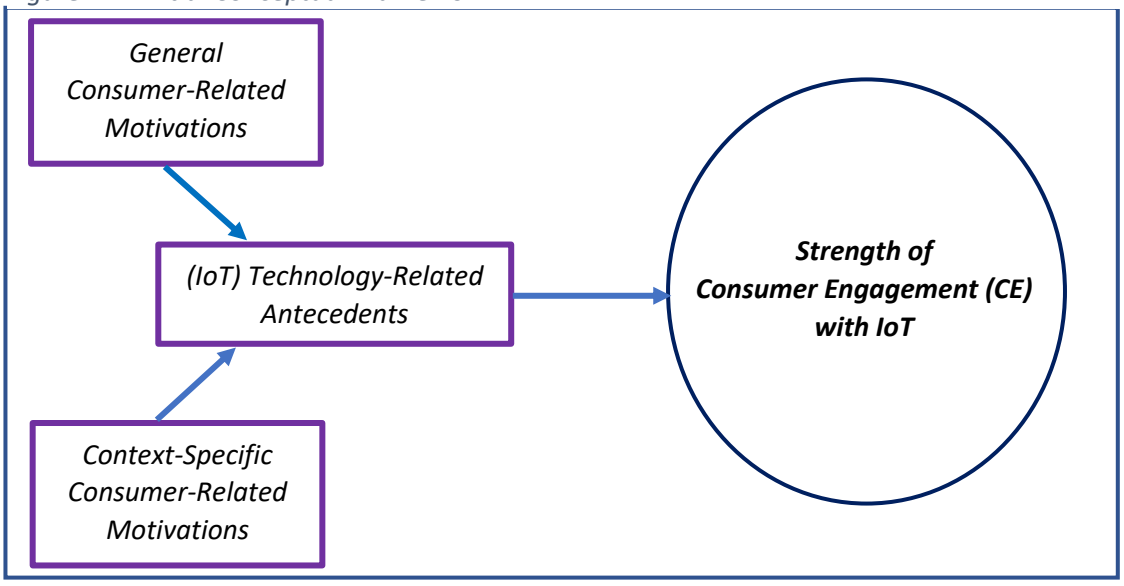
To summarise, PU and PEOU of IoT technologies are two crucial technology-related antecedents that may affect the overall CE process with IoT. Hence, these two factors are conceptualised to have a direct influence on the level of engagement. Moreover, depending on an individual's level of general or context-specific motivations, PU and PEOU may lead to stronger engagement.

4.2.4 Initial Conceptual Framework

Based on the arguments made in sections 4.2.1, 4.2.2 and 4.2.3, Figure 4.1 demonstrates a simple relationship between different types of motivations (i.e., general and context-specific consumer-related motivations) of individuals, technology-related antecedents to CE with the Internet of Things (IoT) technologies and the actual strength of CE with IoT. In this respect, while the Social Presence Theory (SPT) contributes to the framework through highlighting the importance of general consumer-related motivations on technology-related antecedents, the Technology Acceptance Model (TAM) contributes to the framework by helping researcher to understand the influence of technology-related antecedents on the strength of CE with IoT.

Elaborating on this, the SPT plays a key role in the framework to explain the influence of social influence (e.g., general consumer-related motivations, Section 2.3.2) on IoT technology-related antecedents such as perceived ease of use (PEOU) and perceived usefulness (PU) (Section 3.3). In parallel to this relationship, based on the previous customer engagement studies and frameworks, the current framework also investigates the potential impact of context-specific motivations (Section 2.3.3) on technology-related antecedents as both general and context-specific motivations have been discussed to have a similar influence on individuals' perception of different products and services including various technology products. Accordingly, the initial framework (Figure 4.1) shows that the relationship between motivations and technology interaction can be extended to consumer-IoT engagement as well. Finally, rooted from the TAM, the framework also explores the potential direct influence of technology-related antecedents on the actual strength of IoT engagement in order to assess the overall strength of consumer engagement (CE) with IoT.

Figure 4.1: Initial Conceptual Framework



4.3 Summary

The literature focusing on consumer engagement (CE) argues that different factors have the potential to influence the strength of CE with different objects, including technology. Based on this argument, Chapter 4 explains that three main factors have the potential to influence the engagement between a consumer and Internet of Things (IoT) technologies, namely: general consumer-related motivations, context-specific consumer-related motivations and technology-related variables.

Considering the direct and indirect influences of the motivations and technology-related factors, this thesis conceptualises technology-related antecedents to CE with IoT to have a direct influence on the actual consumer-IoT engagement. On the other hand, different types of consumer-related motivations are conceptualised to have an indirect influence on the IoT engagement via their potential effect on the technology-related antecedents to CE with IoT.

The relationship between consumer-related motivations, technology-related factors and consumer-IoT engagement will be further investigated via the exploratory qualitative phase in Chapter 6. Based on the qualitative findings, specific motivations (both general and context-specific) affecting the level of IoT engagement in the context of smart energy devices will also be identified.

Before moving to the discussion of the exploratory phase of this research, the next chapter underlines the specific methodology used in this study.

Chapter 5: Methodology

5.1 Introduction

In this chapter, a detailed overview of the methodological decisions made in this study is presented. Accordingly, before going into detail about the specific methods applied to collect and analyse data, the reasons for selecting these methods are explained. Following this, the later sections talk about sample selection, data collection, and data analysis approaches for both qualitative (i.e., in-depth interviews) and quantitative (i.e., survey) methods.

In order to discuss and justify the method, the research philosophy is clarified in the next section.

5.2 Research Philosophy

Starting from the earliest stages of the research process, it is important for the researchers to understand their research's philosophical assumptions and paradigms. The aim of this section is to clearly and critically explain the underpinning philosophical foundation and dominant paradigm within the discipline of this research.

In order to understand and select the best possible methods for data collection and analysis, together with the overall research approach and strategy, it plays a key role for researchers to determine the ontological philosophy of their study at the early stages of the research. Accordingly, there are two main ontological stances that lead researchers to build their theories: Objectivism (or positivism) and subjectivism (or interpretivism/social constructivism).

Objectivism argues that there is an external and objective reality which is also single and universal (e.g., Aliyu et al., 2014; Alharahsheh and Pius, 2020). Therefore, a researcher's perception and knowledge do not affect the reality. Moreover, in objectivism it is possible for a researcher to understand what is happening without intervention by social entities. Elaborating on this, the reality is not affected by other factors such as culture or social interactions between individuals. Additionally, researchers put themselves out of the research process in the positivist approach and take an external viewpoint (Bryman and Bell, 2011) and they aim to act as an independent observer. So, researchers are independent in the positivist paradigm (Amaratunga et al., 2002). In objectivism, statistically proven data and measurements play an important role because researchers following positivism believe that reality can only be found or confirmed by statistically proven data. Therefore, positivists usually follow quantitative methods such as large-scale surveys in their research (e.g., Saunders et al., 2016; Don-Solomon and Eke, 2018) to obtain generalisable as well as replicable findings in order to focus on facts and reach objectivity. Furthermore, in the positivist paradigm, the generalisability of

the findings to the broader population is also another important aspect, and generally, numerical, high volume data may help researchers to generalize their findings.

Subjectivism, on the other hand, holds that individuals' experiences are important part of the reality and the world is socially constructed (Kasim and Antwi, 2015). Subjectivist researchers believe that people can gain knowledge and experience from their social environments and adapt to the changing situations. Furthermore, the main aim of this type of research is to explore human behaviour and focus on meanings instead of generalising facts (Don-Solomon and Eke, 2018). Hence, under the subjectivist paradigm researchers are usually dependent on the social experience they observe and they aim to understand what is happening in wider social contexts (Amaratunga et al., 2002). Considering the research methods they adopt, subjectivist researchers use various meaning-based methods such as interviews to help them to subjectively observe participants. In general, subjectivist perspective is based on qualitative research in order to explore the reality that constructed by the interaction between individuals in social contexts (Kasim and Antwi, 2015). Thus, as opposed to the positivist ontology, subjectivist research often gathers data from small samples.

Both objectivism and subjectivism have strengths and weaknesses. In this respect, data collection in objectivist research is usually faster and more financially viable. Adding to that, since data is usually collected from large samples, it is easier to widely cover different situations in positivism. However, in many cases, methods used in the positivist paradigm are not flexible enough to help researchers generating theories. They are also not very helpful to understand the meaning of individuals' actions and interaction with other actors. On the contrary, methods followed under the subjectivist paradigm are very useful to understand different meanings, ideas and problems as they are more flexible in nature and have the ability to observe any change happening in the process. Subjectivism also has the potential to lead researchers to theory generation. The main weakness of the subjectivist paradigm can be highlighted as the problems with data collection, management and analysis. Besides, it is also trickier to control the overall research progress in this paradigm compared to objectivism (Amaratunga et al., 2002).

In mixed-method studies, it is usually really hard for researchers to purely rely on either objectivism or subjectivism as multi-method studies carry some of the elements of both paradigms. In this sense, the current study is based on the pragmatism paradigm for many reasons: First of all, many researchers have argued that pragmatism can support mixed-method research (e.g., Pansiri, 2006; Maarouf, 2019). Second, in this research the researcher decided to select smart meter in-home displays (IHD) technologies as the context for the study in order to understand individuals' engagement with these Internet of Things (IoT) products (see Section 1.5 for more details about the

specific context of this study). In order to assess the strength of consumer-IoT engagement, the researcher aims to identify different factors that have the potential to influence the interaction of different actors in a social setting. Depending on this, it can be said that the reality is external and the researcher's goal is to find the best potential reality among multiple ones similar to what pragmatism supports (Maarouf, 2019). In other words, the social interplay between actors may change the reality and generate different experiences (Baert, 2004). Finally, pragmatism is concerned about providing solutions to the real world issues rather than understanding the truth or knowledge behind the reality (e.g., Pansiri, 2006; Creswell, 2014).

In summary, there is no right or wrong when a discussion is made about different philosophical frameworks in business research and different paradigms can be adopted by researchers depending on which way they want to direct their research. For the purpose of understanding the specific interaction between different motivations, technology-related factors and strength of consumer-IoT engagement the researcher adopts a mixed-method research approach in the current study. Based on the pragmatist paradigm, the researcher aims to understand how the overall IoT engagement framework is constructed by the experience of individuals and generate theories to explore underlying factors for better engagement and observe different realities. At the same time, the researcher also focuses on getting generalisable findings to make more concrete assumptions about the actual strength of IoT engagement. In this respect, based on the reasons above the researcher believes that the pragmatist paradigm fits better with this research in terms of epistemological positioning.

Following the philosophy, the research approach and research design are explained next.

5.3 Research Approach and Design

A multi-phased empirical design (i.e., Exploratory Design) was used to achieve the overall aim of this research. Elaborating on this, based on the pragmatist paradigm, this study adopted a sequential mixed method methodology which is divided into qualitative and quantitative stages. In this respect, in the first/qualitative stage, an inductive approach was selected to further explore different variables (i.e., motivations, technology-related antecedents) that have the potential to change a consumer's engagement with a specific IoT technology [i.e., smart meter in-home displays (IHD)]. In other words, the main goal of the first phase of the research was to understand different human-related and technology-related factors that may affect the process of consumer-IHD engagement. In the second/quantitative stage, a deductive research approach was adopted in order to understand the relationship between the factors influencing consumer engagement (CE) with IHD devices and develop generalisable and statistical data for hypotheses testing.

The following sections of this thesis discuss the details (e.g., sample selection, data collection and analysis, etc.) of the qualitative and quantitative stages.

5.4 Phase I: Qualitative Research

In the qualitative stage of this study, in-depth interviews were chosen to collect primary data and explore different variables that have the potential to influence individuals' engagement with smart meter in-home displays (IHD). Accordingly, qualitative interviews and the in-depth data collected from these interviews were aimed at helping the researcher understand consumer engagement with the IHD and explore the range of consumer-related and technology-related factors and their relative importance.

The following section outlines the benefits of qualitative research while highlighting why in-depth interviews were appropriate for this research.

5.4.1 Benefits of Qualitative Research

In many situations, human actions and behaviour are strongly influenced by external settings. In this respect, physical spaces, norms, rewards, traditions, values, and roles can be considered important variables that can affect individuals' actions (Atieno, 2009). According to Maxwell (2013), beliefs, motives and attitudes are best understood through qualitative research. Therefore, qualitative research mainly focuses on different elements of reality that are not possible to be quantified and explains the details of social interactions (Queiros et al., 2017). Thanks to this, qualitative research helps researchers investigate different significant elements in individuals' everyday actions and behaviours. Elaborating on this, the qualitative researcher aims to explore individuals' experience while understanding how human experience is shaped in a larger social context (e.g., Corbin and Strauss, 2008; Rahman, 2020). This way, a more detailed understanding can be achieved about why individuals act or behave in certain situations as different participants' perspectives become valuable.

Moreover, qualitative research is designed in a more flexible structure, and researchers can reconstruct the design depending on what they want to interpret (Maxwell, 2012). Hence, by adopting qualitative research, researchers may adjust the questions, modify the context or other elements to get enhanced responses. While doing that, qualitative research is usually used to facilitate data without completely changing the context. Thus, qualitative methods guide researchers in exploring the relationship between various variables and processes in specific contexts.

Considering the description and definition of research objectives and questions, qualitative research may be adopted as most qualitative methods are helpful to see existing data from different perspectives and formulate theories (Atieno, 2009). As Almeida et al. (2017) also stated, qualitative research focuses on discovering the problem's framework and exploratorily analysing the situation. This is a particularly important aspect of qualitative research because it is an open-ended process in which none of the answers can be identified as entirely right or wrong. This is very important, especially to explore the relationship between potential factors influencing specific processes in larger social contexts.

In this study, in-depth interviews were adopted to collect qualitative data in the first phase of research. In-depth interviews are usually very useful for providing detailed qualitative data and important for getting an in-depth explanation of a specific action or behaviour (e.g., Brashear et al., 2012; Cote and Raz, 2015; Rosenthal, 2016) in a broader social environment. Moreover, one of the advantages of this approach is the close collaboration between the researcher and the participant, allowing interviewees to talk about their own experiences (e.g., Qu and Dumay, 2011; Kendall, 2014) thanks to the possibility of asking highly flexible, open-ended questions. For example, in their research, Axsen et al. (2013) used more flexible and open-ended questions to get more personal answers on their questions and analyse the types and level of effects of different sociological influences on buying/using behaviour of workers who have different levels of experience of using a specific technological product. Similarly, in-depth interviews were selected as the qualitative method in this study in order to get more detailed answers from smart meter in-home display (IHD) users and explore distinct consumer-related and technology-related variables that have the potential to influence consumer-IHD engagement. Furthermore, the highly flexible and open-ended structure of in-depth interviews were the other main reasons for the researcher for choosing this method to collect qualitative data.

Elaborating on this, the purpose of the interviews was to explore key variables that have the potential to affect the strength of IoT engagement in the overall consumer engagement (CE) framework. Based on the pragmatist paradigm, interviews were selected as the best option to help the researcher to understand meanings of different elements in the wider social setting and these elements' impact on human perception. Additionally, the researcher also decided to undertake interviews to find the relevance of different factors influencing consumer-technology interaction that have been highlighted by the previous research in the specific context of IHD engagement.

To summarise, qualitative research is important to get responses that are not possible to obtain via quantitative methods. In qualitative research, individuals' experience, beliefs, motives, opinions and values, together with a number of variables in the social setting, play crucial roles in understanding

and explaining how individuals act in specific situations. The in-depth interview method is one of the most commonly adopted qualitative research methods because researchers can collect detailed and highly informative data with fewer participants than other methods. Therefore, for the purposes of discovering participants' experiences, motives, values and construct a connection between different factors influencing specific actions, in-depth interviews were selected in this research.

The following section sheds light on the design of in-depth interviews.

5.4.2 Design of In-Depth Interviews

Getting more detailed, in-depth information about individuals' domestic energy consumption behaviour, experience with the smart meter and IHD, the relationship between their IHD use and experience, and the influence of motivations on domestic energy consumption behaviour were the main goals of the qualitative interviews. In other words, qualitative interviews' main purpose was to explore and identify different factors that have the potential to influence individuals' interaction with IHD.

Accordingly, in order to get detailed information about participants' interaction with their smart meter in-home display (IHD), interviews were conducted in a semi-structured format, and each participant was asked a number of questions under three main sections/subjects.

In the **first** section, interviewees were asked questions about the location of the IHD at home, how they read the information on the device and how frequently they do it (i.e., integration with the device), IHD's overall impact on interviewees' domestic energy consumption behaviour change, interviewees' detailed experience with the device over the last seven days, and interviewees' level of satisfaction with their IHD. With these questions, it was aimed to understand to what extent individuals interact with their IHD on a daily and/or regular basis. In the **second** section, questions about individuals' overall money attitude on the decision-making process, as well as how technology itself and technology-related factors affect their perception of technology, were asked. Questions regarding the influence of other people's comments and the impact of social influence on the participants' behaviours and actions were also asked in this qualitative interview section. Accordingly, under this section, specific subsections were the influence of other people on participants' domestic energy consumption, comparative feedback option of their IHD, and participants' interest in receiving comparative feedback from their IHD. The purpose of the questions in this section was to understand how different financial, social and technology-related factors could impact the consumer-IHD interaction. In the **final** section, participants were asked questions to understand their overall belief about environment-friendly values, actions and behaviours they undertake to save the environment.

In this section, interviewees talked about what they think about the environment and their intention to undertake pro-environmental actions. Since IHD is a product that can be used to save energy and protect the environment, the questions in the final section were asked to get a deeper knowledge of participants' understanding of the environment-friendly actions and what type of activities they undertake (or willing to undertake) to help saving the environment. Based on the answers to these questions, the researcher believed that he could make some connections between variables and IHD engagement and build the final version of the conceptual framework to assess the influence of different factors on actual strength of engagement.

In summary, in order to understand individuals' domestic energy consumption behaviour, their actual interaction of their IHD, their opinion of the IHD as well as how financial attitudes, social influences and environmental values affect IHD users' perception of these devices and actual interaction with these devices, the researcher decided to ask the specific interview questions to the participants.

A detailed discussion guide is provided in Appendix B. The following section explains the sampling selection for the in-depth interviews.

5.4.3 Sample Selection for In-Depth Interviews

While there is no generally accepted rule on the number of interview participants required to collect highly analysable qualitative data, a number of scholars have argued that having 8 to 12 interviews is the acceptable lower limit (e.g., Baker and Edwards, 2012; Dworking, 2012). Based on this, in this study, qualitative data saturation was reached after having ten interviews with individuals in different areas of Scotland and England. In other words, no new information was forthcoming after contacting 10 participants in the qualitative stage. The requirements for selecting individuals to participate in these interviews was that they should have a smart meter IHD installed in their home and have already used their in-home displays (IHD) to follow their energy consumption at home. Considering these requirements and in order to collect data from different segments of the society, 4 male (40%) and 6 female (60%) candidates were interviewed. Interviewees' age range was 20 to 65, different levels of education (i.e., high school, undergraduate, and PhD) and income (12,000£ to 120,000£ annually) were included. The profiles of each interview participant are shown in section 6.1.

The researcher recruited the participants for the interviews at the university and other locations such as coffee shops and libraries. The researcher himself, with the help of his knowledge and his friends' and colleagues' knowledge (i.e., snowballing sampling), was able to contact seven of the interviewees directly. On the other hand, some candidates were asked to participate in the interviews by following guerrilla approach techniques in various locations. In order to do that, the researcher politely

introduced himself to the potential interviewees and explained to them the details of the research. In some cases, randomly contacting people in different locations and asking them to participate in a study may create some issues such as trust. However, since the researcher got the approval of the ethics committee before looking for participants he was able to contact these individuals randomly and explain them the purpose of the interviews and research. Once the potential candidates agreed they wanted to be involved in the study, they were asked more questions before the interviews. Elaborating on this, individuals that the researcher had not been introduced to by people in his social context, known or met before the interviews, were asked about their availability to participate in the interviews after the researcher asked them some preliminary questions if they met the required criteria. In the end, three more participants, who met the requirement, were available for an interview.

Although the majority of the interview participants were found with the snowball sampling method, and this method has been criticized for not providing completely random sample selection processes (e.g., Sedgwick, 2013; Parker et al., 2019), the researcher took a number of measures to minimise the bias effect. In this respect, in order to overcome bias associated with the selection of the participants, the researcher also asked a number of demographics-based questions to understand participants' backgrounds and aimed not to have in-depth interviews with individuals who had highly similar socio-economic backgrounds. Therefore, some potential candidates were taken out of the list and not interviewed because of this reason. For example, when two interview candidates had the same level of education and total income and were almost the same age, the researcher only interviewed one of them. Additionally, randomly contacting people in different locations to participate in the study also helped the researcher to reach a number of individuals with relatively more diverse backgrounds.

In short, participants for the qualitative, in-depth interviews were selected from different socio-economic backgrounds, and the researcher put enough care to explore the smart meter IHD usage experience of individuals from different segments of the society. Next, the qualitative data collection approach and analysis are explained.

5.4.4 Qualitative Data Collection and Analysis

After giving brief information about the research and the interview, the researcher asked for the permission of every participant for recording before moving on and starting to ask questions. While one interview was done in the video call format (the researcher and the interviewee were in different cities at the time of the interview), all other interviews were done face-to-face in different places, including participants' homes and coffee shops. On average, interviews took around 30-35 minutes in

total. Therefore, it can be said that the interviews were actually in the format of mini-depth rather than much longer in-depth ones.

Before analysis, in order to verify the qualitative data for vigour, reliability and validity data (e.g., Long and Johnson, 2000; Morse et al., 2002; Rose and Johnson, 2020), the researcher decided not to have any interviews take much shorter or longer time than the aimed duration (e.g., 30 minutes). In this sense, in every section of the interviews participants were asked to describe and talk more about their experiences, thoughts or activities in order to get more and enough details from them. Furthermore, each interview was meticulously transcribed by the researcher after carefully listening to the recordings of the interviews. Before analysing the data, the researcher made sure that all of the interviews were transcribed in clean English in Microsoft Word. Following the verification, the qualitative data was analysed using thematic analysis. Accordingly, each transcript was coded depending on the qualitative interview sections explained in Section 5.4.2. In this respect, coding was divided into a number of categories to understand participants' energy consumption at home, satisfaction level (i.e., low, medium, high) of using their smart meter in-home display (IHD) and acceptance/using (i.e., low acceptance level, high acceptance level) of a new technological product. Additionally, the participants' level of different motivations (e.g., social, financial, environmental) were also divided into three categories as low, medium and high. After coding every participants' energy consumption, satisfaction level of their IHD and different types of motivations, the researcher analysed the data to better identify the relationship between participants' IHD adoption and factors with the potential to influence the strength of IHD adoption.

From the qualitative data, it was explored that two technology-related characteristics [perceived usefulness (PU) and perceived ease of use (PEOU) of technology], one general consumer-related motivations [susceptibility to normative influence (SNI)] and two context-specific consumer-related motivations [attitude to money (ATM) and green environmentalism (GE)] can potentially have an influence on consumer engagement (CE) with IHD technologies. Further discussion about identifying these variables affecting the level of consumer-IHD engagement and the most significant findings from the interviews will be provided in Chapter 6.

Before moving into a discussion of each of these findings, information regarding the second phase of research methodology (i.e., quantitative survey) is provided in the following sections.

5.5 Phase II: Quantitative Research

A large-scale survey was chosen to collect primary data in the quantitative stage of this study. After identifying different factors that have the potential to influence consumer engagement (CE) with smart meter in-home displays (IHD) with in-depth interviews in the first phase of the research, the quantitative survey was used to produce more statistically valid, generalisable data which could lead the researcher to test the hypotheses about the relationship between specific variables in the consumer-IHD engagement framework in the second phase of the research.

Next, the benefits of quantitative research and why a large-scale survey was used in this study are explained.

5.5.1 Benefits of Quantitative Research

Following in-depth, face-to-face interviews conducted to get more detailed information about individuals' experience with their smart meter in-home display (IHD), the second stage of the research (i.e., quantitative research) adopted in this study was aimed at helping the researcher to get more numerical data and test the relationships between concepts emerging from the literature review and the qualitative phase.

First, quantitative research is beneficial because researchers may get statistically generalisable outcomes with various quantitative methods (e.g., Smith, 2018). Thanks to its capability to investigate large samples, it is easier to make generalised conclusions with quantitative methods. Additionally, quantitative research gives the researcher the ability to use randomised samples to minimise sampling bias (e.g., Atieno, 2009; Rahman, 2017).

Second, considering the design and analysis, the quantitative approach offers various benefits. In this manner, quantitative research usually requires a detailed design. When the specific quantitative method is designed correctly, other researchers can easily reproduce the analysis and results. In quantitative research, data analysis requires less time as there are different, robust tools (e.g., SPSS, R) to analyse data quickly (e.g., Connolly, 2007).

Third, since the quantitative approach aims to obtain more systematic, scientific and reliable outcomes, quantitative research guides researchers to construct better structured theoretical frameworks and hypotheses (Queiros et al., 2017). In many cases, hypotheses tested with quantitative methods can be potentially generalised to the wider population.

Accordingly, the survey method is useful when researchers want to obtain information from large samples of the population in a shorter time with a relatively low cost. Unlike in-depth interviews, "*the*

breadth of coverage of many people or events means that the results from surveys can be generalisable to a population and provide high external validity" (Kelley et al., 2003, p. 263). For example, Wu (2003) contacted 600 respondents in Taiwan and Rathod, and Bhatt (2013) collected data from 300 respondents in India through surveys to determine the role of psychological and sociological factors in purchasing behaviour of Taiwanese and Indian consumers. In other words, the survey method helped the authors to collect data from large samples in a relatively short period.

Even though a large-scale survey is a commonly used quantitative method to collect statistically generalisable data, one of the limitations of the paper-based quantitative survey method is contacting sufficient people face-to-face. However, online surveys offer the potential for the researcher to gather data from a larger number of people from different geographical regions and with entirely different social and cultural backgrounds (e.g., Wright, 2005). Besides, compared to face-to-face surveys, online surveys can collect responses in a shorter period from individuals located in different areas of the country or world (e.g., Wright, 2005). With paper-based, face-to-face surveys collecting responses usually costs more and requires more time (e.g., Evans and Mathur, 2005; Nayak and Narayan, 2019).

Moreover, Dale (2006) argued that responses on surveys usually change depending on whether the respondents complete the survey fully by themselves or the researcher asks them the questions face-to-face, and people typically give more credible responses when they complete the questionnaires themselves. In online surveys, each participant is able to fill out the questionnaire themselves and whenever they want. While this situation increases automation in data input and management (e.g., Nair and Adams, 2009; Bennett and Nair, 2011), it can also be underlined as another advantage and strength of online surveys compared to other quantitative methods, especially face-to-face surveys.

Another benefit of online surveys is the high flexibility of design. With a computer, researchers may easily change the structure and design of online surveys. Thanks to this, any last-minute edits can be conveniently done in online surveys. Moreover, online surveys can also be used to design much more complex questionnaires (Alessi and Martin, 2010). With various useful specifications (e.g., skip a question, not forwarding to the next question before answering the current question, etc.), online surveys can guide participants throughout the questionnaire and make the overall process much easier for them while helping researchers to collect better quality data (e.g., Manfreda et al., 2008; Evans and Mathur, 2018).

Because of all the reasons explained in this section, the online survey method was selected as the main tool to collect primary quantitative data to test the specific relationships between variables in the second stage of research.

The following sections of this chapter shed light on the specifics of the online quantitative survey implemented to test hypotheses. Later on, a discussion on selecting specific techniques to analyse and interpret the quantitative data is also given in the following sections. To start with, the next section talks about the design of an online survey while explaining the rationale behind choosing different scales to generate the items of each variable in the questionnaire.

5.5.2 Design of Online Survey

The questionnaire for the online survey had three parts: an introductory part and two main parts with questions. Before allowing participants to start answering questions, they were given information about the project and the purpose of the online survey at the beginning of the questionnaire. Additionally, the introductory part of the questionnaire also included some information about smart meter in-home display (IHD) and a couple of images to remind participants what a smart meter IHD looks like. Finally, in the initial part, participants were asked to consent to be involved in the study. Any candidate who did not give his/her consent automatically received a thank you message and could not progress further with the survey.

After giving information about the project and the smart meter IHD and asking for their consent to be involved in the study, participants were asked a number of demographic questions (e.g., gender, age, level of income and education, length of using their smart meter (IHD), etc.). For the purpose of investigating the relationship between different socio-demographic variables, factors influencing individuals' interaction with IHD and their IHD engagement, questions targeting various details of participants were asked in this part of the questionnaire. In other words, questions about demographics were included to understand the influence of control variables on participants' strength of engagement with smart meter IHD. Moreover, some of the demographic questions (e.g., age) were used to automatically eliminate online survey candidates from the survey if they were not in the targeted group. More information about the sample selection for the online survey is given in the next section. Different categories used for demographic characteristics are illustrated in Section 8.2.

Following the first part and questions about demographics, in the second main part of the questionnaire, participants were asked questions to measure their strength of engagement with their smart meter IHD, perceived usefulness (PU) and perceived ease of use (PEOU) of IHD, overall attitude to money (ATM), susceptibility to normative influence (SNI) and green environmentalism (GE). These questions were designed to analyse and assess the specific influence of different technology-related and motivational factors on overall consumer engagement (CE) with IHD. All the items generated to measure these relationships were adopted from academic scales used in relevant studies and fields

(see Appendix C for the table with all the constructs, items, source and reliabilities in the original sources). The rest of this section talks about the scales and items used in the final part of the online survey.

First of all, the user engagement scale by O'Brien and Toms (2010) was selected to measure participants' engagement with their IHD. In the user engagement scale, the 'point of engagement' is generated by a user's/consumer's motivation, interest and ability to interact with the device or application, and more importantly, by the physical attributes (e.g., aesthetics) of the interface of a specific product or application (O'Brien and Toms, 2008).

In order to measure CE more accurately, some scholars have put a considerable amount of attention in their research to construct scales. However, most of those scales have been created to measure the strength of CE mainly with brands only, despite the fact that only the minority of them (e.g., Hollebeek et al., 2014; Vivek et al., 2014) cover different dimensions (e.g., cognitive, emotional and behavioural) to assess engagement. In this respect, this study adopted the user engagement scale that can be adapted to the consumer-IoT interaction to measure different dimensions of engagement as underlined in Section 3.3 earlier. While CE's emotional, cognitive and behavioural dimensionality is highly context-bound and controversial, the adapted user engagement scale aims to assist researchers in understanding individuals' interaction with various computer applications (O'Brien and Toms, 2010; Zhuang et al., 2017; Algharabat, 2018).

Elaborating on this, the researcher decided to use the user engagement scale by O'Brien and Toms (2010) for a couple of reasons. First of all, cognitive, emotional and behavioural dimensions are usually highly context-bound. Although numerous scales can be adapted to consumer-brand, consumer-social media, etc. engagement, these scales do not entirely fit the IoT and smart meter IHD context. In other words, the user engagement scale was adopted because the researcher considered that using this scale to explore different dimensions of IHD engagement was a more effective and better option than using other CE scales that were context-bound (e.g., brand engagement, specific social media tool engagement, etc.). Second, the dimensions (e.g., aesthetics, perceived usability, focused attention, etc.) created by O'Brien and Toms (2010) offer great potential to measure the strength of CE specific to smart meter IHD. For example, the authors argued a strong relationship between consumers' ability and desire to use (i.e., PEOU and PU of technology) a technological product and the aesthetics dimension. Thus, the user engagement scale might help explore the significant relationship between motivations, technology-related factors influencing CE with specific IoT technologies, and CE's actual strength with IoT technologies.

In the first version of the user engagement scale, 'Aesthetics', 'Novelty', 'Interest', 'Motivation' and 'Goals' were the main point of engagement attributes (O'Brien and Toms, 2008). Later on, the authors developed the user engagement scale to have six sub-dimensions. In addition to Aesthetics and Novelty, they added 'Felt Involvement', 'Focused Attention', 'Perceived Usability' and 'Endurability' to replace 'Interest', 'Motivation' and 'Goals' with the purpose of helping CE researchers to understand the different aspects of consumer-technology interactions (O'Brien and Toms, 2010). In order to develop this scale, the authors tested more than 100 items, contacted more than 400 online shoppers, and then conducted another study with 800 online shoppers. In the end, the authors created an instrument with 31 items under six dimensions. After that, they eliminated 12 more items and created the final version of the user engagement scale with 19 items. Following this, items of the user engagement scale were allocated in five dimensions: Aesthetics (AE – five items), Focused Attention (FA – four items), Perceived Usability (PU – five items), Novelty (NO – two items) and Endurability (EN – two items). All of these items were included in the survey of this study.

In order to adapt the user engagement scale to this study, "IHD" (Table 5.1) replaced "Webcast Systems" (i.e., the specific context of the original scale).

Moreover, O'Brien and Toms (2010) initially offered six dimensions in their user engagement scale. Still, they later underlined that among these six dimensions only the aesthetics, perceived usability and focused attention dimensions managed to have high reliability and validity scores with their items, whereas others (i.e., endurability, novelty and felt involvement) failed to build their own dimensions all the time. The items in these dimensions have been distributed to other factors/dimensions in some cases (O'Brien et al., 2018). According to this, by using the aesthetics, perceived usability and focused attention dimensions, researchers may construct reliable and valid models to test the relationships between specific variables in the overall IoT engagement framework and quantitatively investigate the strength of user engagement with high-technology products.

Based on this, this study also adopted three dimensions (aesthetics, perceived usability and focused attention) of the user engagement scale because the items in these dimensions generated really high reliability scores. In addition to that, the literature and findings from the qualitative phase (Chapter 6) indicate that a user's actual engagement with the device highly depends on whether the user finds his/her IHD aesthetically appealing. Additionally, how easy or hard a user sees an IHD to use might significantly influence IHD engagement. Finally, in many cases, when a user is strongly engaged with certain technological products, that user usually puts a certain level of attention when using the device. In this respect, a user's level of attention to the device may affect the IHD engagement as well.

Table 5.1: Scale for Measuring Leve of Consumer Engagement (CE) with In-Home Display (IHD)

Dimensions	***Items***
Aesthetics (AE)	My smart meter in-home display (IHD) is aesthetically appealing
Aesthetics (AE)	My IHD appeals to my senses
Aesthetics (AE)	I find the screen layout of my IHD to be visually pleasing
Aesthetics (AE)	My IHD is attractive
Aesthetics (AE)	I like the graphics and images used on my IHD
Focused Attention (FA)	I block out things around me when I am using my IHD
Focused Attention (FA)	When I am using my IHD, I lose track of the world around me
Focused Attention (FA)	When checking my IHD, I am absorbed in my task
Focused Attention (FA)	When checking my IHD, I am so involved that I lose track of time
Focused Attention (FA)	When using my IHD, I lose myself in this experience
Perceived Usability (PU)	I feel frustrated while using my IHD
Perceived Usability (PU)	I feel annoyed while using my IHD
Perceived Usability (PU)	I feel discouraged while using my IHD
Perceived Usability (PU)	Using my IHD is taxing
Perceived Usability (PU)	Using my IHD is stimulating
Novelty (NO)	I continue to use my IHD out of curiosity
Novelty (NO)	The content of my IHD incites my curiosity
Endurability (EN)	Using my IHD is worthwhile
Endurability (EN)	I would recommend that others use a similar IHD

Adapted from O'Brien and Toms (2010)

Before moving to the next scale, it is important to explain that while the names of the aesthetics and focused attention dimensions were not changed in the adapted engagement scale, the name of the perceived usability dimension was changed to 'Usability' to prevent confusion with one of the technology-related factors, perceived usefulness (PU).

The items for the PU and PEOU of IHD technologies were created based on the scale by Ghazal et al. (2016). Unlike many other PU and PEOU scales, the authors focused on similar technology (i.e., energy-saving app) to construct their scale. Moreover, Saengsuwan (2017) also used similar items to measure the impact of usefulness and ease of use of smart grids on residential consumers' adoption of these technologies. Hence, after careful investigation, the researcher decided to adopt the Ghazal et al. (2016)'s scale to measure PU and PEOU of IHD. However, similar to the scale for IHD engagement, items from PU and PEOU scale were adapted to the IHD context (Table 5.2).

Table 5.2: Scale for Measuring PU and PEOU of Smart Meter In-Home Display (IHD)

Dimensions	***Items***
Perceived Usefulness (PU)	Using my smart meter in-home display (IHD) increases energy conservation
Perceived Usefulness (PU)	Using my IHD saves money
Perceived Usefulness (PU)	Using my IHD improves control over energy consumption
Perceived Ease of Use (PEOU)	My IHD seems easy to use
Perceived Ease of Use (PEOU)	My IHD seems easy to learn
Perceived Ease of Use (PEOU)	It seems easy to get my IHD to do what I want it to do

Adapted from Ghazal et al. (2010)

Third, items to measure participants' attitude to money (ATM) were taken directly from Lim and Teo (1997)'s eight-factor money scale as the researcher believed that the items in this scale had better fit for the assessment of a consumer's overall perception of money compared to alternative money scales. In business literature, many authors (e.g., Koenig-Lewis et al. 2010; Herdjiono and Damanik, 2016) have adapted the money scale generated by Lim and Teo (1997) to understand the potential influence of finance-related variables and perceptions on individuals' actions.

In their paper, Lim and Teo (1997) used 34 items in total: Factor 1 – Obsession (seven items), Factor 2 – Power (five items), Factor 3 – Budget (five items), Factor 4 – Achievement (four items), Factor 5 – Evaluation (three items), Factor 6 – Anxiety (four items), Factor 7 - Retention (three items) and Factor 8 – Non-generous (three items). Nonetheless, since the purpose of this study to explore how individuals manage their money and how individuals' money-saving behaviour influence their perception about specific technologies (i.e., PU of IoT technologies) and eventually the strength of engagement with these technologies, the researcher decided to apply the Budget factor/dimension (Table 5.3) in the online survey to measure participants' level of ATM.

Table 5.3: Scale for Measuring Participants' Level of Attitude to Money (ATM)

Dimension	***Items***
Attitude to Money (ATM)	I am proud of my ability to save money
Attitude to Money (ATM)	I budget my money very well
Attitude to Money (ATM)	I use my money very carefully
Attitude to Money (ATM)	I prefer to save money because I'm never sure when things will collapse, and I'll need the cash
Attitude to Money (ATM)	I feel compelled to argue or bargain about the cost of almost everything I buy

Adapted from Lim and Teo (1997)

Fourth, like most of the scales covering CE, many social/normative influence scales were highly context-bound (e.g., the impact of social influence on mobile technology adoption or purchase of environment-friendly products). Moreover, most of the scales regarding the impact of social influence on individuals' behaviour did not provide suitable items to determine how social factors affect individuals in general. Hence, the SNI scale from Gopinath and Nyer (2009) (Table 5.4), which was commonly used in previous research (e.g., Bennett, 2013; Joe et al., 2017), was adopted in the online survey as that scale's items were mainly focusing on understanding how individuals change their behaviour depending on other people's behaviour or the social influence coming from other people.

Finally, the green environmentalism (GE) scale by Haws et al. (2010) was selected to assess participants' level of environmental motivation and GE (Table 5.5). A number of researchers (e.g., Bhatia and Jain, 2013; Marde et al., 2018) have adapted the GE scale to investigate the influence of environmental concerns on consumer preferences and behaviour. Similarly, the researcher decided to adopt this scale because all of the items were constructed to investigate an individual's overall opinion of the environment-friendly activities and behaviour, which is strongly related to their motivational level to protect the environment.

Table 5.4: Scale for Measuring Participants' Level of Susceptibility to Normative Influence (SNI)

Dimensions	***Items***
Susceptibility to Normative Influence (SNI)	If I want to be like someone, I often try to behave like them
Susceptibility to Normative Influence (SNI)	It is important that others like the choices I make
Susceptibility to Normative Influence (SNI)	I often identify with other people by basing my actions on theirs
Susceptibility to Normative Influence (SNI)	I generally do things that I think others will approve of
Susceptibility to Normative Influence (SNI)	I like to know how to make a good impression on others
Susceptibility to Normative Influence (SNI)	I achieve a sense of belonging with others by thinking like them

Adapted from Gopinath and Nyer (2009)

Table 5.5: Scale for Measuring Participants' Level of Green Environmentalism (GE)

Dimensions	***Items***
Green Environmentalism (GE)	It is important to me that the products I use do not harm the environment
Green Environmentalism (GE)	I consider the potential environmental impact of my actions when making many of my decisions
Green Environmentalism (GE)	My purchase habits are affected by my concern for our environment
Green Environmentalism (GE)	I am concerned about wasting the resources of our planet.
Green Environmentalism (GE)	I would describe myself as environmentally responsible
Green Environmentalism (GE)	I am willing to be inconvenienced in order to take actions that are more environmentally friendly
Green Environmentalism (GE)	I consider the potential environmental impact of my actions when making many of my decisions.

Adapted from Haws et al. (2010)

All items under engagement, PU and PEOU, ATM, SNI and GE were scored on a 1 to 5 – point Strongly Disagree to Strongly Agree Likert scale throughout the online survey. For questions related to demographics, participants were provided different options and categories to select their gender, age,

individuals living in their household, etc. The questionnaire for the online survey is presented in Appendix D.

In conclusion, five scales from relevant studies in the literature were used to prepare the questionnaire for the online survey. Following the design of the online survey, candidates were selected and asked to complete the survey. The next section discusses the sample selection for the online survey and quantitative data collection processes.

5.5.3 Sample Selection for Online Survey and Quantitative Data Collection

As a rule of thumb, collecting responses from 300 participants can be considered as the lower statistically acceptable limit for a survey method (e.g., Muthen and Muthen, 2002; Burmeister and Aitken, 2012). Based on this, the researcher decided to collect 320 responses from British consumers who had experience using a smart meter in-home display (IHD) for statistical generalisation and validation. Despite the fact that the aim was to get nationally representative data, it was not feasible for the researcher to travel across the UK and find potential candidates to fill out the survey all around the country. Moreover, it was impossible for the researcher to identify participants, given that there was no record of people that had a smart meter at home. In other words, using a survey panel company was needed to ensure that a sample of participants with IHD installed in their home match as much as possible a nationally representative profile. Therefore, for the purpose of collecting more geographically dispersed data more conveniently, the researcher contacted a survey panel company (i.e., Qualtrics) to help find respondents. In the end, 320 responses were collected online from participants who were located in different locations in the UK.

After preparing the initial version of the questionnaire and finalising the sample, the researcher used a computer-based survey preparation tool offered by Qualtrics to prepare the final version of the online survey and collect the primary quantitative data. It was anticipated that the survey would take around 9 minutes on average to complete.

In order to comply with the rules of ethics and collect data from the targeted group of individuals with specific socio-economic backgrounds, participants who were younger than 18 or older than 65 were not included in the total number of respondents and all other participants who had the specific demographic characteristics were asked several ‘trap’ questions (e.g., Gao et al., 2016; Alvarez et al., 2019) to be qualified to complete the survey. Accordingly, candidates who failed to answer any of the trap questions were immediately removed from the survey, and their responses were not included in the final data. For example, when a participant was asked to select a specific option such as “Strongly Agree” for a particular item in a question but failed to do so, that participant received a ‘thank you’

message and was informed that they could not progress further with the survey. In this respect, using trap questions was very helpful in ensuring good quality data (e.g., Jones et al., 2015; Liu and Wronski, 2018).

Following the sample selection and data collection, quantitative data preparation and analysis are discussed in the next section.

5.5.4 Quantitative Data Preparation and Analysis

After collecting 320 responses (i.e., completely usable responses), the researcher first exported all the quantitative data to SPSS software. Before editing the responses and prepare the final version of the quantitative data in SPSS, the researcher identified the outliers using the 'Boxplot' option under 'Descriptive Statistics' by selecting the 'Analyse' tool. After clearly analysing the boxplot and checking the circles and the boxplot, the researcher decided to remove nine responses from the dataset. In the end, 311 responses were selected as statistically valid and usable. Next, all the labels (e.g., questions, scale items, etc.) in SPSS were coded for convenience (e.g., Aesth1, Aesth2, Aesth3, Aesth4 and Aesth5 for the Aesthetics items of the engagement scale).

Once the data cleaning process was completed, the researcher checked for negatively worded items to reverse-code them. Accordingly, four items from the engagement scale were reverse-coded: "I feel frustrated while using my IHD", "I feel annoyed while using my IHD", "I feel discouraged while using my IHD", and "Using my IHD is taxing". Every other item used in the online survey was positively worded.

Once the data was finalised, the researcher undertook both univariate and bivariate analyses to better understand the data and the connection between various variables before progressing further with the quantitative data analysis. Additionally, in order to check the distribution of the responses and descriptive statistics such as mean, standard deviation, skewness, etc., the researcher generated charts and graphs in SPSS.

After this step, according to the scales adopted for the quantitative phase and the relevant studies (e.g., Ballantyne et al., 2011; Kusurkar et al., 2013; Carneiro et al., 2018) investigating the relationship between variables that have a high number of items, the researcher decided to apply Structural Equation Modelling (SEM) technique to test the set of hypotheses proposed (see section 7.2 for the specific hypotheses). As stated earlier in Section 1.4, one of the objectives (e.g., RO3) of this research was to quantitatively investigate how consumer-related and technology-related drivers directly and indirectly influence distinct dimensions of consumer engagement (CE) with IoT technologies the

context of energy consumption. As SEM is one of the most popular and most commonly used quantitative analysis tools to assess the relationship between dependent and independent variables, this method was selected to quantitatively analyse the data and undertake hypotheses testing.

According to Lefcheck (2016, p. 573), "*structural equation models are probabilistic models that unite multiple predictors and response variables in a single causal network. They are often represented using path diagrams, where arrows indicate directional relationships between observed variables. These relationships can be captured in a series of structured equations that correspond to the pathways in the model*". SEM is believed to be one of the most robust and most effective tools to test the proposed relationships (e.g., Bollen and Arminger, 1991; Hackl and Westlund, 2000; Hipp and Bollen, 2003; Nachtigall et al., 2003; Tarka, 2018). Thanks to its ability to estimate the relationship between multiple and interrelated variables very effectively and efficiently (i.e., in a single, clearly constructed analysis), SEM has been one of the most common quantitative data analysis tools that are used by researchers in different fields, including health sciences (e.g., Sharif et al., 2019), transportation systems (e.g., Eboli and Mazzulla, 2012), environmental sustainability (e.g., Mardani et al., 2017; Gbongli et al., 2019) and marketing (e.g., Chin et al., 2008; Martinez-Lopez et al., 2013; Goel and Brar, 2018).

Researchers usually undertake two main analyses to construct relationships between observed variables in the overall SEM process: Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). While the EFA is run and basic descriptive statistics of the observed variables are obtained by using SPSS, the CFA (i.e., one of the options of the SEM) is generally implemented in order to verify the factor structure of the variables and test the hypotheses regarding these variables (e.g., Gallagher and Brown, 2013; Prudon, 2015; Dagnall et al., 2018). Similarly, both the EFA and CFA were run in this research. In addition to SPSS, the researcher used SPSS AMOS, which gave the option to draw and state the relationships between the research variables, structure the relationships between the variables (as well as items) together with the overall model and undertake CFA.

5.6 Summary

To conclude this chapter, a sequential mixed method strategy was implemented in this study as the research methodology. While the qualitative data was collected in the first phase through in-depth, face-to-face interviews from 10 participants in different parts of the UK, in the second phase, quantitative data was collected via an online survey created by Qualtrics with a target population of 320 participants who already have used a smart meter in-home display (IHD). In order to analyse the qualitative findings, thematic analysis was used, and the data were coded accordingly. Structural

Equation Modelling (SEM) by using SPSS and SPSS AMOS was applied in order to analyse the quantitative data.

The following two chapters discuss the findings from the qualitative interviews and the resulting conceptual framework and hypotheses development.

Chapter 6: Findings and Discussion of Qualitative Phase

6.1 Introduction

In this chapter, the findings from the exploratory stage of this research are explained in detail. As discussed earlier in section 5.5, qualitative interviews were divided into three main parts. Under each part, participants were asked questions to explore their overall experience with smart meter in-home displays (IHD) and their perception of these devices and identify the potential factors that may influence their interaction with IHD. Before going into detail and explaining the findings, Table 6.1 below shows the profiles of each interview participant.

Table 6.1: Profiles of Interview Participants

Pseudonym	Gender	Age	Level of Education	Level of Income	Occupation
Adam	Male	20	High School	£12,000	University Student
Ciaran	Male	35	University Postgraduate Degree	£33,000	Computer Programmer
David	Male	24	High School	£22,000	Customer Service Advisor
Gisele	Female	35	University Postgraduate Degree	£28,000	PhD Student
Jessica	Female	65	University Postgraduate Degree	£120,000	Medical Doctor
Kelly	Female	42	University Undergraduate Degree	£65,000	Marketing Expert
Mary	Female	50	High School	£25,000	Salesperson
Peter	Male	32	University Postgraduate Degree	£42,000	Lecturer
Sara	Female	30	High School	£35,000	Hairdresser
Zuri	Female	29	University Undergraduate Degree	£26,000	Store Manager

Table 6.1 outlines that in order to collect the qualitative data, individuals of various backgrounds of the society were interviewed. In this respect, selected participants had different education levels, incomes and jobs (see Section 5.4.3 for details of sample selection for the in-depth interviews).

6.2 Participants' Overall Energy Consumption, Smart Meter In-Home Display (IHD) Use and Experience

In this section, after asking some general questions about their smart meter in-home display (IHD) (e.g., when they got the device, their IHD provider and energy company, monthly spending on energy, etc.), participants were asked a question about the location and mobility of their IHD. Among ten participants, two of them were found to regularly change the location of the device to check if it is working properly and follow the information shown on the device regarding the changes in their domestic energy consumption.

> **"[...]** ***Sometimes I unplug it to check if it is working properly unplugged. Maybe once a day or once in every two days. It is handy, easy to carry. Not so heavy. It shows a lot of information****"** *(David)*

> "***It stays in the kitchen, I mean, it is in the original place where they installed it. I occasionally take it and check the numbers whenever I do not forget about it and think of our energy usage […].*****"*** *(Sara)*

In terms of frequency of checking the device and integration with it, most of the participants did not check their IHD very frequently and therefore, they did not have a high level of interaction with the device. In other words, they simply look at the device and read the numbers on it instead of clicking on the device to see different options. In this respect, some interviewees stated that they do not check their IHD frequently as they believe it always provides them with correct numbers and works very efficiently. Moreover, they do not face any problem using their IHD. Besides, these participants do not check different options on their IHD and simply look at the figures presented on the main page of the display.

> "***I used to check it at the beginning, but now I check it once in a month or maybe less. So far, I could not complain about anything so…***" *(Peter)*

> ***"I check my IHD when I am in the kitchen. Usually, I only look at it to see the actual energy consumption."*** *(Kelly)*

> "***I just look at it and read the numbers. I do not click on the buttons that often.***" *(Ciaran)*

On the other hand, some participants were found to check their device more regularly and interested to check different options to find out more about their energy consumption and compare it with the previous results.

> ***"I check the device a couple of times a day. I click on the buttons and see if I am using more or less energy compared to the previous months."*** *(Gisele)*

"***[…] So if I were to just check electricity or gas, to see which one is higher and if I see one is higher I check the previous days and weeks. I get a grasp of which device is using too much energy. It has a feature that says current usage*** *(checking the device),* ***and that is pence per hour."*** *(Zuri)*

Despite the fact that not all participants were found to have a high level of interaction with their IHD, one thing that was common among all the interviewees was that their IHD had the potential to have some level of influence on their domestic energy consumption behaviour. The majority of the participants believed that their IHD actually helped them not exceed their daily (or monthly) energy budgets. Besides, considering the behaviour change regarding domestic energy consumption, the IHD had the most significant impact on how participants use the specific gadgets such as washing machine, water boiler, heater, etc.

"After getting the smart meter and checking how much I was spending on the energy, I started doing laundries at lower temperatures and on shorter programmes." *(Kelly)*

"***It gives you good information about your consumption, so you can control your energy use when you do not want to exceed your limit. I aim to spend less than £1.50 per day. If I see that, I am close to that amount, I may turn off the heater or not use so many gadgets for the day. Once I was almost over the daily limit and had to do the laundry. Therefore I decided to do it the next day."*** *(Adam)*

"Before our IHD was installed in our home, I was using the washing machine at high temperatures. Then, I realised that this caused a significant spike in electricity consumption. […]. Now, I am cleaning the clothes at lower temperatures if they are not very dirty." *(Sara)*

"***I would say definitely. Since it shows my actual consumption and cost, I am more careful about how many times I do the laundry a week. Before that*** (IHD)***, I used to wash clothes like… 3-4 times a week at 60 degrees. Now I try to wash them two times at most on 40 degrees max. Especially when I am alone, I try to be more careful, but when my kid is home, I have to clean more dishes and wash more stuff. [...].***" *(Mary)*

"Once I realised that my kettle was making the energy consumption rate going up so quickly, I decided to put only the required amount of water instead of filling it completely." *(Ciaran)*

"In order to reduce my energy consumption, I am using the microwave more often than the oven when I cook at home." *(David)*

The responses highlighted above underline that interaction or engagement with the smart meter IHD has a high potential to promote behaviour change in the context of domestic energy consumption. Following these quotes about the influence of IHD on behaviour change, participants were asked to give more detail about their IHD user experience.

Accordingly, interviewees were asked to talk about their experience with the IHD during the last seven days. Most of the participants highlighted that they regularly checked their IHD after using a specific gadget, did laundry, turned on the heater, etc. For some participants, numbers regarding their actual consumption on IHD led them to change their energy consumption behaviour to save energy.

For instance, some participants decided to turn off their heater and use it less often after checking their IHD and seeing that they had used too much energy. Accordingly, IHD helped the interviewees adjust their domestic energy consumption in order to not exceed certain values, understand the fluctuations in figures and make comparisons between their actual consumptions and previous consumptions.

> "***I did not go to work on Tuesday because I went to work the previous Sunday. It was a really cold day I had to turn on the heater; I was not feeling so good. But after a couple of hours, I checked the IHD in the kitchen and saw that I was very close to my budget limit. Then I decided to keep the heater off for a while.***" *(David)*

> ***"[…]. Based on the numbers on the system, I reduced the energy consumption, used the heater less than usual… This helped me to spend less than what I aimed last week."*** *(Kelly)*

However, two participants, who stated that they are usually very careful about their domestic energy consumption, highlighted that they did not change their energy consumption behaviour in certain circumstances even though they were using more than the average.

> "***Last week, there were days I spent more than what I aimed. It was a very busy week, so I did not really care if I spent more than the average. Especially the two days when the weather was very cold, so I had to turn on the heater. It may be quite costly to use it, but I had to.***" *(Adam)*

> "***I think because the weather gets colder, I am using my heater in the small room, in the night. I think it uses a lot of energy. But, I did not have any time to check it because I was really busy for the last seven days. So, that is why. I know I might be using a lot, but I did not have time to check the IHD.***" *(Gisele)*

These findings tell us one crucial thing: despite the fact that the IHD holds a very high potential to impact individuals' energy consumption behaviour and guide them to change their behaviour towards more positive ones, the impact of the device is not stable, and the effectiveness of the device significantly fluctuates depending on various factors. Furthermore, engagement intentions with the IHD may be motivated by different reasons such as economic/financial, as highlighted above.

In order to complete this part, participants were finally asked questions regarding their satisfaction with using a smart meter IHD. Analysing the interviewees' level of IHD satisfaction, it was found that none of the interviewees was dissatisfied with their IHD. However, it was also found that in order to increase the level of satisfaction with the IHD and have stronger integrations with the device, some improvements should be made. Some of these improvements can be named as detailed comparative feedback, better screen and more information about the energy consumption of a specific item.

> ***"Umm, good question. On the one hand, it is new, so we have not been using it for a long time, but on the other hand, it can be very useful and convenient to have one. So currently, I can say that it is good to have the device. Winter will probably change our minds. We will see."*** *(Jessica)*

> "***I think I am satisfied. I believe it is quite convenient to see it*** (the display)***. I do not need to climb a ladder to see it. It is very good. But I was more motivated to check it more often in the beginning. […]. Yeah, I want to see this month's energy consumption compared with the previous month, this week's consumption compared with the previous week*** (on the screen)**.** (Comparison) ***With my own consumption, yeah. Like monthly comparisons.***" *(Gisele)*

> "***[…]. As a number, I would say something around six the most. It helps me, but it needs some improvements, as I mentioned. First of all, it needs a better screen with larger font. Sometimes, especially at night, it gets a bit harder to read it. Second, I am not sure whether they are going to add it or not, but it would really help me adjust my consumption if my IHD shows me what others are doing. Third, again, it may be a more technically complicated thing, but I wish to see the energy consumption of every single item separately. For example, oven this much, kettle this much, TV this much…***" *(David)*

Depending on the last quote, it can be argued that the design of a specific smart meter IHD plays a key role in improving the level of user-IHD interaction or engagement. However, the concept of design is outside the scope of this study. For this reason, the design of IHD devices and the impact of design on behaviour change are not explored further in this research.

To sum up this section, in-depth interview participants have stated that they benefit from the features of their smart meter IHD to a certain extent. However, as stated earlier, consumer interaction and engagement with these smart products, as well as individuals' overall satisfaction level of using their IHD, can be increased if certain improvements are made. Additionally, various factors have the potential to have a significant influence on the strength of consumer engagement (CE) with IHD. Therefore, it is important to clearly understand the influence of different factors on the consumer-IHD relationship from this aspect. Accordingly, the main purpose of the second part of the interviews was to understand individuals' attitude towards technology and adopting and using new technology, together with their overall perception of money in general and inclination to make decisions depending on social norms. Hence, these important topics are discussed next.

6.3 Participants' Attitude Towards Adopting, Accepting and Using a New Technology, Willingness to Follow Social Norms in Making Decisions and Perception of Money

In this section, interviewees were asked questions about their overall attitude towards technology and their openness to technology. In addition to these general questions, participants were also asked some specific questions regarding the things they like about their in-home display (IHD).

According to the interview findings, in general, participants' openness to technology and intention to continuously use a specific technology are strongly correlated to certain specifications such as the ease (or convenience) of use and usefulness of that technology. In other words, the ease/convenience of use and useful features (both perceived and actual) of technology are the key factors for individuals to use that technology. In this respect, many participants were highly interested in using new technology as long as it is not very complicated to use and brings easiness and useful aspects to their lives. Before elaborating on this, it is important to explain that as stated in Section 3.3, the level of convenience of using a specific technology is actually strongly related to the level of ease of using that technology. In this respect, convenience can be considered as one of the elements influencing the overall ease of use of a technology.

> "***Technology is good, it is convenient, lets you spend good time.***" *(David)*
>
> "[…] ***Technology brings convenience and ease. It makes things easier to do.***" *(Kelly)*
>
> "***I think I am very open to new technologies. I am kind of a… I mean, in the future, I want that Smart Home thing… I think I have always been just interested in technology. I like trying different gadgets.***" *(Peter)*

"***When you have a device that is not user-friendly and frustrating, then I would use it less. [...] So, basically, user-friendliness means a lot.***" *(Peter)*

"***[...] We*** (together with her partner) ***like trying new technology, but we do not do it that often. If something is convenient for us to have in our apartment, we may buy and use it.***" *(Zuri)*

"***Easy! Easiness and convenience. It is like a tool… I recently bought an iPad just for paper reading and taking notes. Because normally I have so many notes, I carry them, and it is so heavy. One of my friends suggested to me, maybe there is an app…The app called good notes, where you can download your papers and categorise them into different sections, and you can take notes like you are using your paper. It is very easy to use. I think technology helps your life, making your life easier and save you time. I like it a lot.***" *(Gisele)*

"***Well, first of all, technology can help me have a better life. It is about time and convenience. With the new technologies, I can do many things in a shorter period, and I do not need to spend too much effort and so on... I strongly believe that technology is here to make our lives easier and more enjoyable.***" *(Mary)*

"***[...] I try new technology as long as I believe it makes our lives more convenient. So, it has to provide some benefits for using it, and it should be easy to understand and not very complicated to use. We are not very interested in luxurious stuff or are not rush to buy the newest technology like the new iPhone […]. We just don't buy it for fashion or just because it is on the market.***" *(Jessica)*

Based on these quotes, it can be assumed that the higher the level of ease of using and usefulness of a specific technology, the higher the chance of better integration with the device and intention to continuously use the device is. Considering the IHD, interviewees have stated that their device is easy to use and provides them with different useful elements that can influence their everyday behaviour.

"You can easily see that your energy usage actually increases on the system when you use so many gadgets at the same time." *(Ciaran)*

"***Also, it*** (smart meter IHD) ***gives information about CO2 spent."*** *(Gisele)*

"***[...]. Before the smart meter, I was receiving the bill at the end of the month, and there was no chance for me to see how much I was spending in the middle of the month, and I was worried about my consumption from time to time. [...]. Also, I know that some goods in my apartment use more energy than I can imagine. Like an oven… Instead of using it all the time, I prefer to use the microwave. I try not to use so many gadgets, especially not at the same time.***" *(David)*

Therefore, similar to many other smart products, the ease of use and usefulness of smart meter IHD can be underlined as some of the key elements generating the level of user/consumer engagement (CE) with these products.

Even though the level of usefulness of the IHD was found to have variation among participants, most of them have commonly underlined some of the benefits of using an IHD in their residence. Among these benefits or useful aspects of IHD, the majority of the interview participants stated that receiving simultaneous information about their energy consumption and expenditure, seeing clear warning messages about energy consumption on display, better management of electricity or gas consumption, and comparison of actual energy consumption with the previous consumption were the main benefits of using a smart meter IHD.

Considering the clear warning messages about actual energy consumption, a number of participants have highlighted that different shapes (e.g., arrows, etc.) or colours used by their IHD to show their energy consumption (i.e., green for staying under the budget or red for using too much electricity, etc.) were very helpful for them to realise whether they were using too much energy in their household or not.

> *"**When I see the colour on it gets between red and yellow, amber yeah, actually these are the times when I use dishwasher together with washing machine and maybe cooking. So, I think using all of these makes it** (consumption) **go up really quickly. Then, I try to be more careful about my consumption. I check my actual consumption and compare it with yesterday's values. Every day I aim not to spend more than 1 pound on energy."** (Gisele)*

> ***"I like that it gives me information about my actual energy usage. I can see the device going up and down when I am using … let's say washing machine or cooking stuff."** (Mary)*

> " ***[…]. The device warned me with red colour when I exceed the budget."** (Adam)*

Thanks to detailed, simultaneous information on energy consumption and clear warning messages, participants also stated that their smart meter IHD had assisted them in managing their energy consumption more efficiently and effectively. Moreover, comparing the actual energy consumption with the consumption of previous days, weeks, months, etc., was another useful attribute of smart meter IHD, according to many of the participants.

> *"**[…]. I have not received any extraordinary numbers (on my bill) in the last three months after I got my smart meter.**" (Ciaran)*

"We have done everything we can to reduce our energy consumption. We have the energy lights installed and that stuff. Our heating can be maintained quite well but electronic devices not very energy efficient. I can see that whenever we are using the washing machine, IHD goes crazy. And then whenever we have the oven or iron on, let's say it goes above the budget. We could do better because the budget is quite low for us, and it should not be that costly." *(Zuri)*

"[…]. I believe it will help us to better manage ourselves during next winter. Another thing is that when I am in the kitchen and if I see that it is going like the amber-red colour on the screen, I try to use maybe less equipment at the same time. I know that when I use so many items simultaneously, it can go up quite easily. Both my husband and I are more careful when we use our gadgets. Now I am also more careful when I put water into the boiler. I just put the necessary amount. The boiler, it is tricky, can actually use a lot of energy." *(Jessica)*

"*Eeh, I think it is a great device, and I really like having one in my place. I would say I am 8 out of 10 if ten is the most satisfied. It really helps me understanding my consumption.*" *(Mary)*

"If I were to just check electricity or gas, to see which one is higher and if I see one is higher, I check the previous days and weeks. I get a grasp of which device is using too much energy. It has a feature that says current usage (checking the device), *and that is pence per hour. […].* **I think that it has the history of my usage, so I check if it is higher this week or lower. If I have made a change in my daily routine. I think the history function is the one I like the most.***" (Zuri)*

"[…]. You can see how much you use this month or week. Also, you can choose it to show how much you spend only on electricity or only on gas. I mean, I always see there how much energy I use and money. Today, tomorrow…" (Gisele)

In addition to the usefulness of the IHD, the ease of use of these technologies was also important for continuous use and resulted in a higher level of consumer interaction and engagement with these devices. Similar to the usefulness, the majority of the interviewees have mentioned that using their smart meter IHD was easy enough and not complicated for them.

"*It* (smart meter IHD) *makes our lives easier. It is simple to understand, and I believe we use it a lot. At least we do not have to climb up to check the numbers anymore* [laughs] *[…].*" *(Sara)*

"*Yes, it is really easy to understand it. I can check how much I actually spend on gas and electricity […]. The information, in general, is very straightforward.*" *(Mary)*

"It is very easy to see the numbers. I can easily see how much energy we are using and how much we are spending on it right away, no need to wait for the end of month bills. There is no need to do anything else, just looking at the display." *(Jessica)*

"***It is super easy to understand. It gives you the exact numbers, so there is nothing complicated. Another thing is that you do not need to do anything to use it. It is there for you to read it and relax. In its actual form, I think it is very well developed."*** *(Ciaran)*

Other than the impact of the ease of use and usefulness of the IHD on users' interaction with these devices, it was also revealed during the interviews that the ease of use of IHD has the potential to influence the usefulness of the IHD. To support this, some participants stated that the ease of using their IHD (i.e., ease of seeing different information regarding their energy consumption) improved the usefulness of the device for them. Besides, the ease of using the IHD was one of the main factors for some interviewees to perceive their IHD as more useful.

"It is really easy for me to see my daily energy consumption by one click. I can also compare my weekly and monthly consumptions more conveniently and often." *(Gisele)*

"It (information on her IHD) ***is quite easy to follow. Not complicated. Yeah…You can check how much you spend at the same time. You do not need till the end of the month. Convenient in that sense."*** *(Kelly)*

"As a programmer, I feel that it is a really good technology. It is actually smart, and it gives you enough information about your energy use. It is not too big and looks nice. The size of the numbers shown on the system is quite big and easy to read. In general, I like how easy it is to understand and use the system." *(Ciaran)*

"It is really easy; I check it whenever I think that I used quite a lot. So, whenever we turn the heating on, and it is cold outside, I always check it to see the difference. So, I can know how warm I can make the house during the winter." *(Zuri)*

To summarise, it was found that both of these IHD-related characteristics, the ease of use and usefulness, have a high potential to directly influence individuals' interaction and engagement with their IHD. Based on the interview findings, it can be argued that the usefulness had different aspects and these aspects showed slight changes among the participants. However, the majority of the interviewees stated that the effective information delivery together with a well-designed and effective alarm system on energy consumption and various other features to explore and manage actual energy consumption were the primary benefits of IHD devices and factors that made these devices useful for the participants. Accordingly, the IHD can be considered a kind of technology that may make

individuals' lives simpler and more beneficial. Additionally, individuals perceive the IHD as highly easy to understand and use. The final significant finding was the potential effect of the ease of use of the IHD on the usefulness of the IHD.

Considering all of these discussions and findings, what participants have described is, in reality representing what we have seen in the theory of consumer-technology interactions as 'perceived ease of use' (PEOU) and 'perceived usefulness'(PU) (see Section 3.3 for details). Therefore, very similar to the relevant studies covering the technology acceptance model (TAM), PEOU and PU were found to have a potential impact on a consumer's engagement with his/her IHD, and it can be assumed that the level of PEOU of an IHD, may positively influence the level of PU of that device.

Understanding the influence of other people's comments on the interviewees' domestic energy consumption behaviour plays a central role to explore the impact of social influence on their perception of a specific technology and energy consumption behaviour change. Accordingly, following questions about accepting and using new technology and IHD, the participants were asked whether they talk to other people in their social context about their domestic energy consumption and change their energy consumption behaviour at home depending on the comments of the others.

Some of the interviewees do not prefer to talk to other people about their domestic energy consumption. But, on the other hand, some actually speak to others and share their experience with their friends, family, etc. but still do not change their domestic energy consumption behaviour or interaction with the device just because others tell them they are using too much energy.

> "***Sometimes people have a chat about it, and when I tell them I spend that much, I get surprised when I learn that I actually spend less than they do. […]. But I would not say that I would care about it that much, and I like how my supplier is working. I like it, and people are not usually bothered unless they have a lot of issues.***" *(Peter)*

> "***I… I do not know whether it would affect my energy consumption and interaction with the device*** (IHD)***. I occasionally talk to my friends about my energy consumption, and some of them tell me that I am using too much energy in my house. But I really do not know. I already try to do my best to… You know, sometimes when you are busy or when it is really cold outside you just want to relax in your house, so you do not think about if you are going to spend 5£ more or not.***" *(Mary)*

> "***Not with my friends but with my parents. If they tell me that I should be more careful and spend less on utilities, then I would change my energy consumption and use less energy than I am using now. But that never happened. I think I am not doing that bad.***" *(Adam)*

However, for the vast majority of the participants, others' comments have a significant impact on the domestic energy consumption behaviour change as they talk about their domestic energy consumption with their friends and aim to adjust their energy consumption and interact more with the IHD depending on their friends' consumption and what their friends tell them.

"***I and my husband, we usually talk about our energy spending with our friends and our parents. [...]. We do not want to spend more than what our friends are spending on energy. We also decided to get a smart meter because our friends suggested us. Now it is easier to control our spending. Actually, a couple of friends used to tell us that we were spending a bit more on the utilities than we were supposed to spend. Therefore, we were just thinking about the options to reduce our energy costs. It was before the smart meter installed in our place. [...].***" *(Sara)*

"***Yes, my partner and I are quite eco-friendly, I would say. If we have any chance to change our behaviour, we will use less. If people tell us we could do something, we try to do it, to help the environment. If it is applicable***." *(Zuri)*

"***I talk about it*** (i.e., his energy consumption) ***to my family and friends. Since I live on a very limited budget, I prefer to listen to what they might tell me. Comments of others sometimes help me to do better in terms of energy-saving at home. I really try hard not to exceed a certain amount at the end of the month.***" *(David)*

From these quotes, it can be assumed that the influence of social factors and normative elements may increase some consumers' level of PU of the IHD as they believe that their IHD help them to manage their energy consumption more efficiently. Furthermore, the influence of other people has the high potential to lead some people to explore and understand the different benefits or the PU of their IHD.

Following this, a question regarding comparative feedback on their IHDs (i.e., feedback comparing their domestic energy consumption with their friends' or similar homes' energy consumption) was asked to each participant. It turned out that, during the time of the interviews, participants' IHDs were not able to provide any comparative feedback on the system. Thus, participants were next asked questions to understand their interest in receiving comparative feedback from their IHDs. Some of the interviewees had a high level of interest to get comparative feedback:

"[...]. It would be great to see what others are spending on energy, actually. I wish my IHD had that option. Because If I see that I am spending more than average or my friends, I would be worried and even try harder to find ways to cut down my energy consumption." *(David)*

*"**I wish it had it, though. Still, I sometimes talk to friends and check online to see the average spending of other people on energy."** (Sara)*

"It may be interesting to see what other people on average are doing. It can give some idea about where we stand and how good we are doing. Although it can be a bit worrying to see that your house is spending much more than the average." *(Kelly)*

"**It would be interesting to see how much other people, on average, spend on energy…**" (Ciaran)

Additionally, some participants stated that they would be highly interested in receiving some amount of comparative feedback on their device and may consider changing their energy consumption behaviour at home.

"I would like to have the information about other similar apartments similar to mine. Other strangers that have 2-bedroom apartments, two people are living in there. If we see someone else is doing a better job than us, even though we try to do our best to save energy, it can motivate us to do more and try again." *(Zuri)*

"I think it would be beneficial in the sense that you can actually see how much people in similar flat spend, and if you see that you are using more, then it is obvious that there is an issue. You never know what the right amount is, so yeah, why not." *(Peter)*

Taking the last quote into consideration, it can be said that social influence has the potential to positively change users' perception of the usefulness of their IHD even though some users (e.g., Peter) believe that they do not change their energy consumption dramatically depending on social factors.

These findings imply that individuals do not always share their experience with others in their social context, and they are not very motivated to change their actions based on the comments of other people. Yet, a social influence still has a very significant potential influence on how useful individuals perceive their IHD devices, the level of interaction/engagement with their device, and ultimately, their domestic energy consumption behaviour change. Even though a consumer's inclination to follow (or disapprove) social influence has the potential to influence the perception of different benefits of IHD products, interview findings suggest that for most of the interviewees, social influence has an impact on the level of PU of IHD. Accordingly, similar to how it has been described in previous studies (Section 4.2.1) investigating the relationship between social factors and CE with different objects, a consumer's level of susceptibility to normative influence (SNI – Section 2.3.2) can be considered as a significant motivator and consumer-related factor to have stronger engagement with IHD.

In addition to the impact of social influence or SNI, interview findings also highlighted that consumers' overall perception of money and financial concerns (Section 2.3.3 and Section 4.2.2) might work as a key motivator to influence their perception of a specific technology and engagement with that technology. Accordingly, it was further explored that when money holds a more important position in

individuals' lives and individuals are more concerned about money, they perceive their IHD as more useful, as they believe it is an effective tool for them to better manage their expenses and even save money in certain situations.

Regarding overall money attitude, two interviewees, David and Gisele, stated that money was very important for them, they wanted to have more of it, and they were highly concerned about it under their current circumstances.

> "***Money is something I really want to have more right now [Laughs]. No, I know it is not everything, but you need it to buy stuff. Without it, you are not safe, you may not be as healthy as you should be, and you do not have enough comfort in your life. This is the rule of the world. At the moment, I make around 22,000 a year, including the bonuses. This is not enough for me to buy most of the items I like. It would be great if I could earn more.***" *(David)*

> "***I think if you know that there is a 'mental account' and we have a budget to spend on what we eat, travel… other different categories. So, money is like a…, and I need to have it to follow the plan. Because I am not earning it right now, always spending. So, I have to spend money to follow my plan at the moment. Still, I travel because you know kids when they are on holidays… At the moment, I am definitely concerned about money because this is… I have to have a budget to think about every day. Actually, I have a plan to think about how much I can spend every day. I do not follow it, but I have to because it is very important.***" *(Gisele)*

Furthermore, both participants mentioned that they changed their energy consumption (e.g., turned off the heater, used less gadget simultaneously, etc.) when they saw a warning message on their IHD highlighting that they exceeded their budget. Hence, their high level of concern about money led them to perceive their IHD as useful to a certain extent.

Some other interviewees, who were also highly concerned about money, said they would change their domestic energy consumption behaviour if their IHDs showed that they consume more than the average or their budget. A high level of financial concern guided some participants to perceive their smart meter IHD as more useful since their IHD really helped them understand that using a specific gadget was causing them to spend much money on energy. In some cases, IHD was highly useful as it allowed users to check their budget and control their energy consumption and spending, which eventually saved them some money.

> "***[...]. Without money, it is really hard to build your life on stable structures. People feel safe, comfortable and more relaxed when they have money. But does it bring happiness? It is arguable. I do not think having a lot of money would completely change me and make me a different***

person. On the other hand, since we live on a budget, it would be great to have some extra cash on the side. [...]." *(Sara)*

"[...]. I used to wash our clothes on 60 degrees. But I did not know that it costs a lot and uses too much energy." *(Sara)*

"It shows your previous weeks' spending as well, so you can compare your actual consumption with those numbers. Adjust yourself not to exceed a certain value. If you are spending more, obviously, you are doing something wrong. Things will change in winter…" *(Kelly)*

For many of the participants, there was a strong relationship between their concern about money or overall attitude to money (ATM) and the level of PU of their smart meter IHD, and therefore, their engagement with the device.

In addition to overall IHD interaction, attitude towards technology, intention to follow social norms, and perception of money, in the last part of the interviews, participants talked about what they think about the environment and environmental issues as well as their attitude towards pro-environmental activities and some of these activities they undertake.

6.4 Participants' Attitude Towards the Environment, Opinions About the Environmental Issues and Environment-Friendly Activities

In order to understand the participants' attitude to green/environment-friendly values, questions about their overall understanding of green consumerism, recycling habits, and, more importantly, activities they undertake to save the environment were asked to the participants in the last stage/part of the interviews.

The majority of the participants regarded themselves as environment-friendly individuals, and except one participant (i.e., David), all others mentioned that they cared about the environment and they frequently do certain things (e.g., recycling, using public transportation, etc.) to minimise their damage on the environment. Moreover, being a green consumer was much more important for some of them than the money they spend. For example:

"***[...]. I know many white good companies use different scales on their products. For example, A++, A+… When I buy a new product, I prefer to buy the ones with at least A+. For example, last year, I replaced my fridge, and I bought the one with an A++ energy efficiency scale. It was a bit more expensive than the other models, but it is worth it. I know I am using too much electricity because I am on my computer/laptop all the time, I play computer games, I watch TV. At least I could do this*** (buying an energy-efficient product)." *(Ciaran)*

Moreover, as stated earlier, many interviewees started to use some of their gadgets (e.g., water boiler, oven, etc.) more efficiently in terms of saving energy as it got easier for them to control their energy consumption level and not to waste energy after they got their smart meter in-home display (IHD). In a sense, this may imply that some participants viewed their IHD as something useful to save energy. In other words, these participants' overall attitude to pro-environmental values increased their perception of the usefulness of their IHD.

In addition to changing their energy-inefficient white goods with energy-efficient ones, walking instead of driving or using public transportation and not leaving the lights on, replacing old bulbs/lights with energy-saving ones was one of the most commonly done things by participants to improve their environment-friendly behaviour.

Some participants also mentioned that they replaced their old inefficient lights together with changing some of their energy-consumption activities (e.g., not using boiler on the high setting, putting on another piece of the sweater instead of turning on the heater, washing clothes at 30 degrees instead of 60). Accordingly, after getting their IHD, some participants decided to stop using different products (e.g., washing machine and dishwasher) at the same time as their IHD helped them understand the spikes in their energy consumption.

> *"**[...]. In our house, we have sensor lights in the halls, so they are never left on. We replaced the bulbs with the green energy ones. I and my husband like walking and trying to walk as much as we can. Instead of taking the lift, we take the stairs. It is a small thing, but it may help. Even though I am not sure, I think our fridge, oven and vacuum cleaner all have the highest ratings on the energy efficiency scale.**" (Jessica)*

> *"**We have done everything we can to reduce our energy consumption. We have the energy lights installed and that stuff. Our heating can be maintained quite well but electronic devices not very energy efficient. I can see that whenever we are using the washing machine, IHD does crazy. And then whenever we have the oven or iron, let's say it goes above the budget. We could do better because the budget is quite low for us, and it should not be that costly.**" (Zuri)*

> *"**As I said, I am really worried about the environment. That is why I try to keep my energy use at a minimum possible level. I hate wasting energy and resources. If I can do something electronically, I prefer to do it electronically, as I do not like using too much paper. I follow the news and join the local and international organisations which claim that they save the environment. I even sometimes send them money, not so much, but at least it is something. I***

think seeing the financials on my IHD also gives me an idea and help me to adjust my consumption in some sense. *" (Mary)*

Based on this, it can be argued that a high level of pro-environmental mentality and behaviour improved the level of perceived usefulness (PU) of the IHD for some participants. Furthermore, it was identified that individuals' environmental concerns and environment-friendly activities [or level of green environmentalism (GE) based on the discussion of green consumerism and pro-environmentalism in Section 4.2.2] had the potential to positively influence the level of PU of their IHD.

In summary, individuals with a high level of GE may interact more with their IHD and have stronger engagement with their device, which may lead them to undertake positive behaviour change in the context of domestic energy consumption in the long term. Hence, individuals' higher levels of attitude to green/environment-friendly values may lead them to have stronger IHD interaction and motivation to engage more with IHDs.

6.5 Summary

To conclude, in the light of the literature on technology-related factors influencing consumer-technology interaction (Section 3.3) findings from the face-to-face, in-depth interviews indicate that two technology-related characteristics, usefulness or perceived usefulness (PU) and convenience of use or perceived ease of use (PEOU) of smart meter in-home display (IHD) devices hold high potential to positively influence the strength of consumer-IHD interaction and the extent to which consumers actually engage with their IHD.

Additionally, in line with existing literature on CE and how different motivational factors affect consumer decision making, concerns about money or attitude to money (ATM) (i.e., based on the financial motives explained in Section 2.3.3), social influence or susceptibility to normative influence (SNI) (i.e., based on how societal factors lead consumers to change their actions and behaviour – Section 2.3.2) and environment-friendly values or green environmentalism (GE) (i.e., based on the concept of 'environmentally responsible behaviour' explained in Section 2.3.3 and smart energy devices investigated under the concept of green/environmentally responsible consumerism – Section 4.2.2) of individuals were all found to have a potential impact on how useful individuals picture their smart meter IHDs. Based on this relationship between all these general consumer-related motivations (i.e., SNI) and context-specific consumer-related motivations (i.e., ATM and GE), PU and PEOU of IHD technologies and individuals' engagement with IHD technologies, ATM, SNI and GE can be argued to have an indirect, positive impact on the strength of consumer-IHD interaction and engagement via

their influence on the level of the PU of IHD. In other words, the findings from the qualitative phase assisted the researcher in understanding the different variables in the consumer-IoT engagement, the specific relationship between these variables, and therefore, development of the final framework (Chapter 7)

Furthermore, IHD's ability to build stronger experiences for a consumer in the overall interaction/engagement framework and the specific interaction between a consumer and non-human elements related to IHD imply that the qualitative findings support the Social Presence Theory (SPT) (Section 3.4).

Based on the discussion from the existing literature and interviews conducted to get more exploratory data, Table 6.2 below shows the themes and sub-themes created based on the interviews together with the illustrative quotes.

While technology-related characteristics of PU and PEOU, together with consumer-related motivations of SNI, ATM and GE, were found to have an influence on individuals' engagement with IHD technologies, their relative importance and potential level of strength of influence on the relationships mentioned above require more attention. Accordingly, in order to find more generalisable data that shed light on the significant interplay between various factors and these factors' potential influence on the level of consumer-IHD interaction and engagement, the researcher conducted a quantitative stage for the second phase of this study. While the findings from the quantitative phase and discussion of those findings are interpreted in Chapter 8, the next chapter presents the final conceptual framework and hypotheses of this study.

Table 6.2: Themes and Illustrative Quotes of In-Depth Interviews

Themes	***Sub-Themes***	***Illustrative Quotes***
Technology characteristics and IHD engagement	***Perceived ease of use (PEOU – Section 3.3) of IHD on IHD Engagement*** ***[Based on the convenience/ease of use of IHD on IHD engagement]***	*"I usually check it* (IHD) a *couple of times a day. Most of the time, when I am in the kitchen. I think the information is correct. It must be, I trust British Gas. It is really straightforward and, yes, easy to follow the changes on the system."*
	Perceived usefulness (PU – Section 3.3) of IHD on IHD engagement ***[Based on the usefulness of IHD on IHD engagement]***	*"I think it is easy to see every day how much you use and then you saw yesterday, then you compare week, month. [...]. You can see how much you use this month or week. Also, you can choose it to show how much you spend only on electricity or only on gas. Also, it gives information about CO2 spent. I mean, I always see there how much energy I use and money. Today, tomorrow…"*
Influence of others and IHD engagement	***[Susceptibility to normative influence (SNI – Section 2.3.2 and Section 4.2.1) on PU of IHD*** ***[Based on social/normative influence on PU of IHD]***	*"[…]. Now it is easier to control our spending. Actually, a couple of friends used to tell us that we were spending a bit more on the utilities than we were supposed to spend."*
Financial situation and IHD engagement	***Attitude towards money (ATM – Section 2.3.3 and Section 4.2.2) on PU of IHD*** ***[Based on money concerns/financial attitude on PU of IHD]***	*"[...]. Before smart meter, I was receiving the bill at the end of the month, and there was no chance for me to see how much I was spending in the middle of the month, and I was worried about my consumption time to time."*
Environmental concerns and IHD engagement	***Green environmentalism (GE – Section 2.3.3 and Section 4.2.2) on PU of IHD*** ***[Based on pro-environmental behaviour on PU of IHD]***	*"As I said, I am really worried about the environment. That is why I try to keep my energy use at a minimum possible level. I hate wasting energy and resources. […]. I think seeing the financials on my IHD also gives me an idea and help me to adjust my consumption in some sense."*

Chapter 7: Final Conceptual Framework Development

7.1 Introduction

Based on the literature discussing the engagement relationship between individuals and technology, an initial conceptual framework illustrating the relationship between different factors that have the potential to influence consumer engagement (CE) with the Internet of Things (IoT) technologies, in general, was demonstrated in Chapter 4. While the initial conceptual framework (see Figure 4.1) shows the simple relationship between different types of motivations (i.e., both general and context-specific consumer-related), technology-related antecedents in the context of IoT and actual CE with IoT, it does not explain the relationship between variables in detail.

In this respect, following the findings from the qualitative stage, this chapter illustrates the final version of the conceptual framework together with the set of hypotheses that will be tested later in Chapter 8. In Chapter 7, the explanation of each of the variables constructing the conceptual framework is provided with the rationale behind proposing every one of the hypotheses. In other words, the main purpose of this chapter is to clearly illustrate the conceptualised model to the readers and clarify the importance of the findings from the qualitative stage in developing the model and the hypotheses.

Accordingly, the following section talks about the framework conceptualisation and generation of specific hypotheses in the context of smart meter in-home display (IHD) technologies to a greater extent.

7.2 Final Conceptual Framework and the Set of Hypotheses

In the specific smart grid context, Gangale et al. (2013) stated that understanding consumers and their actions, motivating them to become more energy-efficient, and engaging them in the early stage of the energy delivery system have the potential to influence consumers' acceptance and adoption of smart grid technologies. Additionally, despite the fact that some authors (e.g., Kirk et al., 2015; Zhai et al., 2018; Orben and Pryzbylski, 2020) have already investigated consumer-technology interaction in different areas, these studies mainly argue how individuals accept to use of technology and why do they adopt that technology instead of focusing on the post-adoption stage of technology engagement.

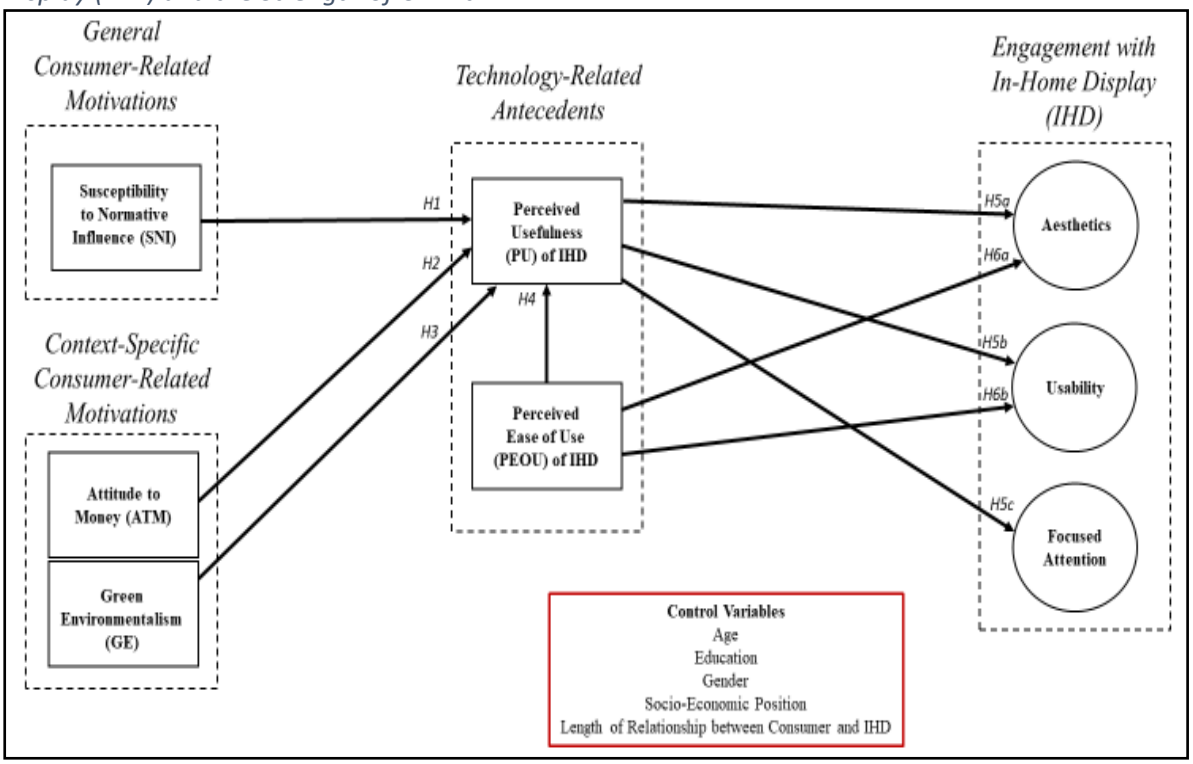
Gangale et al. (2013) also underlined that smart grid technologies might only reach their full potential when individuals change their attitude towards these products and their engagement intention with these technologies, and consumer engagement (CE) with smart grid technologies is essential in order to obtain more sustainable energy consumption results in the long-term.

As stated earlier in Chapter 6, the findings from the exploratory phase via face-to-face in-depth interviews underline that different motivational elements of consumers, together with what consumers think about using new technology and their overall perception of technology-related factors, have the potential to directly or indirectly affect consumer-IoT interaction and smart meter in-home display (IHD) to be more specific.

In this respect, drawing from the Technology Acceptance Model (Section 3.3) and Social Presence Theory (SPT) (Section 3.4), the final conceptual framework of this study (Figure 7.1), illustrates how various motivation-based factors, namely susceptibility to normative influence (SNI), attitude to money (ATM) and green environmentalism (GE), have the potential to indirectly impact on the strength of CE with the desired engagement object [i.e., smart meter (IHD)] and how technology-related characteristics [i.e., perceived usefulness (PU) and perceived ease of use (PEOU) of technology] may play a significant role in directly improving the relationship between consumers and smart IHD products.

As demonstrated in the conceptual framework below, the set of hypotheses in this study are divided into two main categories: hypotheses regarding consumers' motivations and hypotheses regarding consumers' perception of technology-related antecedents to CE with IHD. First, motivation-related hypotheses are proposed.

Figure 7.1: Conceptual Framework for Factors Influencing Consumer Engagement (CE) with In-Home Display (IHD) and the Strength of CE with IHD



7.2.1) Motivation-Related Hypotheses

1) Susceptibility to Normative Influence (SNI) and Perceived Usefulness (PU) of a Smart Meter In-Home Display (IHD)

As stated in previous chapters, social influence and social pressure from friends, family, or wider society have the potential to have an impact on the relationship between a consumer and technology products (e.g., Kaba et al., 2008; Connell and Kozar, 2012; Azar et al., 2016). In parallel with this, it was also discussed that normative influence has also been found to be an effective variable on the perception of technology, and eventually use of, and engagement with, technology (e.g., Teo, 2009; Kulviwat et al. 2009; Chen and Yeh, 2017).

Accordingly, a consumer's perception of social norms and susceptibility to normative influence have a direct impact on their perceived usefulness level of different technological products such as e-learning technologies (e.g., Yuen and Ma, 2008), computer-mediated technologies in general (e.g., Stibe et al., 2013), mobile applications (Min et al., 2019) or green information technologies (Wati et al., 2011).

Considering the smart meter in-home display (IHD) interaction, the findings from the qualitative stage suggest that social influence and a consumer's susceptibility to normative influence (SNI) can directly affect how useful the consumer perceives his/her IHD to be. In this respect, it is really important for some consumers that their IHD allows them to control their energy spending as their friends or families tell them to do. Thus, it is proposed that:

H1: ***The higher the level of a consumer's SNI, the higher the level of PU of an IHD***

2) Attitude to money (ATM) and Perceived Usefulness (PU) of a Smart Meter In-Home Display (IHD)

In Chapter 2 and Chapter 4, it was discussed that financial motivation, attitude toward the personal financial situation and individuals' overall attitude to financial elements together with financial concerns might have an impact on a consumer's interaction with different products/services as well as use and engagement with IoT technologies.

Moreover, in the context of energy consumption and engagement with energy-saving technologies, the impact of attitude to money on the strength of consumer engagement (CE) with technology has been reviewed in several examples of relevant literature (e.g., Elbaz and Zait, 2016; Ellabban and Abu-Rub, 2016).

In this sense, a consumer's overall attitude to money (ATM) and budget/spending on electricity or energy, in general, is related to their perception of the perceived usefulness of smart grid technology.

Therefore, consumers usually find their smart grid products more useful if it helps them to reduce their energy expenditure.

Supporting this, many face-to-face interview participants of the qualitative stage have mentioned that using their smart meter in-home display (IHD) helps them to better understand how much they spend on the energy and control their energy budget more easily. Hence, these participants believed that their IHDs have been very useful for them. Thus, the following hypothesis is proposed:

H2: ***The higher the level of a consumer's ATM, the higher the level of PU of an IHD***

3) Green Environmentalism (GE) and Perceived Usefulness (PU) of a Smart Meter In-Home Display (IHD)

Environment-friendly consumers usually look for alternatives to engage more in activities that aim to save the environment (Section 4.2.2). Furthermore, when it comes to the acceptance, use and engagement with environment-friendly technologies, individuals' green lifestyles and their level of environmentalism may be identified as some of the factors directly affecting the relationship between consumers and technologies. Chen (2016), for instance, argued that 'green perceived value' has a positive influence on how useful consumers perceive environmental products. In this sense, green environmentalism (GE) can also be considered as one of the factors that may motivate individuals to perceive energy-saving technologies as more useful.

The findings from the qualitative phase show that in many cases, individuals find their smart meter in-home display (IHD) useful because the device allows them not to use too much electricity or gas and help them save the environment. In other words, some users feel like they act green-environmentalist thanks to their IHD. Therefore:

H3: The higher the level of a consumer's GE, the higher the level of PU of an IHD

In short, all three consumer-related motivations have a high potential to positively increase the level of PU of IHD.

7.2.2) Technology-Related Hypotheses

4) Perceived Ease of Use (PEOU) of a Smart Meter In-Home Display (IHD) and Perceived Usefulness (PU) of that IHD

The Technology Acceptance Model (TAM) developed by Davis in 1989 illustrates that in different contexts, perceived ease of use (PEOU) can be a direct determinant of perceived usefulness (PU) (see Section 3.4). Accordingly, in addition to Davis (1989), many studies (e.g., Amin et al., 2014; Doshi,

2018) on consumer interaction with technology in the last couple of decades have underlined the importance and impact of PEOU of a specific technology on the level of PU of that technology.

Similarly, in the context of the Internet of Things (IoT) technologies, many scholars (e.g., Park et al., 2014) have found that the PEOU of a specific IoT product has a positive impact on the PU of that technology. In addition to that, the findings from the qualitative stage also shed light on the fact that the convenience of using the smart meter in-home display (IHD) or the level of PEOU of IHD improves the level of PU of IHD for many individuals. As the IHD helps a consumer check the energy consumption and expenditure very conveniently and easily without climbing a ladder or waiting until the end of the month, that consumer thinks that interacting with the device offers great benefits and uses. Accordingly:

H4*: *The higher the level of perceived ease of use (PEOU) of an IHD, the higher the level of perceived usefulness (PU) of that IHD

5) Perceived Usefulness (PU) of a Smart Meter In-Home Display (IHD) and Consumer Engagement (CE) with that IHD

Section 4.2.3 reviewed how the perceived usefulness (PU) of specific technology can influence interaction or engagement between that device and a consumer. Like many smart IoT products, the level of PU of smart grid technologies also has a high potential to directly affect the strength of consumer-smart grid engagement.

Considering the relationship between a consumer and a smart meter in-home display (IHD), the qualitative findings show that the level of PU of an IHD usually has a direct influence on consumer engagement (CE) with the IHD. For instance, some users stated that they interacted more with the device to minimise their energy consumption once they realised their IHD provided them simultaneous feedback on their energy consumption.

Furthermore, as the level of all three engagement dimensions (i.e., aesthetics, usability and focused attention) of user engagement may change depending on the PU of a technological product (O'Brien and Toms, 2008), it is assumed that PU of IHD has the potential to influence all these dimensions in CE with IHD. Depending on this argument, the fifth hypothesis is formed as:

H5a, b, c: ***The higher the level of perceived usefulness (PU) of an IHD, the higher the level of consumer engagement (CE) with that IHD on the (a) aesthetics, (b) usability and (c) focused attention dimensions***

6) Perceived Ease of Use (PEOU) of a Smart Meter In-Home Display (IHD) and Consumer Engagement (CE) with that IHD

Finally, similar to the PU of technology, PEOU of technology has been argued to be a very significant technology characteristic for a consumer to interact and engage more with different smart IoT products (see Section 4.2.3).

Elaborating on this, according to the face-to-face interviews, the level of perceived ease of use (PEOU) of a smart meter in-home display (IHD) has a high potential to have an important influence on the strength of a consumer's engagement with the device. In this respect, many interview participants have said that they like using their IHD because they find it straightforward to use as they do not have to put too much effort into understanding the messages on the display or other specifications of the device. Moreover, the participants have also said that they would not use the device frequently if it were hard to understand the messages on display or complex to use the device to figure out how much energy they were consuming.

Considering the engagement dimensions, unlike the PU of an IHD, it can be discussed that the influence of PEOU of an IHD on the focused attention dimension of consumer-IHD engagement is not strong because a consumer usually put more attention to a technological product when that consumer finds it more useful (e.g., O'Brien and Toms, 2010) but being easy to use (or not) of a product may not have a significant impact on a consumer's actual attention to that device (e.g., Huang et al., 2012; Wang et al., 2020). Therefore, the influence of PEOU of an IHD on the focused attention dimension of consumer engagement (CE) with that IHD is not included and investigated in this study.

Accordingly, the following hypothesis is proposed:

H6a, b*: *The higher the level of perceived ease of use (PEOU) of an IHD, the higher the level of consumer engagement (CE) with that IHD on the (a) aesthetics and (b) usability dimensions

To summarise the hypotheses relating to consumers' perception of technology characteristics, both PU and PEOU of smart meter IHD have the potential to influence the level of consumer-technology engagement on different dimensions.

7.3 Summary

In conclusion, together with different general [susceptibility to normative influence (SNI)] and context-specific [attitude to money (ATM) and green environmentalism (GE)] motivations of consumers, both perceived usefulness (PU) and perceived ease of use (PEOU) of smart meter in-home displays (IHD) are key elements that have potential to directly or indirectly influence the strength of consumer engagement (CE) with these devices.

From a consumer perspective, in the short-term, financial savings or reductions on energy bills are the main concerns of many consumers, and a consumer may be more willing to use and engage more with the IHD to reduce energy consumption and thereby save money. In contrast, when a consumer has to make a decision in a natural market setting, non-monetary incentives such as environment and health may generate a more powerful conservation effect in the long term (Asensio and Delmas, 2015). Hence, in the context of household energy consumption, in addition to the financial/monetary motivation, social and environmental motivations are also crucial in influencing a consumer's engagement actions thanks to their strong potential to impact technology-related characteristics.

Therefore, all three types of consumer-related motivations have the potential to indirectly influence CE with IHD. While a consumer's overall thoughts about money and ATM, inclination to change his actions depending on specific norms, and green environmentalist attributes may have an impact on the PU level of these highly technological, smart devices, both PU and PEOU of IHD (i.e., technology-related characteristics) may have a direct effect on the different dimensions of consumer-IHD engagement. For this reason, it is essential to investigate all of these critical relationships that may lead a consumer to have a stronger engagement with his IHD and continue to use the device to save money, get social approval or maybe just to feel better psychologically by protecting the environment.

In this respect, following the final conceptual framework and hypotheses development, the next chapter sheds light on the findings from the quantitative phase and discuss the process of hypotheses testing.

Chapter 8: Findings and Discussion of Quantitative Phase

8.1 Introduction

The purpose of this chapter is to investigate the relationships between consumer-related motivations [i.e., attitude to money (ATM), susceptibility to normative influence (SNI) and green environmentalism (GE)], technology-related characteristics [i.e., perceived usefulness (PU) and perceived ease of use (PEOU)] of IHD and the dimensions of engagement with IHD (i.e., aesthetics, usability and focused attention). Additionally, this chapter also outlines specific types of quantitative data analysis that were adopted to test the proposed hypotheses (see Section 7.2) and obtain statistically generalisable data.

In this respect, a large-scale quantitative survey was implemented to collect quantitative data based on individuals' individual activity in their residence. The following section sheds light on the demographic background of the consumers who completed the survey before the discussion of survey findings.

8.2 Demographic Profile of the Survey Respondents

After collecting the quantitative data, the researcher undertook data cleaning and generated the final sample size (Section 5.5.4). Table 8.1 below provides a summary of the demographic characteristics of respondents. Based on the table, it can be argued that a good mix of respondents that are reasonably representative of the general population completed the online survey.

Accordingly, among 311 participants, the results show that compared to males, there were more females who completed the online questionnaire. Considering the age of participants, across all five groups, the first group (i.e., group consists of individuals between 18 and 24 years old) was the smallest. The highest level of education the participants have completed were mostly college (105 participants), university undergraduate degree (88 participants), and high school (82 participants). On the other hand, individuals with university postgraduate degree (33 participants) and doctorate level (3 participants) generated around 12% of the total number of participants. Table 8.1 also shows that the participants who had less than £20,000 annual gross household income (i.e., first group) and the participants with an annual gross household income level between £20,000 and £39,999 (i.e., second group) were a total of 208 individuals and had a cumulative percentage of approximately 70%. On the other hand, 12 participants stated that their gross annual household income was more than £80,000.

In order to understand whether the number of individuals and children living in the household has a significant impact on the strength of individuals' engagement with their IHD or not, participants were asked to answer two questions in the online questionnaire: "How many adults (over 18 years old) including yourself are in your household?" and "How many children (under 18) are in your

household?". For the first question, participants stated that around 81% had only 1 or 2 adults living in their household. Only 11 of them stated that four or more adults were living in their homes. When asked for the number of children living in the household, only 23 participants indicated they had three or more children. Moreover, 140 of them had no children living in the household when they completed the questionnaire.

Table 8.1: Summary of Demographic Characteristics of Survey Respondents (N=311)

Demographic Characteristics	***N***	***Percentage****
Gender		
Male	*124*	*40%*
Female	*187*	*60%*
Age Group		
18-24	*30*	*10%*
25-34	*94*	*30%*
34-44	*68*	*22%*
44-54	*51*	*16%*
54-65	*68*	*22%*
Level of Education		
High School	*82*	*26%*
College Degree	*105*	*34%*
University Undergraduate Degree	*88*	*28%*
University Postgraduate Degree	*33*	*11%*
PhD	*3*	*1%*
Gross Household Income		
Less than £20,000	*84*	*27%*
£20,000 - £39,999	*124*	*40%*
£40,000 - £59,999	*69*	*22%*
£60,000 - £79,999	*22*	*7%*
£80,000 - £100,000	*7*	*2%*
More than £100,000	*5*	*2%*
Number of Adults Living in House		
1	*76*	*24%*
2	*177*	*57%*
3	*47*	*15%*
4	*8*	*3%*
More than 4	*3*	*1%*
Number of Children Living in House		
0	*140*	*45%*
1	*84*	*27%*
2	*64*	*21%*
3	*14*	*4%*
More than 3	*9*	*3%*
Length of Relationship with smart meter in-home display (IHD)		
Less than 6 months	*74*	*24%*
6 months – 12 months	*127*	*41%*
More than 12 months	*110*	*35%*

**** Percentages are rounded to the closest number***

In addition to the simple demographic information, individuals were asked to state how long they have been using their smart meter in-home display (IHD). To answer this question, participants were given three options: “Less than 6 months”, “6 months - 12 months”, and “More than 12 months”. While the responses were almost equally distributed between the second (127 participants) and the third options (110 participants), the first option received a relatively lower number of responses (23.8%, 74 participants). Therefore, there were more participants who had been using their IHD for 6 months or longer compared to the participants who had been using their IHD for less than 6 months.

Following the presentation of the participants’ demographic background, the next section sheds light on the univariate statistics of different items [i.e., engagement with IHD, perceived usefulness (PU) and perceived ease of use (PEOU) of IHD technologies, attitude to money (ATM), susceptibility to normative influence (SNI) and green environmentalism (GE) items] used in the online survey. First, descriptive statistics for the engagement with IHD items, items for the dependant variable, are analysed in the following section.

8.3 Simple Descriptive Statistics

8.3.1 Descriptive Statistics for the Engagement Items

Analysis of descriptive statistics for the variables highlighted in the conceptual framework (section 7.2) starts with the dependent variable of the model. In this case, consumer engagement with smart meter in-home display (IHD) was presented as the dependent variable. While the engagement scale used in the online survey had 19 items, all of these items were allocated under various dimensions. Therefore, before going into details of the descriptive statistics of the engagement items, the researcher first applied an exploratory factor analysis (EFA) to check the communalities and factor scores of the engagement items.

In order to apply the EFA and undertake the necessary dimension reduction, the researcher used the same extraction and rotation methods applied for the EFA in the original study (i.e., O’Brien and Toms, 2010), Maximum Likelihood and Oblimin with Kaiser Normalisation, respectively. The researcher focused on two important things when undertaking the EFA on the engagement items. First of all, according to Field (2017), it was important not to have any of the items loaded with a score of more than 0.350 on more than a single factor. Second, it was also significant not to have any item with a communality score below 0.30. These numbers were taken as a statistically significant threshold (Field, 2017) depending on the number of total respondents, 311 in this study.

Accordingly, all 19 items were checked carefully after EFA. Then, the researcher removed the items (i.e., items loaded to more than one factor with a score over 0.35 or items with a communality score

less than 0.3) step by step. In other words, after removing one item, the researcher reruns the EFA to check the factor loadings and communality scores of the remaining items. For example, Table 8.2 below shows that "The content of my IHD incites my curiosity" was decided to be removed as it loaded on two factors with a score of more than 0.35.

Table 8.2: First Step of the EFA on the Engagement with IHD Items

Pattern Matrix[a]				
	Factor			
	1	2	3	4
My smart meter in-home display (IHD) is aesthetically appealing	.857	-.009	-.054	-.089
My IHD is attractive	.851	-.106	.013	-.070
I like the graphics and images used on my IHD	.630	.109	.071	.064
I find the screen layout of my IHD to be visually pleasing	.608	.048	-.028	.202
My IHD appeals to my senses	.590	.038	.235	.051
I feel annoyed while using my IHD	-.063	.884	.126	-.051
Using my IHD is taxing	-.096	.708	-.123	.001
I feel discouraged while using my IHD	.164	.688	-.037	-.195
I feel frustrated while using my IHD	.007	.626	-.121	.231
I would recommend that others use a similar IHD	.332	.335	.089	.283
When I am using my IHD, I lose track of the world around me	.098	-.043	.789	-.285
When checking my IHD, I am so involved that I lose track of time	.052	-.020	.761	-.089
When using my IHD, I lose myself in this experience	-.066	-.086	.748	.164
I block out things around me when I am using my IHD	-.057	-.163	.548	.231
When checking my IHD, I am absorbed in my task	.053	.145	.531	.154
Using my IHD is stimulating	.261	-.006	.370	.337
I continue to use my IHD out of curiosity	.068	-.027	.162	.433
Using my IHD is worthwhile	.326	.314	-.067	.424
The content of my IHD incites my curiosity	.350	-.020	.047	.421
Extraction Method: Maximum Likelihood. Rotation Method: Oblimin with Kaiser Normalization.[a]				
a. Rotation converged in 11 iterations.				

Five more items were sequentially removed from the engagement scale with the same logic: "Using my IHD is worthwhile", "I would recommend that others use a similar IHD", "When using my IHD, I lose myself in this experience", "I continue to use my IHD out of curiosity" and "Using my IHD is stimulating". In the end, 13 remaining items were allocated under three factors (Table 8.3). Two of these factors were named the same as in the original paper: Factor 1 – "Aesthetics" and Factor 3 – "Focused Attention". To avoid confusion with the "Perceived Usefulness" variable, Factor 2 was named as "Usability" (Table 8.3) instead of "Perceived Usability".

It is also important to note that none of the final 13 items had a communality score of less than 0.30 (Table 8.4). Moreover, the score of the Kaiser-Meyer-Olkin (KMO) measure was calculated as 0.852. That score was much higher than the generally accepted score range of 0.800 (Field, 2017). Goodness-of-fit test was also statistically significant at the $p<0.01$ level with a Chi-Square of 69.309.

Table 8.3: Factor Structure of the Final 13 Engagement with IHD Items

Pattern Matrix[a]			
Engagement Items	Factor		
	1 *(Aesthetics)*	2 *(Usability)*	3 *(Focused Attention)*
My IHD is attractive	.834		
My smart meter in-home display (IHD) is aesthetically appealing	.828		
I like the graphics and images used on my IHD	.671		
I find the screen layout of my IHD to be visually pleasing	.671		
My IHD appeals to my senses	.590		
I feel annoyed while using my IHD		.892	
Using my IHD is taxing		.698	
I feel discouraged while using my IHD		.667	
I feel frustrated while using my IHD		.625	
When checking my IHD, I am so involved that I lose track of time			.786
When I am using my IHD, I lose track of the world around me			.724
When checking my IHD, I am absorbed in my task			.550
I block out things around me when I am using my IHD			.515
Extraction Method: Maximum Likelihood. Rotation Method: Oblimin with Kaiser Normalization.[a]			
a. Rotation converged in 6 iterations.			

Table 8.4: Communality Scores of the Final 13 Engagement with IHD Items

Communalities		
	Initial	Extraction
My smart meter in-home display (IHD) is aesthetically appealing	.535	.627
My IHD appeals to my senses	.514	.561
My IHD is attractive	.551	.650
I like the graphics and images used on my IHD	.480	.533
When checking my IHD, I am so involved that I lose track of time	.458	.614
When I am using my IHD, I lose track of the world around me	.459	.564
When checking my IHD, I am absorbed in my task	.301	.352
I feel frustrated while using my IHD	.457	.492
I find the screen layout of my IHD to be visually pleasing	.440	.481
I block out things around me when I am using my IHD	.340	.352
I feel annoyed while using my IHD	.522	.704
I feel discouraged while using my IHD	.460	.504
Using my IHD is taxing	.468	.544
Extraction Method: Maximum Likelihood.		

Following the EFA, reliability analysis was run to check the internal validity of the 13 engagement items all together as well as items in three engagement dimensions together with all other scales used in this study. Before discussing the descriptive statistics for the engagement items and presenting further analysis, Table 8.5 below highlights the Cronbach's Alphas for the items used in the survey. Accordingly, all of the survey items were scored above the acceptable value of 0.7 (Hair, 2010). Therefore, there was no problem considering the reliability of the survey items.

Table 8.5: Cronbach's Alphas for the Survey Scales

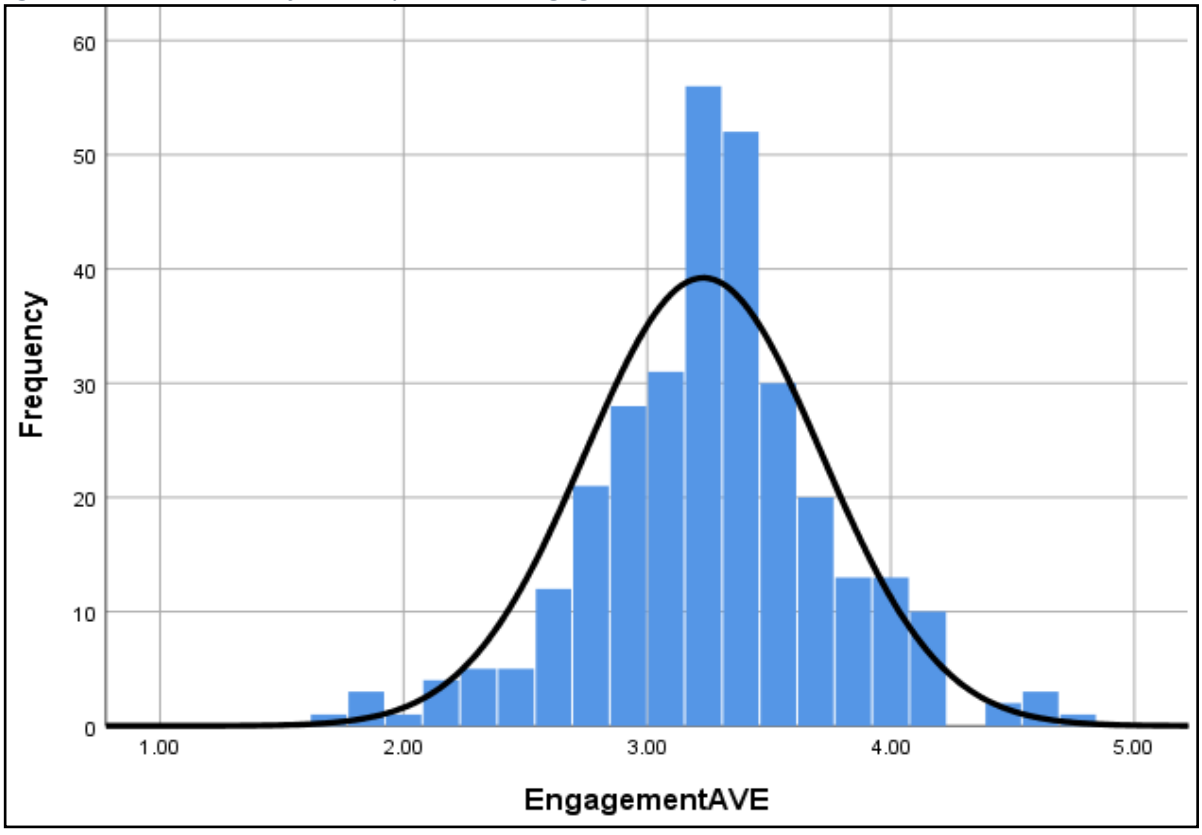
Scale	***Cronbach's Alpha***	***Number of Items***
Engagement	*.776*	*13*
[Aesthetics]	*[.859]*	*[5]*
[Usability]	*[.821]*	*[4]*
[Focused Attention]	*[.754]*	*[4]*
Perceived Usefulness (PU)	*.801*	*3*
Perceived Ease of Use (PEOU)	*.848*	*3*
Attitude to Money	*.833*	*5*
Susceptibility to Normative Influence (SNI)	*.852*	*6*
Green Environmentalism (GE)	*.909*	*6*

After the reliability analysis, descriptive statistics for all 13 IHD engagement items were examined in SPSS. In order to analyse the descriptive statistics of all of the engagement items at once, a new engagement average variable called "EngagementAVE" was created by simply adding all 13 engagement items altogether and dividing the final score by 13 to get the average scores of responses on the engagement items. The mean score for the EngagementAVE variable was 3.23 (Table 8.6). This score implies one important thing: online survey participants tended to be on the agree side (compared to disagree side) when asked questions related to their engagement with an IHD. Furthermore, as a general rule, distributions can be considered normal when kurtosis is between -1 and +1 (Hair et al., 2017). Therefore, average responses on the engagement items were normally distributed (Figure 8.1) with a kurtosis value of 0.861 and a negative skewness score of -0.121. This skewness score also means that the EngagementAVE data were fairly symmetrical (Cain et al., 2017; Hair et al., 2017).

Table 8.6: Descriptive Statistics for EngagementAVE

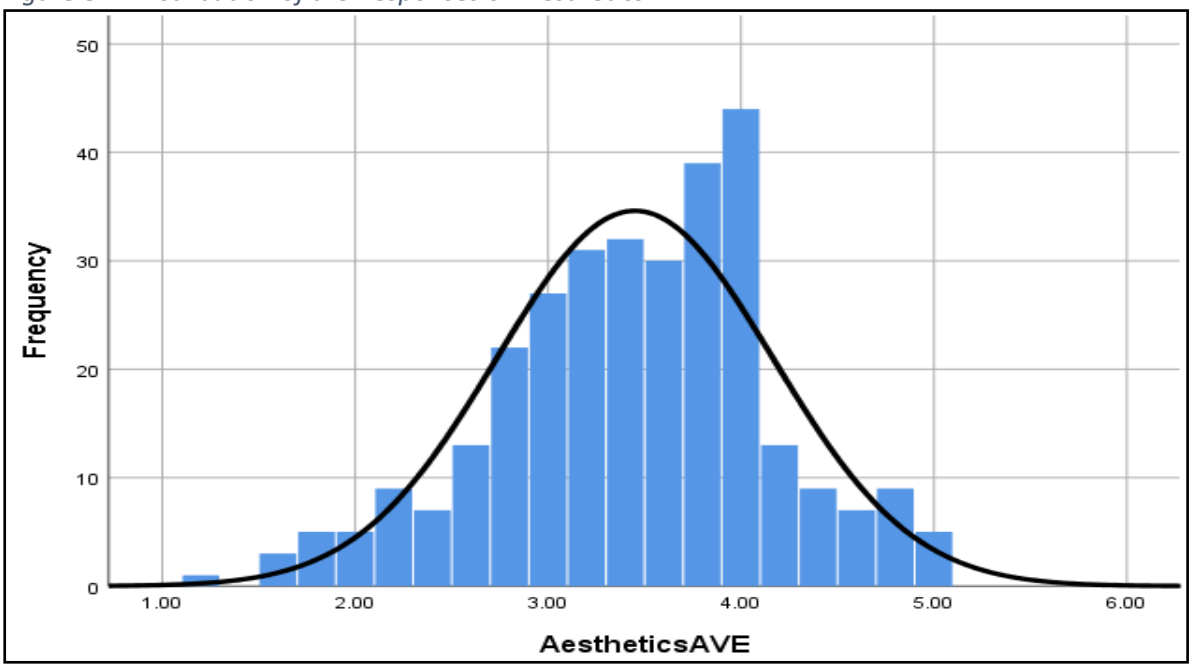
N	*311 (Valid)*
Mean	*3.2303*
Median	*3.2308*
Standard Deviation	*.4865*
Variance	*.237*
Skewness	*-.121*
Kurtosis	*.861*

Figure 8.1: Distribution of the Responses on EngagementAVE



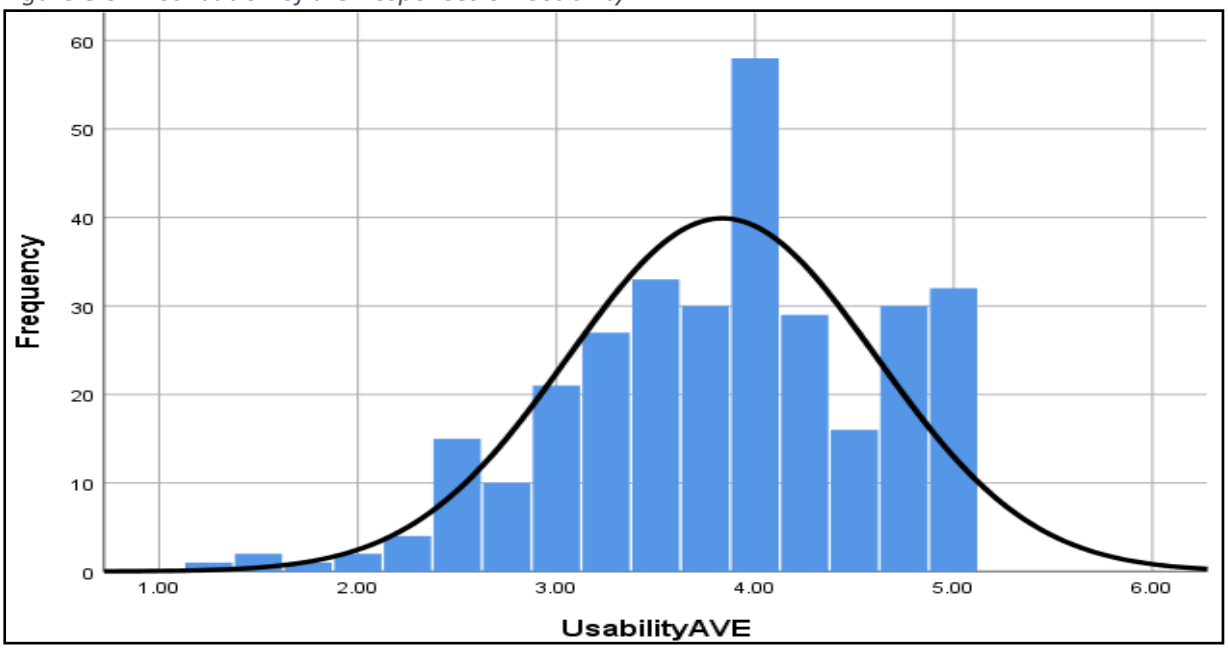
Similar to 13 engagement items, five Aesthetics items were summated and the summed value divided by five to generate a new variable called "AestheticsAVE". While the mean value was 3.45, the most frequently selected option was the "Agree" option (i.e., the mode was equal to 4.00). Therefore, it can be assumed that, on average, the survey respondents identified their IHD as aesthetically engaging. Besides, average responses on the aesthetics items were normally distributed (Figure 8.2) with a kurtosis score of 0.077 and a negative skewness score of -0.325. Hence, the AestheticsAVE data were symmetrical.

Figure 8.2: Distribution of the Responses on AestheticsAVE



In order to explore the average responses on four Usability items, these four items were first summated and then divided by four. As a result of these operations, a new variable called "UsabilityAVE" was created in SPSS. The mean for UsabilityAVE was 3.83. Additionally, like AestheticsAVE, the Agree option was again the most frequently selected option by 311 respondents. While the responses were normally distributed (Figure 8.3) with a kurtosis value of -.053, the value of skewness was calculated to be negative and stronger than the skewness score of AestheticsAVE. However, it was still in the range of -0.5 and 0.5 (Cain et al., 2017). Thus, the UsabilityAVE data were also symmetrical.

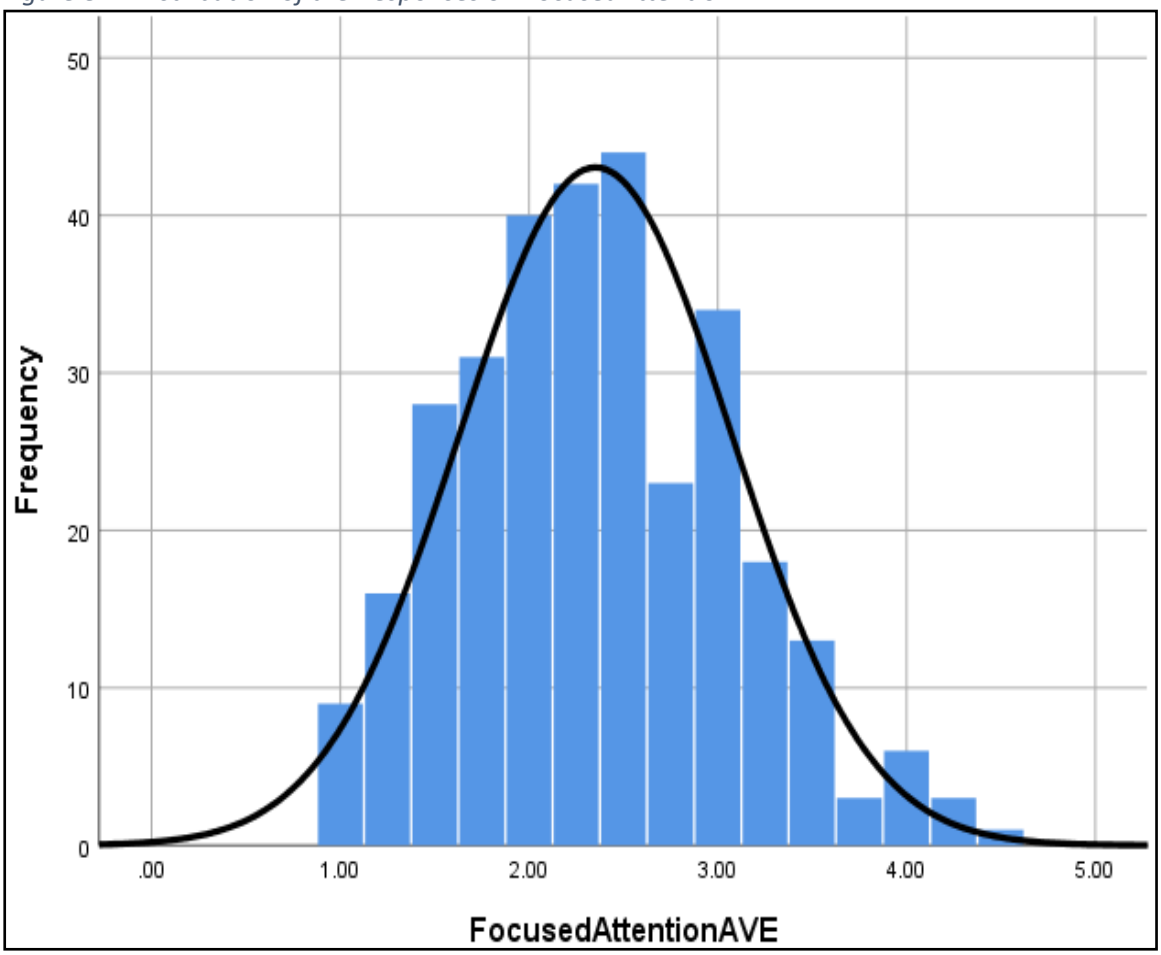
Figure 8.3: Distribution of the Responses on UsabilityAVE



Finally, with the same method used to create EngagementAVE, AestheticsAVE and UsabilityAVE, the researcher used four items of the Focused Attention dimensions to create the "FocusedAttentionAVE" variable in SPSS to check the descriptive statistics for the average responses on the focused attention items. Unlike the first three findings explained above, the average score of 311 responses on the average of four focused attention items was calculated below 3.00 (i.e., 2.35), and the mode of the responses was 2.50. Therefore, on average, online survey participants tended to disagree more (compared to agree) with the statements used to measure the level of engagement on the focused attention dimension. It could be further argued that respondents, on average, did not recognise their IHD as a strongly effective device to attract their attention.

Furthermore, different from two other engagement dimensions, responses on FocusedAttentionAVE were normally distributed with a kurtosis value of -0.224 and positively skewed with a score of 0.342 (Figure 8.4). Therefore, the FocusedAttentionAVE data were symmetrical.

Figure 8.4: Distribution of the Responses on FocusedAttentionAVE



In conclusion, out of 19 original engagement scale items, only 13 of them were selected to be used after running exploratory factor analysis (EFA). Three final dimensions (i.e., Aesthetics, Usability and Focused Attention) were created depending on the factor loadings. Following this, the researcher analysed the descriptive statistics for the engagement dimensions by calculating their average values. Initial results underline that while participants view their smart meter in-home display (IHD) as highly engaging on the aesthetics and usability dimensions, average responses on the focused attention dimension were closer to the disagree option. Regarding the distributions of the data, responses were normally distributed in each of the three engagement dimensions.

The following section interprets the descriptive statistics for two independent variables that were conceptualised to have a direct influence on the strength of consumer engagement (CE) with smart meter IHD technologies in Chapter 7: Perceived usefulness (PU) and perceived ease of use (PEOU) of the IHD.

8.3.2 Descriptive Statistics for Technology-related Characteristics Items

To test their internal validity and understand whether they were statistically valid to use in data analysis and hypotheses testing, the researcher first applied reliability analysis to check the items of both PU and PEOU (see Section 8.3.1). As expected, Cronbach's Alpha scores of both technology-related characteristics' items were much higher than the lower limit of 0.70 (Table 8.5).

After reliability tests, all three PU items were summated and then divided by three to calculate the average response on these PU items, and a new variable, "PerceivedUsefulnessAVE", was created in SPSS. Following the same steps, "PerceivedEaseofUseAVE", a new variable measuring the average responses on PEOU items, was also generated in SPSS. For PerceivedUsefulnessAVE and PerceivedEaseofUseAVE, the most frequently selected option was the Agree option (i.e., mode = 4.00) (Figure 8.5 and 8.6), while the averages of the responses on these variables were calculated 3.77 and 3.91, respectively (Table 8.7 and Table 8.8). The responses were normally distributed with kurtosis values of 0.675 and 0.813 for PerceivedUsefulnessAVE and PerceivedEaseofUseAVE, respectively. Besides, for both of the new variables, skewness scores of the responses on these variables were negative and strong: -0.610 for PerceivedUsefulnessAVE and -0.974 for PerceivedEaseofUseAVE. Hence, both of these variables' data were moderately skewed.

Table 8.7: Descriptive Statistics for PerceivedUsefulnessAVE

N	*311 (Valid)*
Mean	*3.7685*
Median	*4.00*
Standard Deviation	*.7960*
Variance	*.634*
Skewness	*-.610*
Kurtosis	*.675*

Table 8.8: Descriptive Statistics for PerceivedEaseofUseAVE

N	*311 (Valid)*
Mean	*3.9057*
Median	*4.00*
Standard Deviation	*.7227*
Variance	*.522*
Skewness	*-.974*
Kurtosis	*.813*

Figure 8.5: Distribution of the Responses on PerceivedUsefulnessAVE

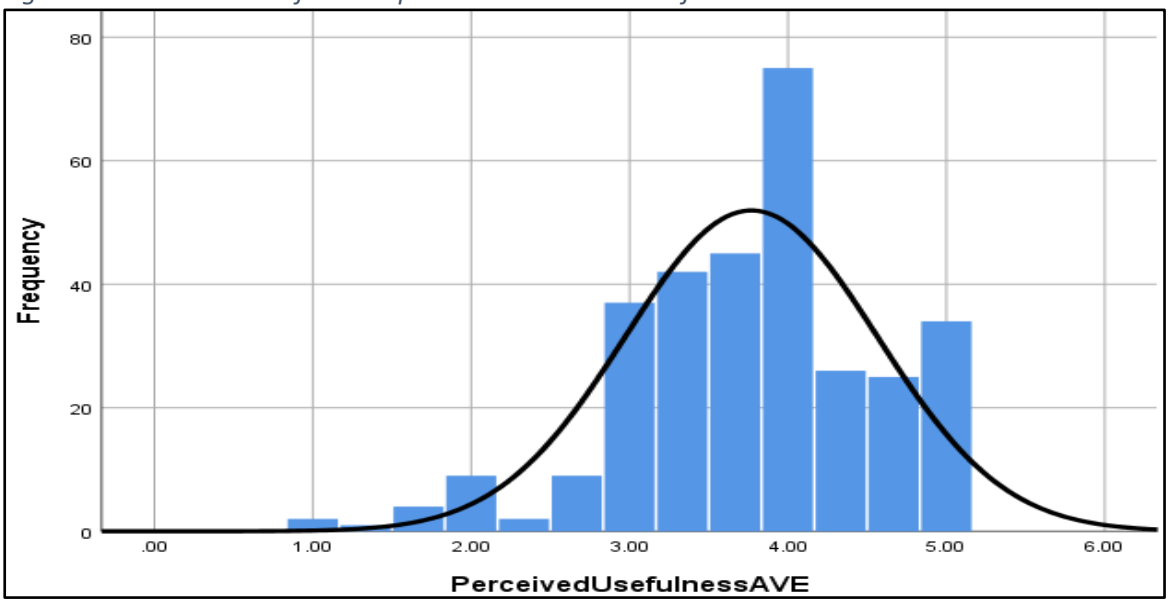
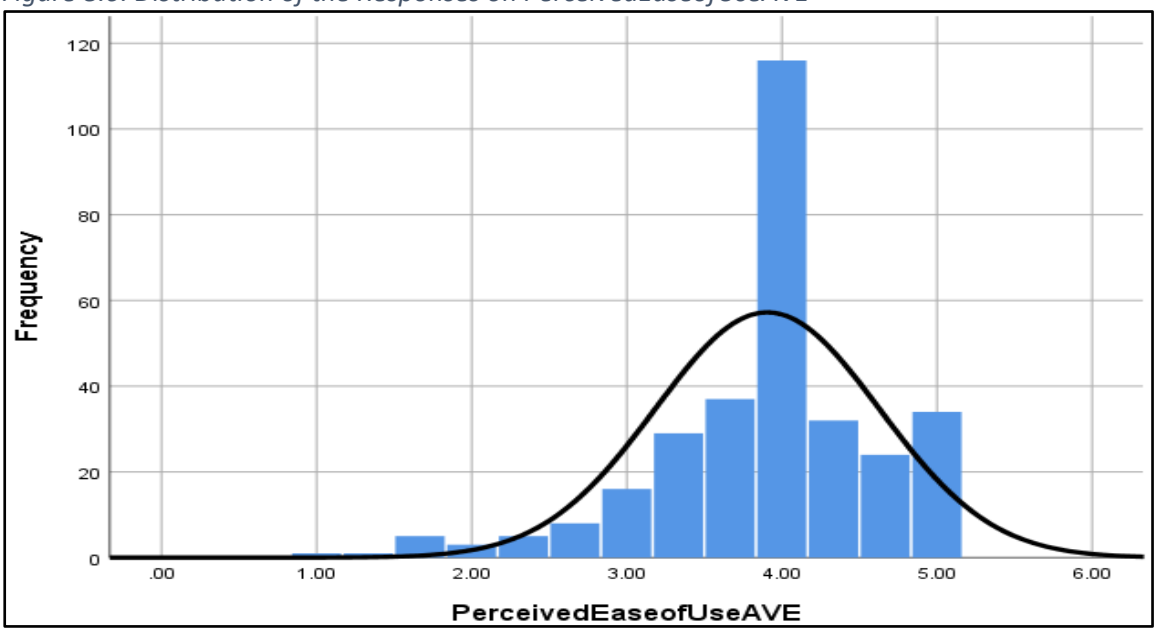


Figure 8.6: Distribution of the Responses on PerceivedEaseofUseAVE



To sum up, similar to relevant studies covering perceived usefulness (PU) and perceived ease of use (PEOU) of technology on the level of consumer interaction with technology (e.g., Chung and Kwon, 2009; Park et al., 2014), items used in scales for both PU and PEOU of smart meter IHD technologies generated a high validity score, and there was no reason for the researcher to remove any of the items from these scales. Furthermore, simple descriptive statistics findings also imply that the survey participants, on average, had a very positive perception regarding the usefulness and ease of use of their IHD.

The next three sections analyse the descriptive statistics for consumer-related motivations items, namely attitude to money (ATM), susceptibility to normative influence (SNI) and green environmentalism (GE) items. To start with, descriptive statistics for ATM items are discussed first.

8.3.3 Descriptive Statistics for Attitude to Money (ATM) Items

After the validity check (see Table 8.5 in Section 8.3.1), each of the five ATM items was summated first and then divided by five to find the average responses of participants on these items. "AttitudetoMoneyAVE" was created as a new variable as a result. Table 8.9 below demonstrates the simple descriptive statistics for this variable. At first glance, it can be assumed that participants, on average, had a relatively high level of overall ATM as the average score of responses on five ATM items was found out to be 3.50 on a 1 to 5-point Likert scale.

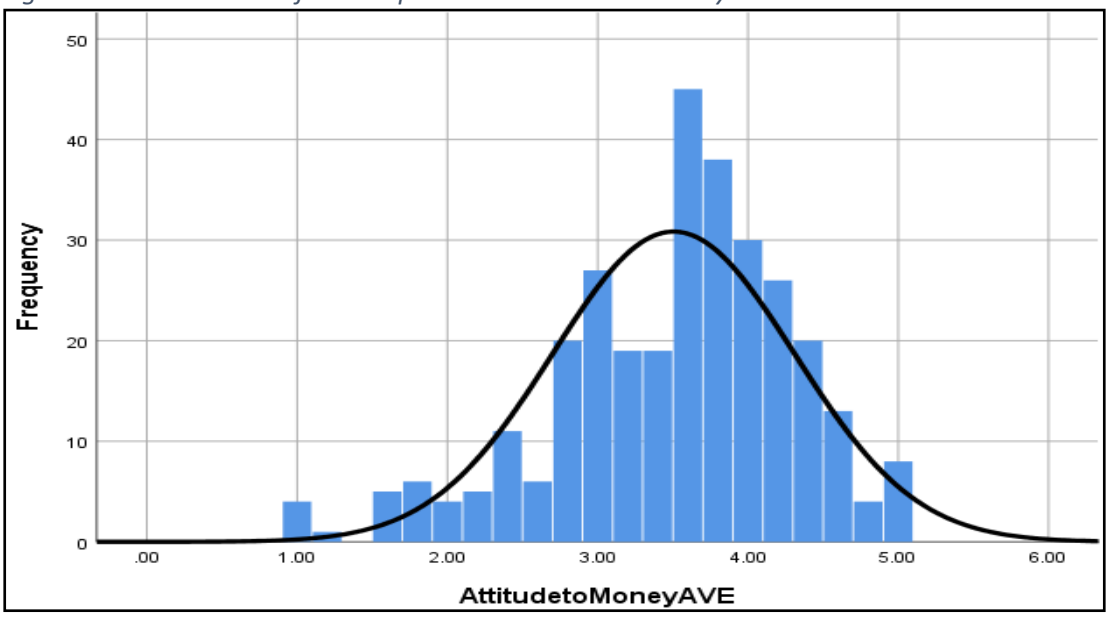
AttitudetoMoneyAVE data were moderately skewed. Considering the kurtosis value of 0.550, it can be argued that the data were normally distributed.

Table 8.9: Descriptive Statistics for AttitudetoMoneyAVE

N	*311 (Valid)*
Mean	*3.5048*
Median	*3.600*
Standard Deviation	*.8043*
Variance	*.647*
Skewness	*-.713*
Kurtosis	*.550*

Moreover, responses on the average of ATM items were normally distributed (see Figure 8.7 for a visual illustration).

Figure 8.7: Distribution of the Responses on AttitudetoMoneyAVE



In short, based on the five-item scale, findings from simple descriptive statistics highlight that, on average, respondents cared about their finances and put attention on their budget. While it is still challenging to make generalisations at this stage, it can be contended that British smart meter in-home display (IHD) users are usually interested in their financial circumstances.

The following section states the descriptive findings for the items of the second consumer-related motivations: Susceptibility to normative influence (SNI).

8.3.4 Descriptive Statistics for Susceptibility to Normative Influence (SNI) Items

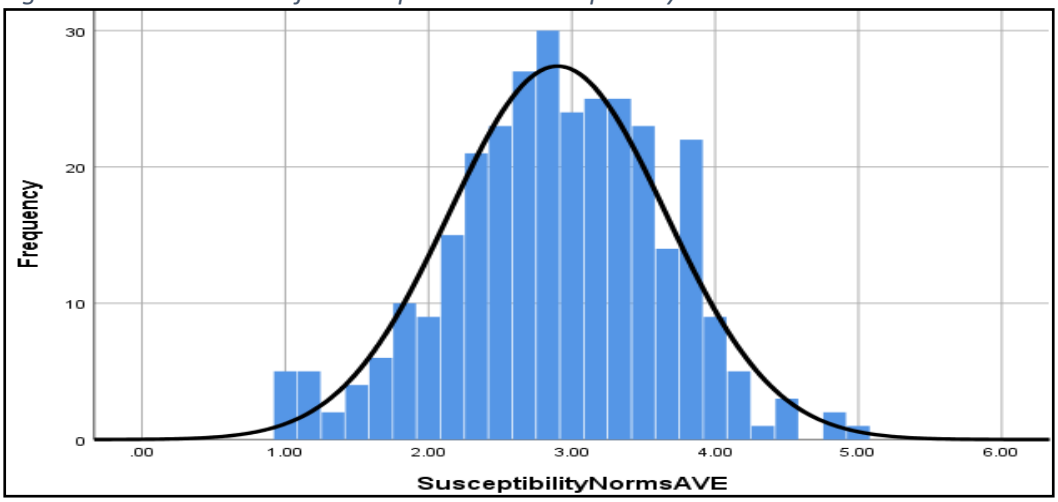
Following a really high Cronbach's Alpha score of 0.85 (Table 8.5 in Section 8.3.1), it was found that the majority of the survey participants selected the Disagree and Strongly Disagree options combined considering the SNI items. Nevertheless, since the total number of responses on each side were almost equal to each other, the mean for the average responses on "SusceptibilityNormsAVE" (i.e., a new variable created in SPSS after summing all 6 SNI items and then dividing the summated value by six) was found to be 2.90 (Table 8.10). Hence, participants were not found to have a high level of inclination to change their actions depending on how others act or what others tell them to do.

Table 8.10: Descriptive Statistics for SusceptibilityNormsAVE

N	*311 (Valid)*
Mean	*2.8998*
Median	*2.8333*
Standard Deviation	*.7548*
Variance	*.570*
Skewness	*-.208*
Kurtosis	*.014*

Moreover, responses on SusceptibilityNormsAVE were normally distributed (Figure 8.8) with a kurtosis value of 0.014 and a relatively weak, negative skewness score of -0.208. Hence, the SusceptibilityNormsAVE data were fairly symmetrical as well.

Figure 8.8: Distribution of the Responses on SusceptibilityNormsAVE



In order to finish discussing descriptive statistics for survey items, the following section sheds light on the descriptive statistics for items of the third and final consumer-related variable, namely green environmentalism (GE).

8.3.5 Descriptive Statistics for Green Environmentalism (GE) Items

Among all the scales adopted to prepare the online survey, GE Items (i.e., six items) had the strongest internal validity, and these items were the only ones with a Cronbach's Alpha score above 0.90 (Table 8.5 in Section 8.3.1).

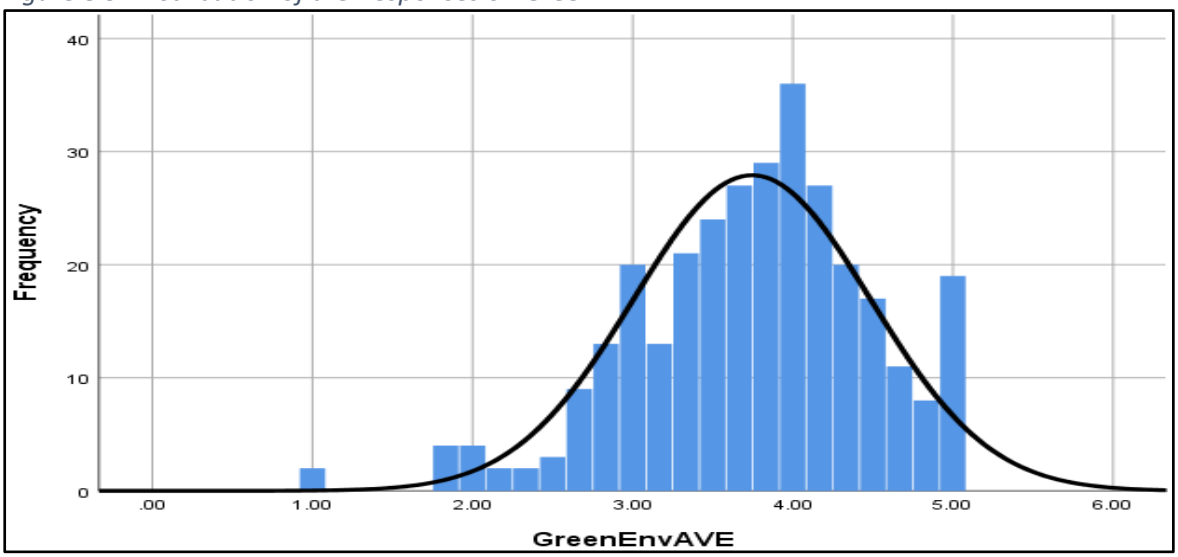
The researcher first created a new variable called "GreenEnvAVE" by adding six GE items and dividing the summed value by six. The majority of the responses on GreenEnvAVE were located on the Agree and Strongly Agree side with a mean score of 3.74 (Table 8.11). Accordingly, the survey participants, on average, had a high level of willingness to follow green/environment-friendly activities and change their behaviour (to a certain extent) to protect the environment. Moreover, the GreenEnvAVE data were moderately skewed (Figure 8.9). Considering the kurtosis value of 0.644, it can be added that the GreenEnvAVE data were normally distributed.

Table 8.11: Descriptive Statistics for GreenEnvAVE

N	*311 (Valid)*
Mean	*3.7449*
Median	*3.8333*
Standard Deviation	*.7407*
Variance	*.549*
Skewness	*-.583*
Kurtosis	*.644*

In summary, the green environmentalism (GE) scale was reliable for the online survey to explore participants' attitude to GE. Depending on the average of the responses on the average of GE items (which was normally distributed), it can be concluded that 311 survey respondents, on average, had a relatively high level of motivation to save the environment.

Figure 8.9: Distribution of the Responses on GreenEnvAVE



While the initial, simple descriptive statistics were useful to explore the nature of the data in detail, the next sections of this chapter focus on testing the specific relationships proposed earlier in section 7.2. In this respect, the results of hypotheses testing are explained in the following sections.

8.4 Structural Equation Modelling (SEM) and Findings

8.4.1 Structural Model Development in SPSS AMOS

Before constructing the structural equation model in AMOS, an additional exploratory factor analysis (EFA) was run to check the communalities and factor loadings of 36 items in eight dimensions (i.e., Attitude to Money (ATM – 5 items), Susceptibility to Normative Influence (SNI – 6 items), Green Environmentalism (GE – 6 items), Perceived Usefulness of in-home display (IHD) (PU – 3 items), Perceived Ease of Use of IHD (PEOU – 3 items), Aesthetics (5 items), Usability (4 items) and Focused Attention (4 items).

Results from EFA highlighted that the last item of the ATM scale (i.e., "I feel compelled to argue or bargain about the cost of almost everything that I buy") had a communality score of 0.236, which was below the lower acceptable limit of 0.3 and this item's factor loading score of 0.309 was also below the acceptable factor loading score of 0.35 (Table 8.12) for 311 participants (Field, 2017).

Table 8.12: Factor Loading of the Final ATM Item

Pattern Matrix[a]								
	Factor							
	1	2	3	4	5	6	7	8
I feel compelled to argue or bargain about the cost of almost everything that I buy				.309				
Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization.[a]								
a. Rotation converged in 7 iterations.								

Therefore, the last item of the ATM scale was removed, and a second EFA was run (See Appendix E for the full EFA) to test the communalities and factor loadings of the remaining 35 items. The results highlight that all the items were loaded under their allocated dimensions without any communality issues. Additionally, the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) was calculated to be 0.883. Accordingly, the high KMO result implied that collecting data from 311 participants to test the relationship between 8 dimensions and 35 items was perfectly adequate. Finally, after removing

the last item from the ATM scale, Cronbach's Alpha (CA) score for the remaining four ATM items was rechecked. On the positive side, the remaining ATM items generated a higher CA score than the ATM CA score illustrated in Section 8.3.1 (i.e., 0.89 compared to 0.83), and therefore, internal validity. Table 8.13 below demonstrates the finalised version of variable names, the number of factors each variable was allocated on and the CA score of each variable.

Table 8.13: Final Factor Distribution of Variables and Cronbach's Alpha Scores for Variables

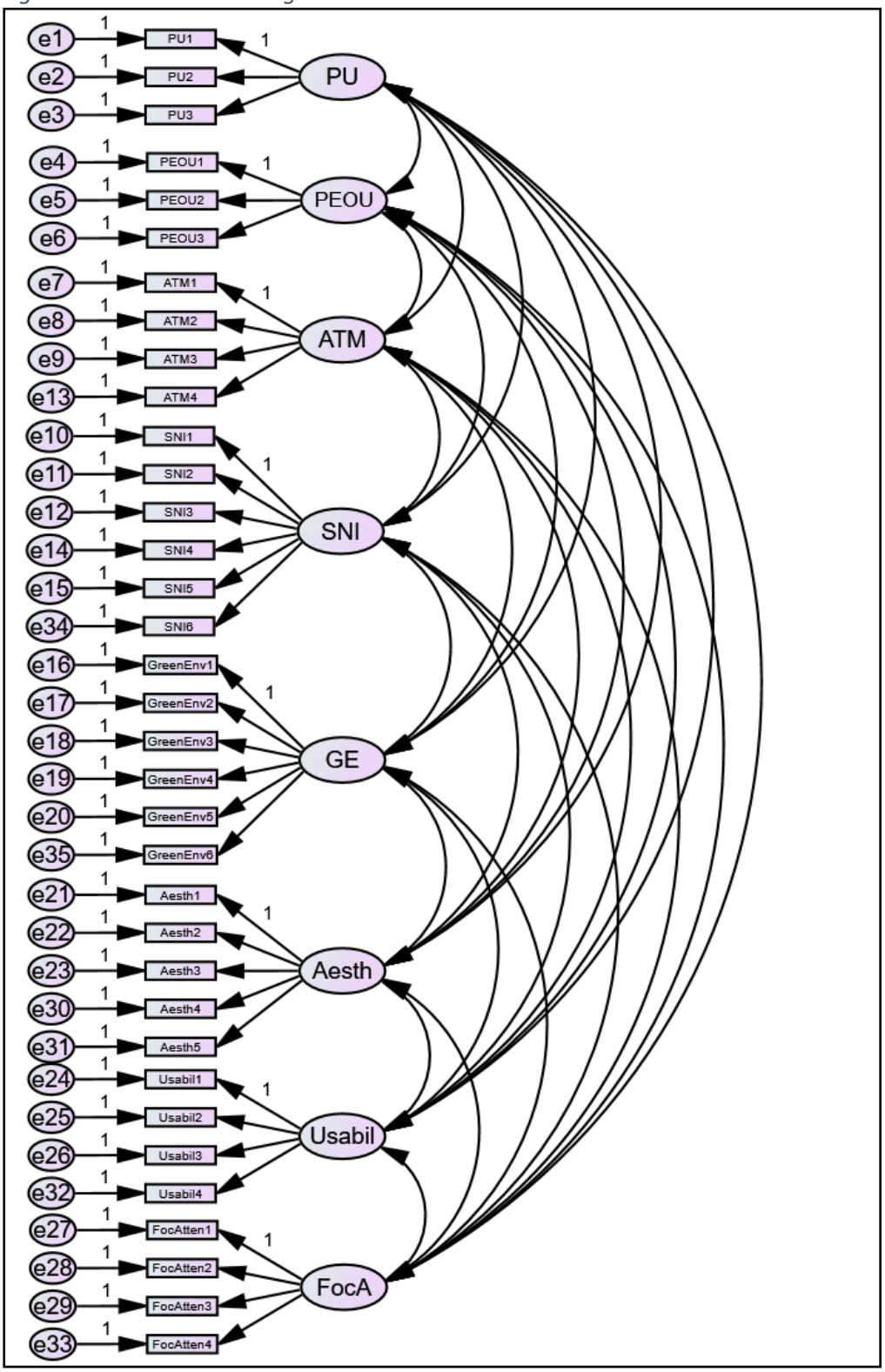
	Initial Eigenvalues				
Factor	Total	% of Variance	Cumulative %	Variable Name	Cronbach's Alpha
1	8.453	24.150	24.150	Green Environmentalism	0.91
2	4.651	13.288	37.438	Aesthetics	0.86
3	3.258	9.308	46.746	Susceptib. to Norm. Inf.	0.85
4	2.386	6.817	53.564	Attitude to Money	0.89
5	2.005	5.730	59.294	Usability	0.82
6	1.255	3.586	62.879	Perceived Ease of Use	0.85
7	1.199	3.426	66.305	Focused Attention	0.75
8	.835	2.386	68.691	Perceived Usefulness	0.80
Extraction Method: Maximum Likelihood.					

Next, a structural equation model to undertake the confirmatory factors analysis (CFA) was created in AMOS to check the fit between variables and the overall model fit. Figure 8.10 below was produced to find out some of the important statistical measures (i.e., Comparative Fit Index (CFI)) concerning the goodness of the model fit. It is important to note that since AMOS software only allows variable names that are less than eight characters, some variable names were shortened to build the model. Table 8.14 shows the variable names and their shortened versions in SPSS AMOS.

Table 8.14: List of Variable Names used in SPSS AMOS

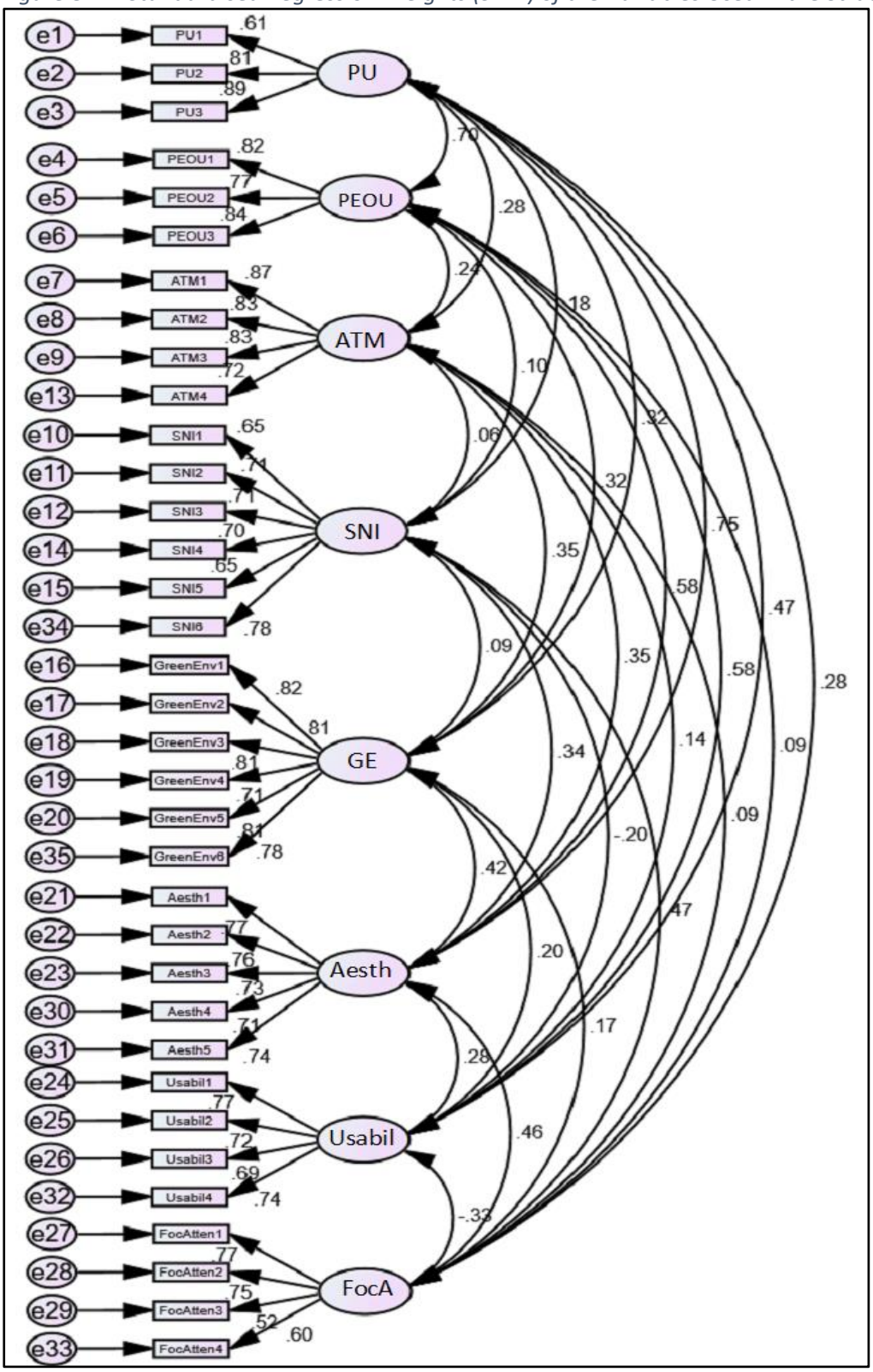
Original Name of the Variable	***Variable Name in Amos***
Perceived Usefulness	*PU*
Perceived Ease of Use	*PEOU*
Attitude to Money	*ATM*
Susceptibility to Normative Influence	*SNI*
Green Environmentalism	*GE*
Aesthetics	*Aesth*
Usability	*Usabil*
Focused Attention	*FocA*

Figure 8.10: Initial Path Diagram



The output path diagram in Amos (Figure 8.11) shows the standardized regression weights of each variable.

Figure 8.11: Standardised Regression Weights (SRW) of the Variables Used in the Structural Model



Considering the model fit, it can be argued that the model with 35 items had a really good model fit. To support this, it is important to highlight the high CFI score of the model. A number of researchers (e.g., Hu and Bentler, 1999) have contended that for an acceptable (or satisfactory) model fit, the CFI

value should be 0.90 or higher. Table 8.15 points out that the CFI of the model in Figure 8.10 was higher than this value. Second, Hu and Bentler (1999) also argued that the Root Mean Square Error of Approximation (RMSEA) value has to be 0.06 or lower for a good model fit. RMSEA value of 0.05 (Table 8.16) implies that the model had a good fit. Last but not least, Kenny et al. (2015) stated that the PCLOSE (or p of Close Fit) of a model has to be greater than 0.05 for a satisfactory model fit. Hence, the PCLOSE value of 0.453 (Table 8.16) indicates that the specific model constructed in AMOS is a close-fitting model.

Table 8.15: CFI Value of the Structural Model

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.847	.829	.926	.917	.926
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Table 8.16: RMSEA and PCLOSE Values of the Structural Model

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.050	.045	.055	.453
Independence model	.174	.170	.178	.000

Although the above findings showed that the model had a good fit, the 'Common Method Bias' (CMB) method was also applied to double-check the fit between all of the variables and items of the model. In order to run CMB, a factor reduction in SPSS by restricting all of the items on a single factor and not selecting any rotation method was applied. It is commonly argued that 'Extraction Sums of Squared Loadings' (ESSL) produced in the output table (i.e., 'Total Variance Explained') has to be less than 50% (e.g., Podsakoff et al., 2012; Fuller et al., 2016). From Table 8.17, it can be seen that the ESSL value of the 35 items was far less than the above limit of 50%. Therefore, the model was found to have a perfect fit.

Table 8.17: ESSL for 35 Items Restricted on a Single Factor

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.453	24.150	24.150	7.727	22.078	22.078
2	4.651	13.288	37.438			
3	3.258	9.308	46.746			
4	2.386	6.817	53.564			
5	2.005	5.730	59.294			
6	1.255	3.586	62.879			
7	1.199	3.426	66.305			

Extraction Method: Maximum Likelihood.

Next, model variables were checked to understand if they had a multicollinearity problem. The multicollinearity test was done by listing the specific dependant variables and independent variables under the linear regression tab in SPSS and selecting the 'Collinearity Diagnostics' option under the statistics section. In total, a multicollinearity test was conducted four times. First, the relationship between the three consumer-related motivations (i.e., ATM, SNI and GE) and one of the technology-related characteristics (i.e., PU) was checked as it was hypothesized that consumer characteristics had the potential to directly influence PU of smart meter in-home display (IHD). After that, the relationship between two technology-related characteristics (i.e., PU and PEOU) and three engagement dimensions (Aesthetics, Usability and Focused Attention) were checked. Tables 8.18 to 8.21 highlight that there was no multicollinearity problem in the model as the Variance Inflation Factor (VIF) was calculated to be less than the maximum acceptable value of 10 (e.g., Hair et al., 2014; Gomez et al., 2016).

Table 8.18: VIF Score of Consumer-Related Motivations Variables on PU of IHD

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	ATM	.901	1.110
	SNI	.995	1.005
	GE	.898	1.114

a. Dependent Variable: PU

Table 8.19: VIF Score of PU and PEOU of IHD on the Aesthetics Dimension

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	PU	.645	1.550
	PEOU	.645	1.550

a. Dependent Variable: Aesth

Table 8.20: VIF Score of PU and PEOU of IHD on the Usability Dimension

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	PU	.645	1.550
	PEOU	.645	1.550

a. Dependent Variable: Usabil

Table 8.21: VIF Score of PU and PEOU of IHD on the Focused Attention Dimension

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	PU	.645	1.550
	PEOU	.645	1.550

a. Dependent Variable: FocA

After the multicollinearity test, the Common Latent Factor (CLF) technique (Figure 8.12) was used in SPSS AMOS to check if all 35 items fit together finally. Accordingly, the CLF value was found to be 0.471. Moreover, CFI, RMSEA and PCLOSE values of the final model highlight that the model has a good fit (Table 8.22 and 8.23).

Figure 8.12: CLF to Check the Final Fit of the Latent Variables

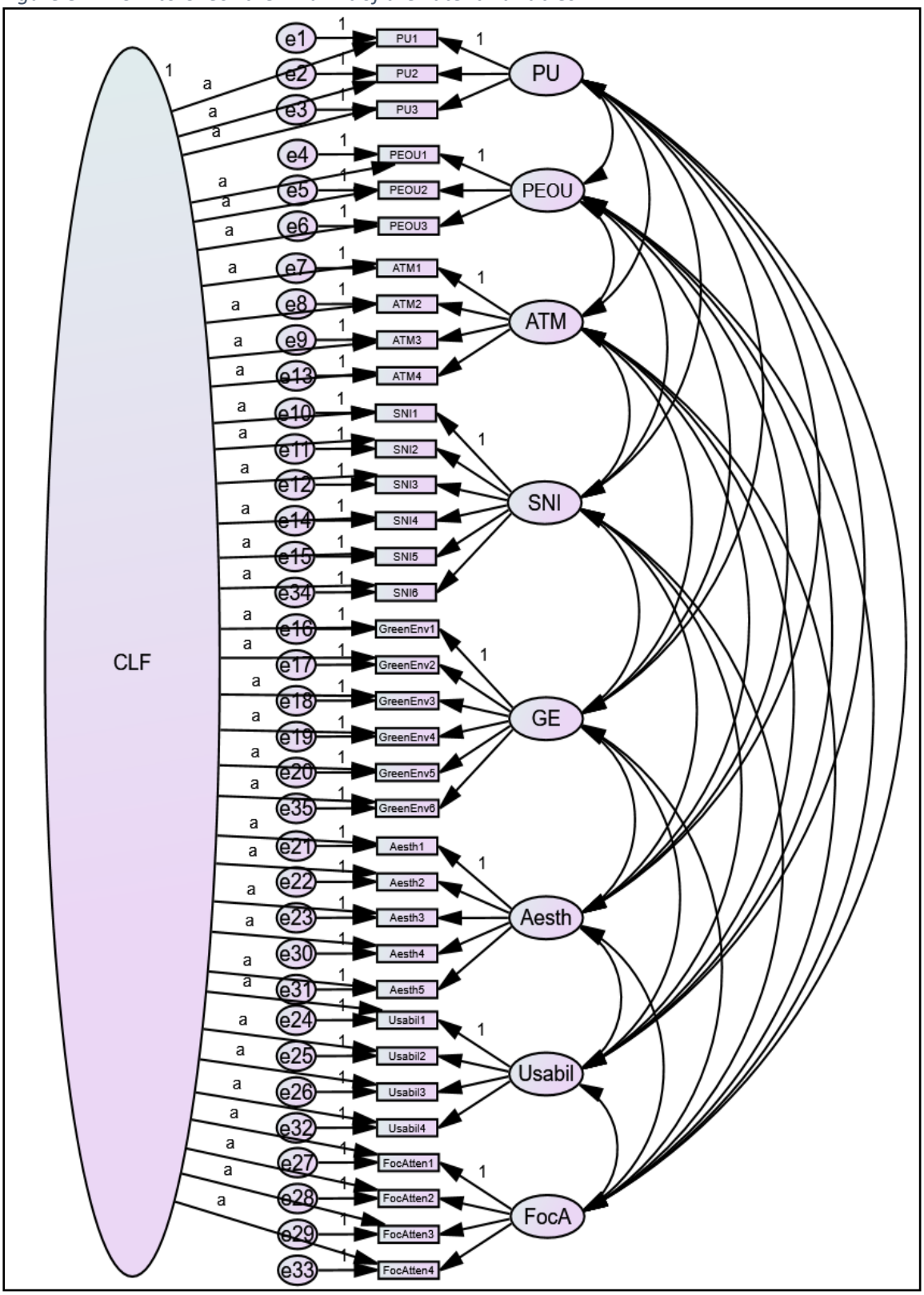


Table 8.22: Final CFI Value of the Structural Model

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.847	.828	.926	.916	.925
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Table 8.23: Final RMSEA and PCLOSE Values of the Structural Model

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.050	.045	.056	.439
Independence model	.174	.170	.178	.000

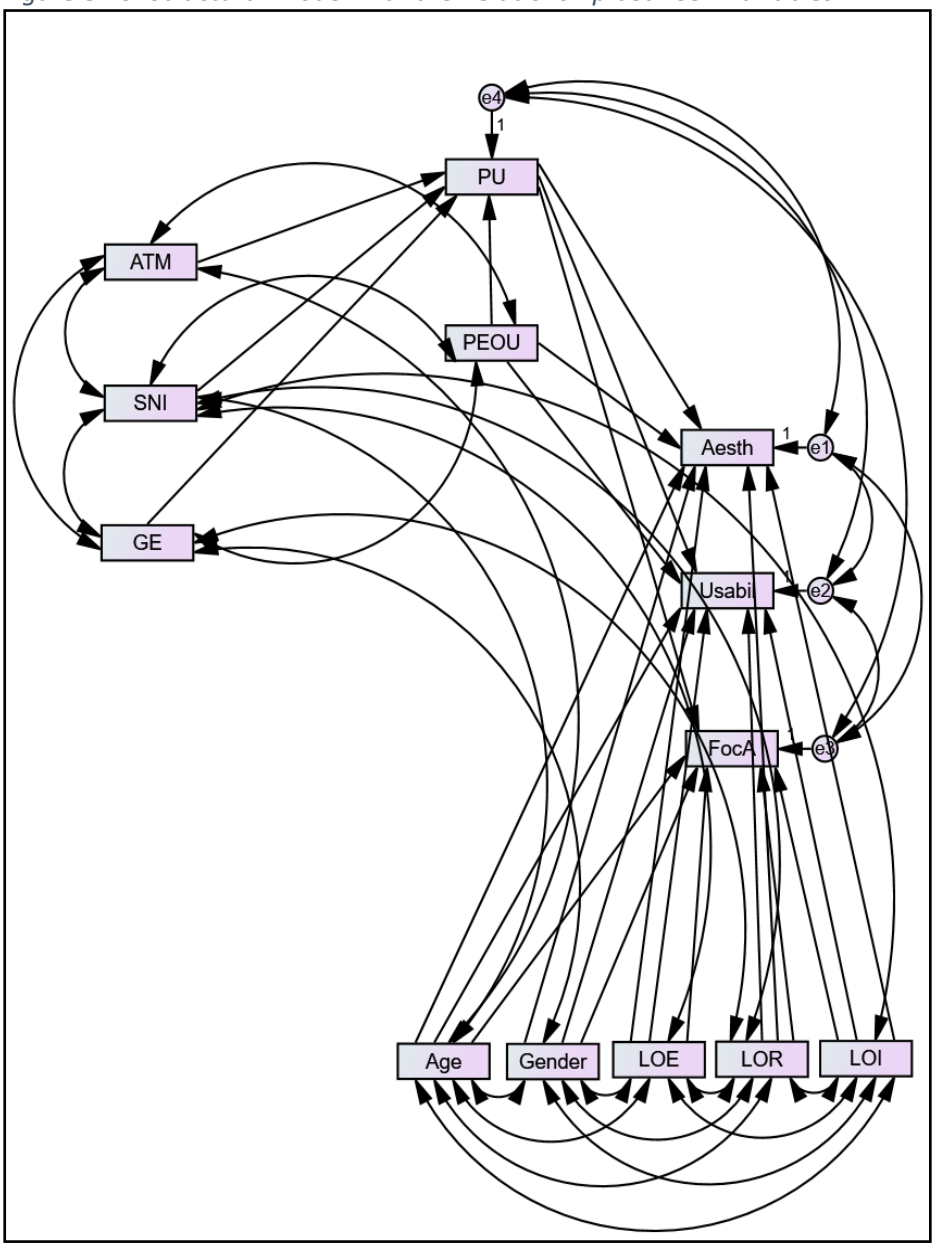
In conclusion, based on the dimension reduction results, 13 engagement items were included in the final model, divided into three dimensions (i.e., Aesthetics, Usability and Focused Attention). Except for one item of the ATM scale, all other items had high communality and factor scores. Therefore, 35 items generated the final version of the structural model with really high fit scores.

Following the dimension reductions and model fit, the results of the hypotheses testing are discussed in the next section.

8.4.2 Hypotheses Testing

Following the necessary checks implemented for the final model fit, a model for testing hypotheses proposed in section 7.2 was generated in SPSS AMOS. Together with all eight latent variables [i.e., attitude to money (ATM), susceptibility to normative influence (SNI), green environmentalism (GE), perceived usefulness (PU) and perceived ease of use (PEOU) of in-home display (IHD) technologies, aesthetics, usability and focused attention dimensions of consumer engagement (CE) with IHD], five control variables [age, gender, level of education (LOE), length of relationship with IHD (LOR) and level of household income (LOI)] were included in the model to undertake hypotheses testing. Figure 8.13 highlights the relationship and paths between independent, dependent and control variables of the model.

Figure 8.13: Structural Model with the Relationship between Variables



Based on the CFI (Table 8.24), RMSEA and PCLOSE (Table 8.25) values, the structural model illustrated above (Figure 8.13) had no fit-related issues. Hence, using all of the variables formed a close-fitting model for the hypotheses testing.

Table 8.24: CFI Value of the Structural Model for Hypotheses Testing

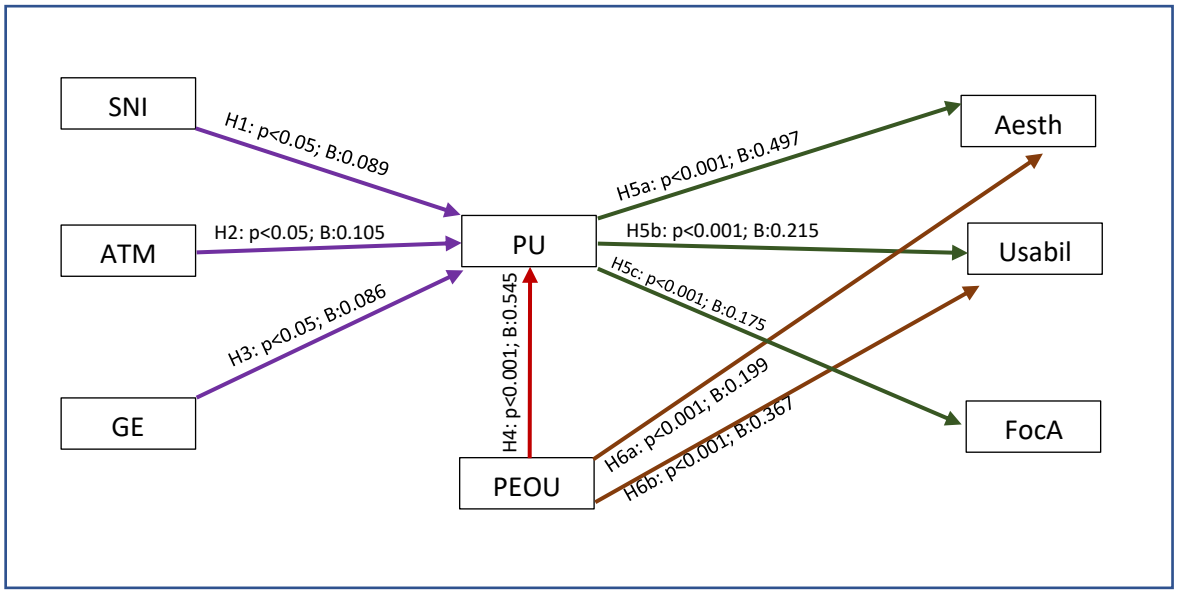
Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.944	.824	.970	.899	.968
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Table 8.25: RMSEA and PCLOSE Values of the Structural Model for Hypotheses Testing

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.060	.037	.082	.221
Independence model	.188	.178	.199	.000

As the model had an adequate fit, the proposed hypotheses were tested. Figure 8.14 illustrates the probability or significance level (i.e., p) and standardised regression weights (i.e., Beta – B) of each of the hypotheses.

Figure 8.14: Significance Level and Standardised Regression Weights of Hypotheses



Accordingly, the results of the hypotheses testing are also provided in Table 8.26 together with the effect sizes (*r*), r-squared variances (r^2), and t-values of the results.

Table 8.26: Results of Hypotheses Testing

Hypothesis	Beta (B)	Supported at	*r*	r^2	t-values
H1 – Susceptibility to normative influence (SNI) has a positive direct influence on Perceived Usefulness (PU) of in-home display (IHD)	0.089	p<0.05	0.116	0.013	1.65
H2 – Attitude to money (ATM) has a positive direct influence on PU of IHD	0.105	p<0.05	0.184	0.034	2.10
H3 – Green environmentalism (GE) has a positive direct influence on PU of IHD	0.086	p<0.05	0.207	0.043	1.88
H4 – Perceived ease of use (PEOU) of IHD has a positive direct influence on PU of IHD	0.545	p<0.001	0.695	0.483	3.95
H5a - PU of IHD has a positive direct influence on the Aesthetics dimension of engagement with IHD	0.497	p<0.001	0.512	0.262	3.02
H5b - PU of IHD has a positive direct influence on the Usability dimension of engagement with IHD	0.215	p<0.001	0.349	0.121	2.80
H5c – PU of IHD has a positive direct influence on the Focused Attention dimension of engagement with IHD	0.175	p<0.001	0.224	0.050	1.56
H6a – PEOU of IHD has a positive direct influence on the Aesthetics dimension of engagement with IHD	0.199	p<0.001	0.255	0.065	1.91
H6b - PEOU of IHD has a positive direct influence on the Usability dimension of engagement with IHD	0.367	p<0.001	0.411	0.169	2.59

Looking at these results, it can be argued that both general (i.e., SNI) and context-specific (i.e., ATM and GE) consumer-related motivations have the potential to significantly influence how useful consumers perceive their smart meter IHD technologies to be. Therefore, the findings showed that different type of motivations have the potential to affect the overall IHD engagement framework through their impact on a technology-related characteristic (i.e., PU). Accordingly, technology-related characteristics, both PU and PEOU of IHD were found to have a positive and significant direct influence on different dimensions of engagement with IHD and, therefore, on the overall strength of IHD engagement. In this respect, when individuals perceive their IHD as more useful, they also see their device as more aesthetically appealing and attractive and spend more 'focused' time with the device. Similarly, when individuals perceive their IHD as easier to use, they believe the device is more

attractive and offers a higher level of usability. Furthermore, it was also found that the level of PEOU of IHD has great potential to increase the level of PU of IHD not only at the acceptance and adoption stage but also at the post-adoption stage.

Finally, the relationship between technology-related factors (i.e., PU and PEOU) and dimensions of engagement (i.e., aesthetics, usability, focused attention) was much stronger than the proposed relationship between consumer-related motivations and the level of PU of smart meter IHD. Thus, it can be underlined that consumers' perception of technology-related characteristics may have a very strong influence on the post-adoption stage of human-technology interaction in the context of IoT technologies regardless of the level of motivations.

Following the hypotheses testing, the next section talks about how control variables influence the relationship between different variables of the model and the strength of CE with IHD technologies.

8.4.3 Findings Relating to Control Variables

As the responses for some of the control variable questions were scattered around multiple answers based on Table 8.1 (see Section 8.2), the response ratio for many categories were negligibly small to generate statistically generalisable data. For instance, only three (around 1%) respondents among 311 stated that their level of education was on a PhD level. Moreover, only a total of 12 (about 4%) individuals stated that their domestic household income was more than £80,000. Therefore, in order to have a sufficient number of respondents under each category and understand the differences between individuals, control variables with more than two options, namely age group, level of education (LOE), gross household income or level of income (LOI) and length of relationship (LOR) with smart meter in-home display (IHD) were grouped into two options.

In this sense, instead of five groups, the age group was divided into two groups. While individuals between 18 to 24 and 25 to 34 were put together to represent the younger respondents, the number of individuals older than 34 were combined to form the older respondents' group. Accordingly, the "18-34" group had 124 participants and "35-65" had 187 participants. Considering the LOE, individuals were put under "High School and College Degree" (187 participants) and "University Undergraduate Degree and higher" (124 participants) categories. For the LOI, "Less than £40,000" (208 participants) and "£40,000 and more" (103 participants) were the two categories. Finally, for the LOR, rather than grouping individuals into three categories, the first two categories (i.e., using IHD for less than 6 months and using IHD for more than 6 months but less than 12 months) were combined. In this respect, new LOR groups were "Up to 12 months" (201 participants) and "Longer than 12 months" (110 participants).

Moreover, groups were renamed in SPSS Amos for ease of calculation. The first category was named 'Younger' and the second category 'Older' for the age group. For the LOE, the first group was named 'Less Educated', and the second group was named 'More Educated'. For the LOI, the first group was named 'Low Income' while the second group named 'High Income'. For the LOR, the groups were named '12 months and less' and 'More than 12 months', respectively.

Following these steps, the influence of each of the control variables on the relationship between consumer-related motivations [i.e., attitude to money (ATM), susceptibility to normative influence (SNI) and green environmentalism (GE)], technology-related characteristics [i.e., perceived usefulness (PU) and perceived ease of use (PEOU)] of smart meter IHD and different dimensions (i.e., aesthetics, usability and focused attention) of consumer-IHD engagement was computed in SPSS AMOS with structural equation modelling (SEM).

First, the differences between male and female consumers were investigated (Figure 8.15). This model had a great fit based on the CFI (Table 8.27), RMSEA and PCLOSE (Table 8.28) values, as explained earlier in section 8.4.1. Therefore, the results were acceptable.

Figure 8.15: Structural Model to Check the Influence of Gender on the Proposed Relationships

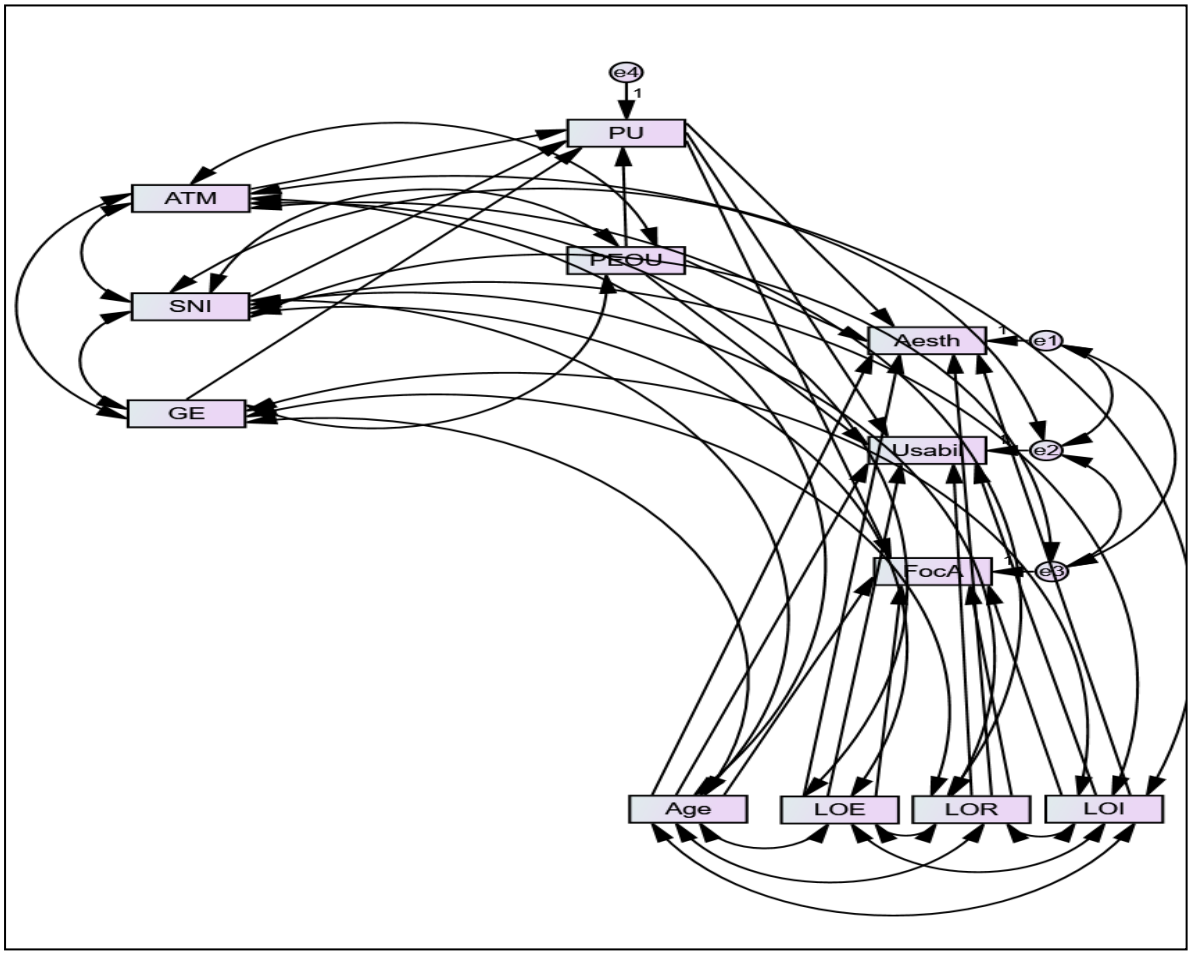


Table 8.27: CFI Value of Figure 8.15

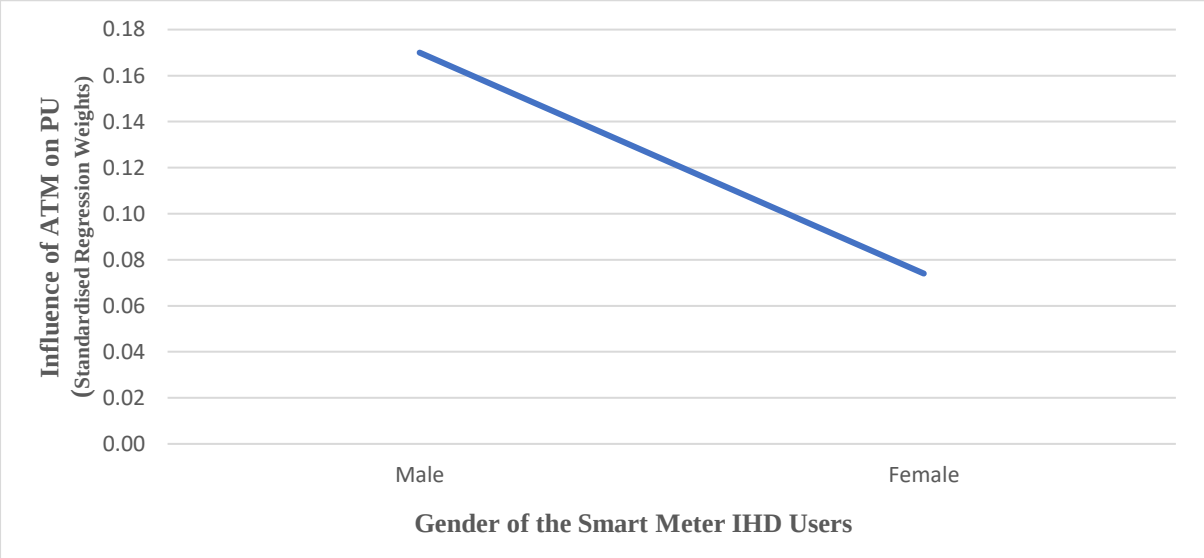
Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.931	.782	.976	.914	.973
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Table 8.28: RMSEA and PCLOSE Values of Figure 8.15

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.040	.017	.060	.771
Independence model	.138	.130	.147	.000

Considering the differences between males and females, only one difference was found. The results highlight that while ATM has a statistically significant impact on the level of PU of IHD for males (p=0.031; B=0.170), its influence is not statistically significant for females (p=0.193; B=0.074). Figure 8.16 illustrates the influence of ATM on PU of IHD with regards to the gender of the respondents.

Figure 8.16: Influence of ATM on PU of IHD with regards to the Gender of the IHD Users



Based on this finding, it can be argued that, while male users believe that using their IHD provide them with some sort of financial benefit (i.e., saving money by using less energy), female users, on average, do not think that a smart meter IHD has potential to offer benefits related to financial savings or gains. Section 8.5 provides a further discussion on this and other findings relating to control variables together with the results of hypotheses testing (see Section 8.4.2).

Second, differences based on the age groups were analysed (Figure 8.17). CFI, RMSEA and PCLOSE values of Figure 8.17 can be seen in Table 8.29 and 8.30, respectively.

Figure 8.17: Structural Model to Check the Influence of Age on the Proposed Relationships

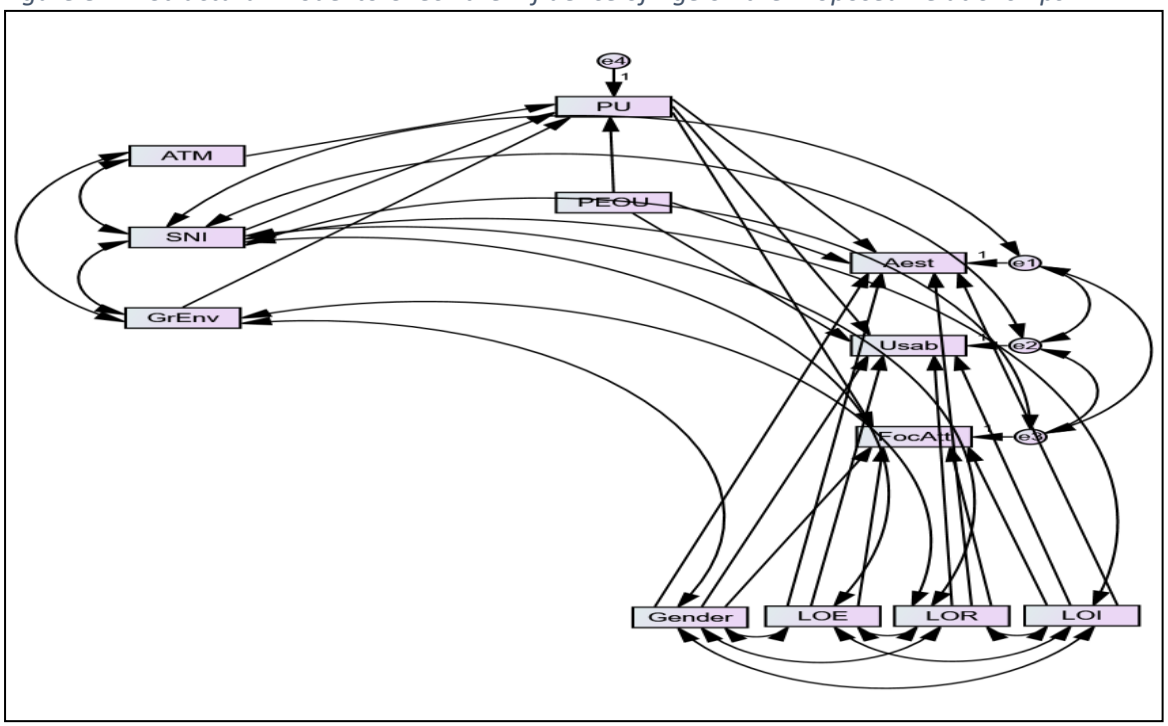


Table 8.29: CFI Value of Figure 8.17

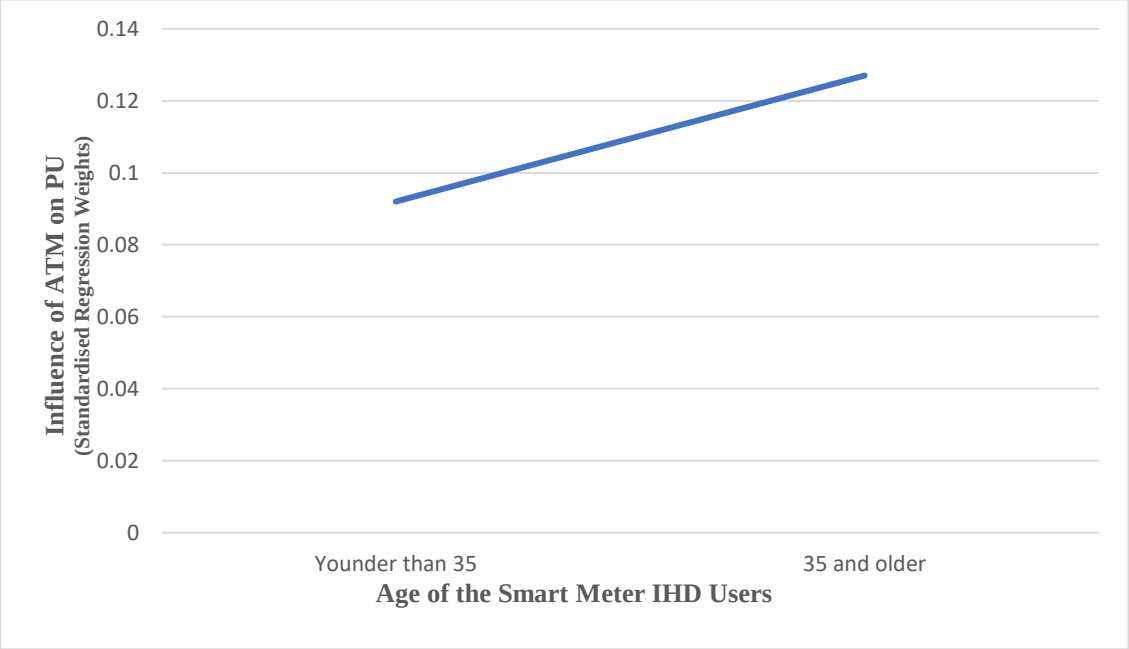
Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.917	.752	.966	.887	.962
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Table 8.30: RMSEA and PCLOSE Values of Figure 8.17

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.045	.025	.064	.646
Independence model	.134	.126	.143	.000

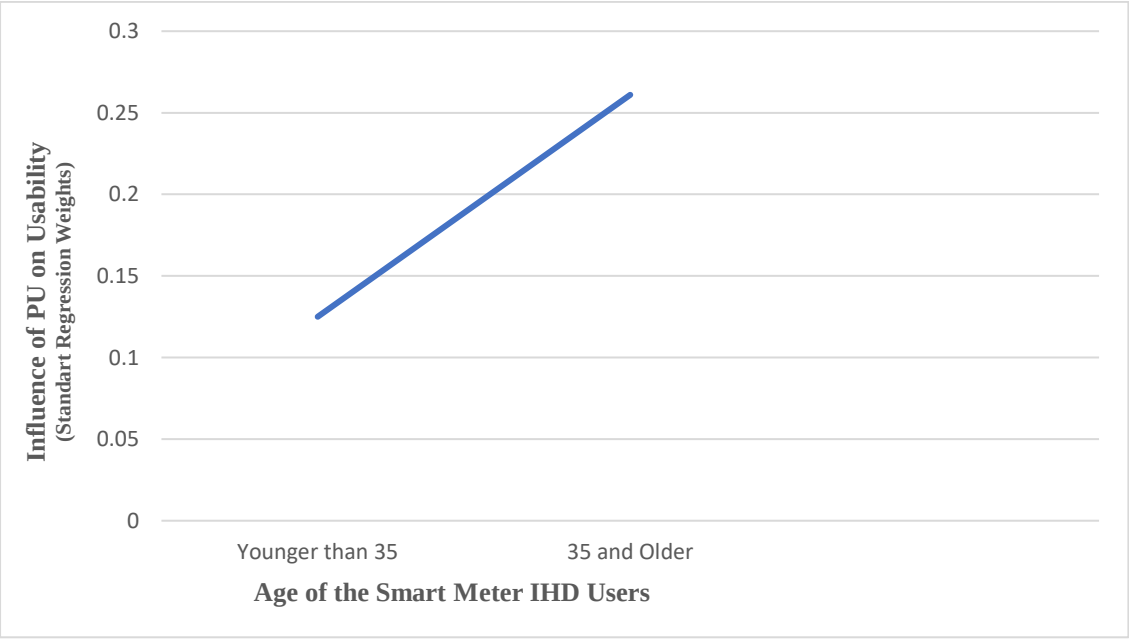
The results show that ATM has a statistically significant influence (p=0.040; B=0.127) on PU of IHD only for the older group (i.e., individuals who are 35 and older). The difference between the younger (i.e., individuals younger than 35) and the older group are illustrated in Figure 8.18.

Figure 8.18: Influence of ATM on PU of IHD with regards to the Age of the IHD User



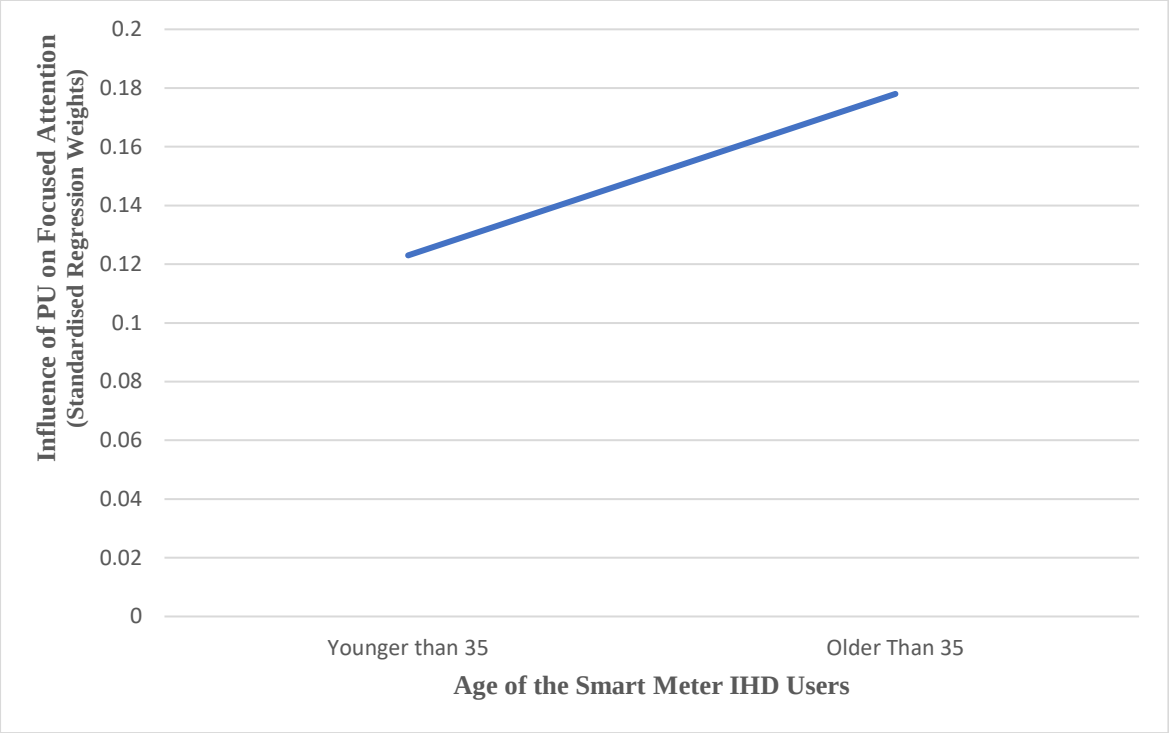
The influence of PU of IHD on the usability dimension of IHD engagement was found to be the second difference between the two age groups. While this influence was not statistically significant for the younger group (p=0.246; B=0.125), it was statistically significant for the older group (p<0.001; B=261). Figure 8.19 shows the difference between the two groups.

Figure 8.19: Influence of PU of IHD on the Usability Dimension of IHD Engagement with regards to the Age of the IHD Users



The third difference between age groups was the influence of PU of IHD on the focused attention dimension of IHD engagement. Similar to the influence of PU of IHD on the usability dimension, PU of IHD was found to have a statistically significant influence ($p<0.001$; $B=0.178$) on the focused attention dimension only for the older group (Figure 8.20).

Figure 8.20: Influence of PU of IHD on the Focused Attention Dimension of IHD Engagement with regards to the Age of the IHD Users



These findings imply that while older consumers believe that using a smart meter IHD would help them have better financial outcomes, younger individuals do not perceive their IHD as a product that could help them save money or gain other types of financial benefits. Besides, the actual level of PU of IHD does not lead younger individuals to find their IHD as more usable and focus more on their device when they use it, whereas the level of PU is really important for the older users to see the device as more usable and put more attention to the device (i.e., checking the messages, following the trends) when they spend time checking it.

Third, the influence of LOE on the relationship between variables was examined in AMOS (Figure 8.21). Once again, the model had a really good fit depending on the CFI (Table 8.31), RMSEA and PCLOSE (8.32) values.

Figure 8.21: Structural Model to Check the Influence of LOE on the Proposed Relationships

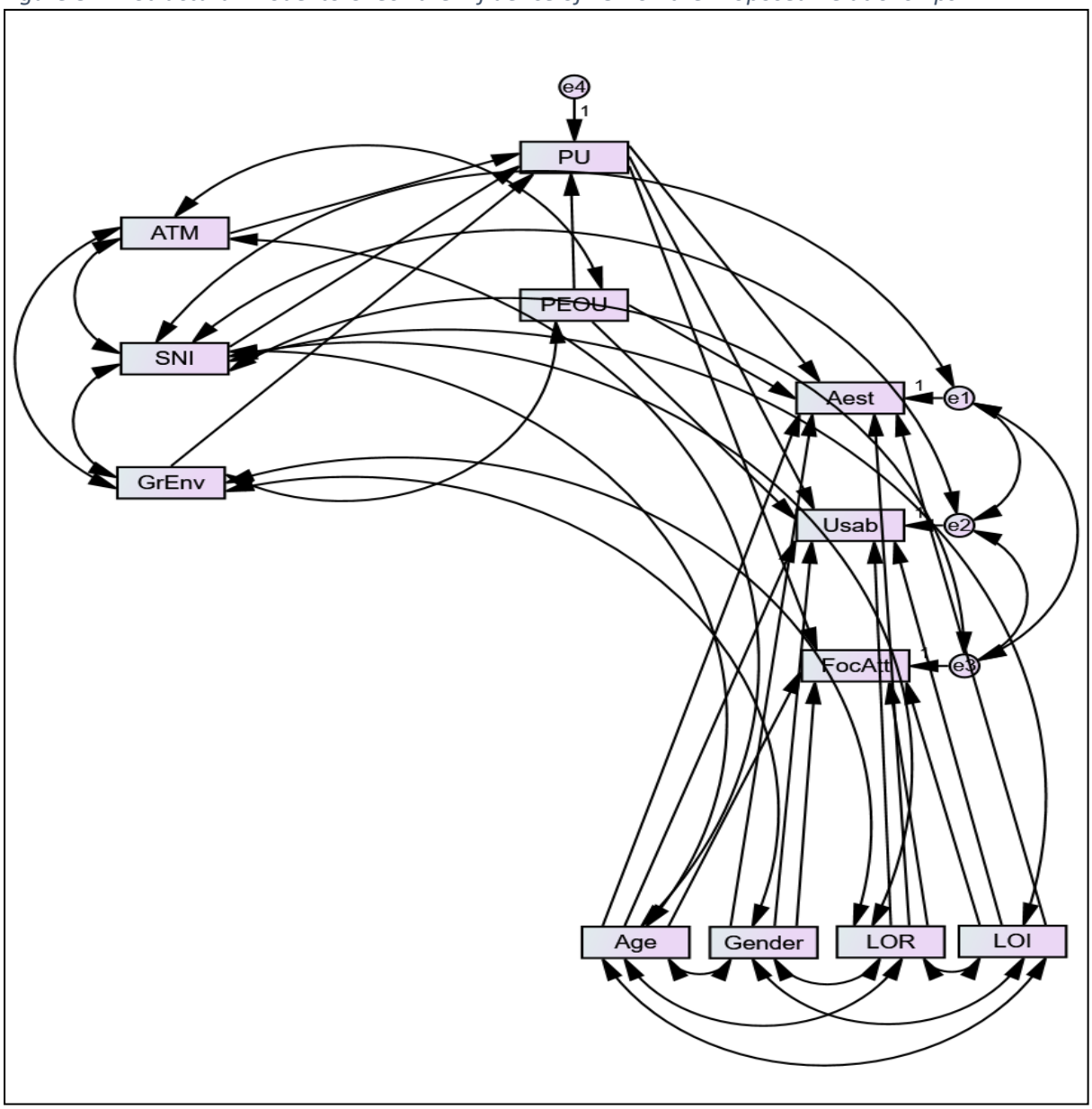


Table 8.31: CFI Value of Figure 8.21

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.924	.761	.968	.889	.965
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Table 8.32: RMSEA and PCLOSE Values of Figure 8.21

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.046	.026	.065	.610
Independence model	.138	.130	.147	.000

Considering the LOE of consumers, the influence of ATM (p=0.002; B=0.175) and GE (p=0.016; B=0.152) on PU of IHD was found to be significant only for the more educated group (Figure 8.22 and Figure 8.23).

Figure 8.22: Influence of ATM on PU of IHD with regards to the LOE of the IHD Users

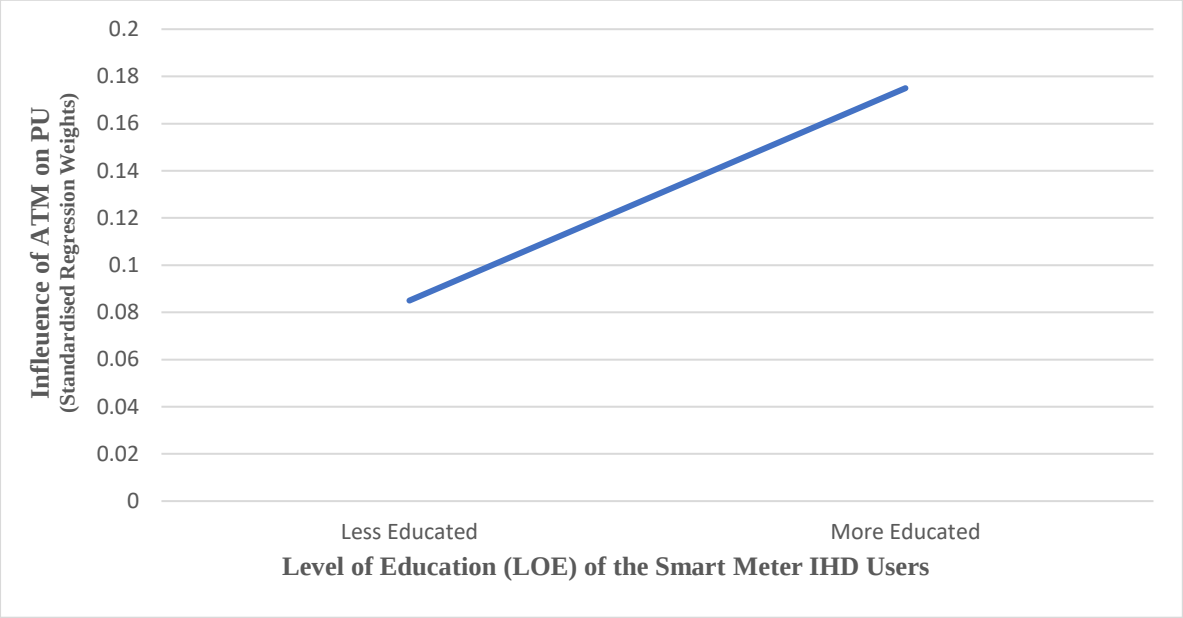
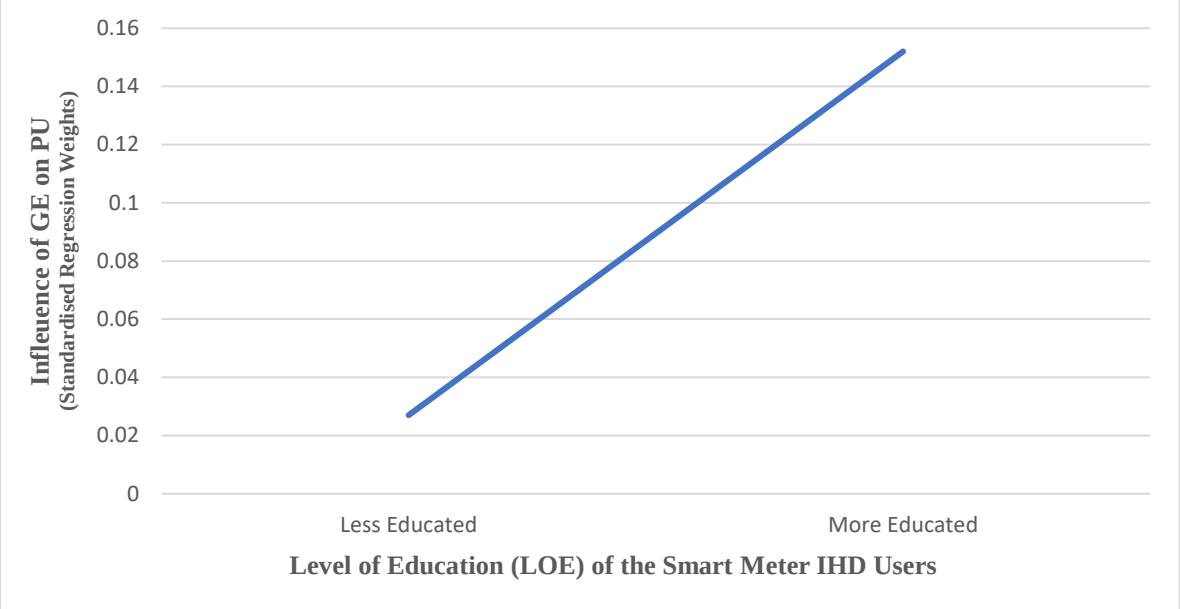


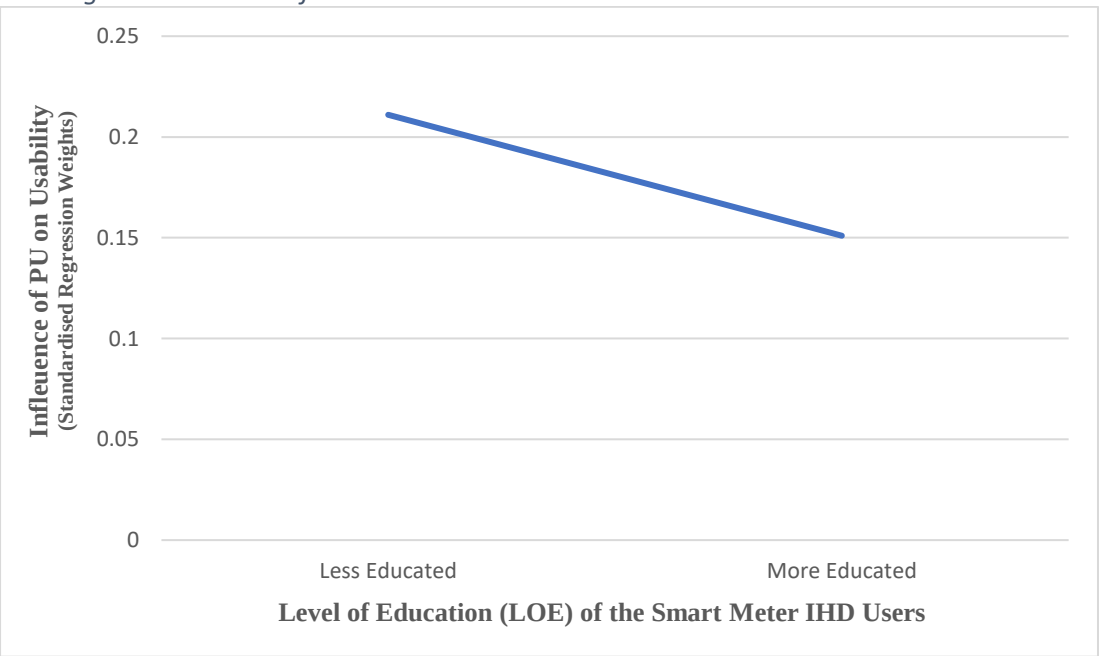
Figure 8.23: Influence of GE on PU of IHD with regards to the LOE of the IHD Users



Accordingly, both financial and environmental motivations (or concerns) are important elements for individuals with a higher level of education to perceive their smart meter IHD as more useful as IHD may help them to protect the environment and save money at the same time. Hence, it can be discussed that when the education level of individuals increases, they may see IHD as more useful thanks to the high potential to getting financial and environmental benefits from using the device.

On the other hand, Figure 8.24 demonstrates that PU of IHD has a significant effect (p=0.002; B=0.211) on the usability dimension of IHD engagement only for the individuals in the less educated group.

Figure 8.24: Influence of PU of IHD on the Usability Dimension of IHD Engagement with regards to the LOE of the IHD Users



Thus, the level of PU of IHD is not a key factor for more educated people to see their IHD as usable, whereas for the individuals with a lower level of education, there is a direct relationship between the PU and the usability of the IHD. Based on this finding, it can be contended that the consumers who have a higher level of education may not think that it is necessary for them to have a very useful device to make it highly usable as they may have better knowledge of how to use the device compared to the less educated individuals. In other words, the complexity of using a device (not to be confused with the PEOU of IHD) may be inversely correlated with the LOE of consumers.

Following the LOE, the differences between the low income and high-income groups were investigated. While Figure 8.25 shows the structural model constructed to explore differences between these groups, Table 8.33 and 8.34 highlight the values related to the fit of this model. According to the findings, the only difference among income groups is the influence of SNI on the level of PU of IHD. While this influence was statistically significant (p=0.016; B=0.176) for the high-income group, no statistically supported relationship between SNI and PU of IHD was found for the low-income group. Figure 8.26 below illustrates the difference between the two groups.

Figure 8.25: Structural Model to Check the Influence of LOI on the Proposed Relationships

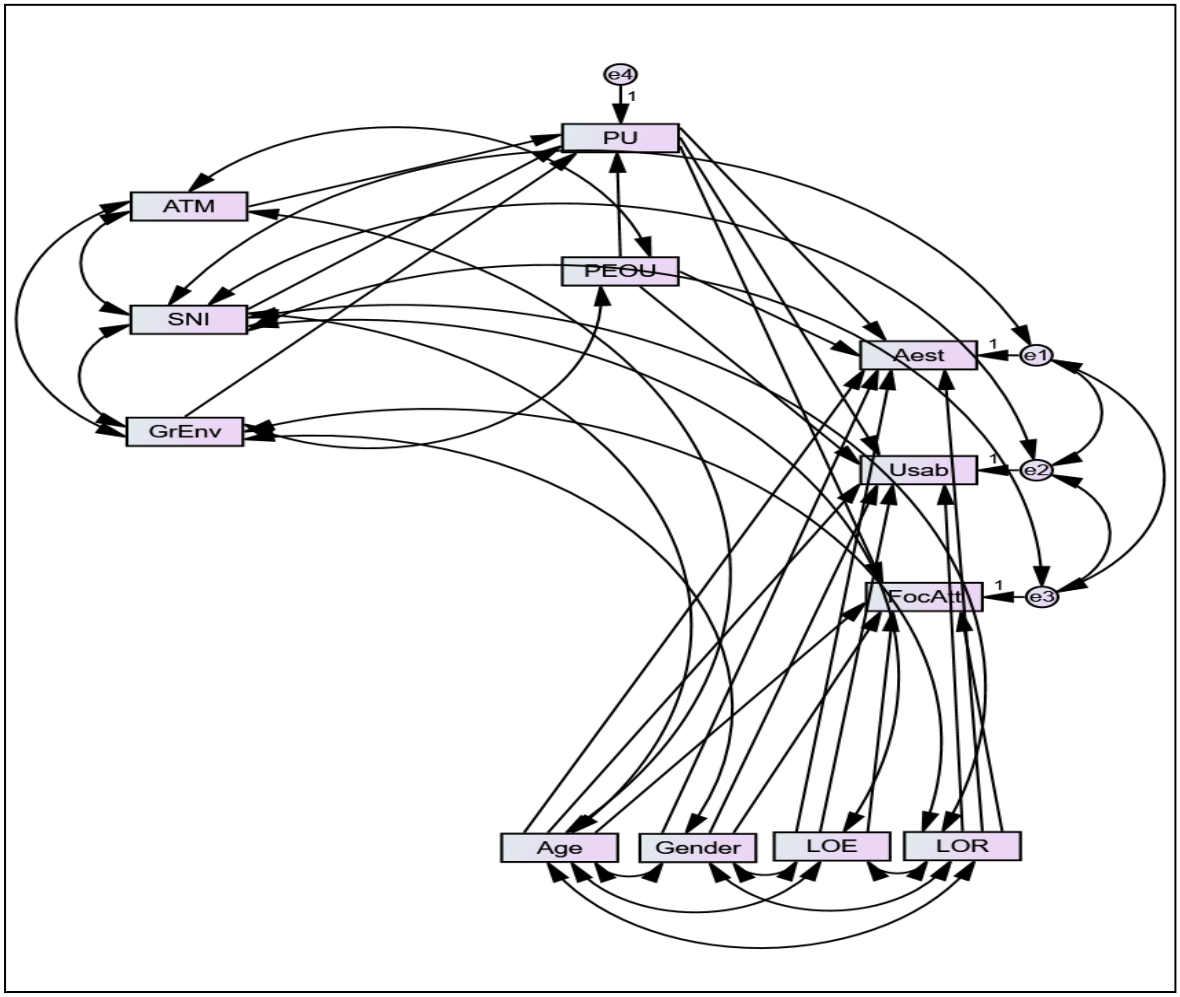


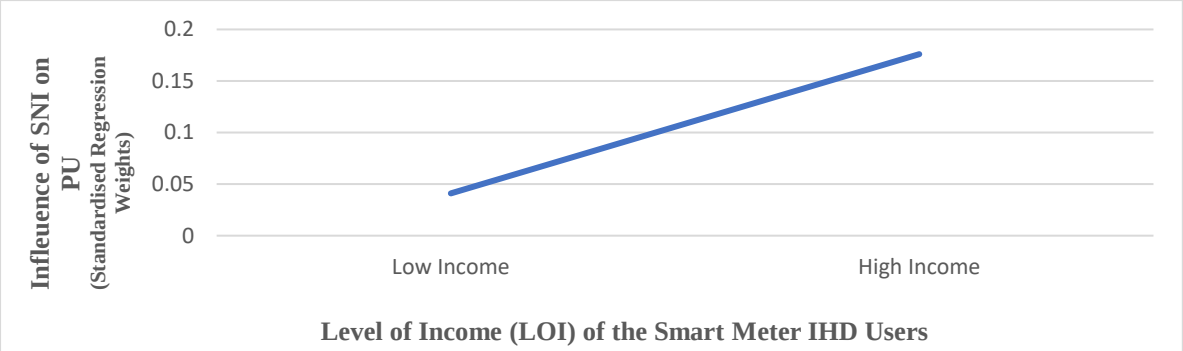
Table 8.33: CFI Value of Figure 8.25

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.929	.777	.976	.916	.973
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Table 8.34: RMSEA and PCLOSE Values of Figure 8.25

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.039	.014	.059	.805
Independence model	.134	.126	.143	.000

Figure 8.26: Influence of SNI on PU of IHD with regards to the LOI of the IHD Users



This important finding indicates that the influence of social norms does not have a strong potential to directly affect how useful individuals with lower levels of income perceive their IHD. The reason for this can be the relatively higher importance of financial concerns (or ATM) and potential monetary gains and savings that can be gained by using the IHD more often rather than using the device just to comply with the others in the social context for the low-income group. However, for individuals who do not have a high level of financial concerns, it might be more important to follow social norms to get social approval and acceptance, and these individuals may perceive their IHD as more useful if it can help them improve their social status.

Finally, the differences between individuals who have been using their smart meter IHD for 12 months or less and more than 12 months were investigated based on the model shown in Figure 8.27. Once again, considering the CFI (Table 8.35), RMSEA and PCLOSE (Table 8.36) values, the model had a good fit. Therefore, the findings were acceptable.

Figure 8.27: Structural Model to Check the Influence of LOR on the Proposed Relationships

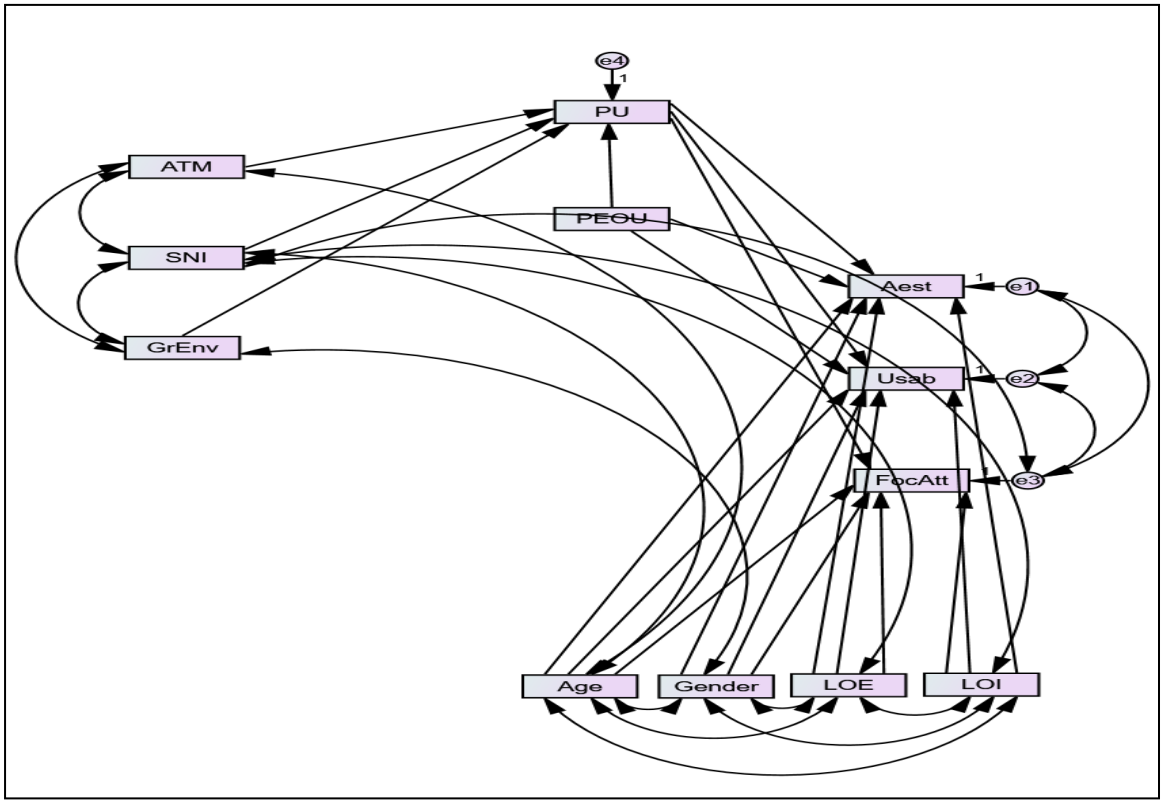


Table 8.35: CFI Value of Figure 8.27

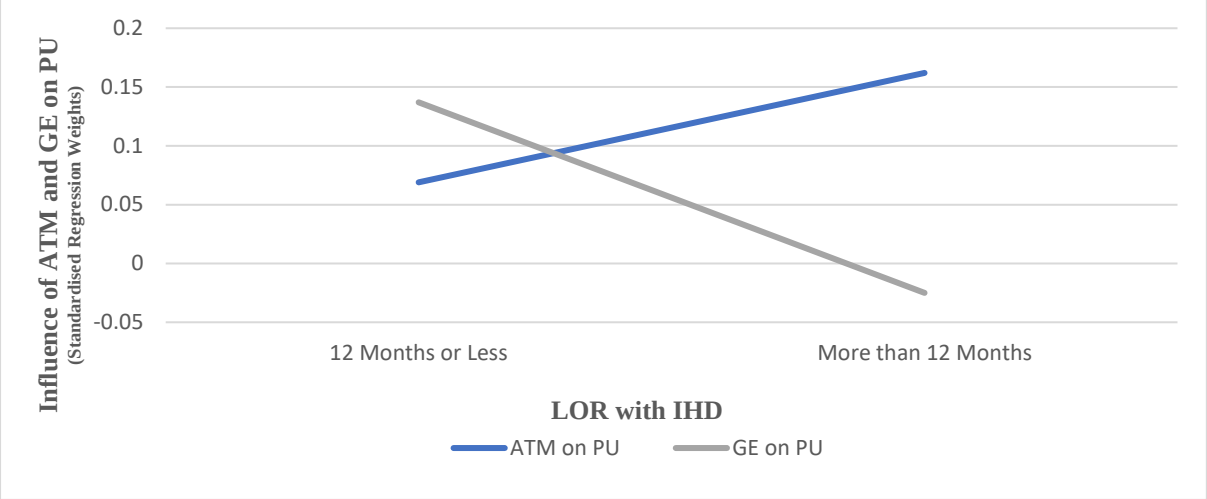
Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.923	.778	.975	.920	.972
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Table 8.36: RMSEA and PCLOSE Values of Figure 8.27

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.038	.013	.057	.842
Independence model	.133	.125	.142	.000

When the survey respondents are divided into two groups based on their length of relationship (or LOR) with IHD, the influence of ATM and GE on PU of IHD show differences between groups (Figure 8.28).

Figure 8.28: Influence of ATM and GE on PU of IHD with regards to the Users' LOR with IHD



While the influence of ATM on PU of IHD was found to be statistically significant (p=0.046; B=0.162) only for the group of consumers who have been using their IHD for more than a year, GE's influence on PU of IHD was measured to be significant (p=0.017; B=0.137) only for the consumers who have been using their IHD up to a year. Hence, it can be argued that, for individuals who have had the IHD for less time, financial motivation or any form of financial expectation they can get from their IHD is less important than the potential to act in environment-friendly ways and protect the environment by using IHD. These consumers potentially perceive the device as more useful when they believe that it is an important tool for them to involve in pro-environmental activities such as consuming less electricity and gas. On the contrary, financial concerns become a priority for individuals who already used their IHD for more than a year over the feeling of environmental protection. Thus, these individuals may see a smart meter IHD as more useful when it helps them spend less on energy.

In short, both consumers' perception of the characteristics of smart meter IHD and the influence of these characteristics on the strength of engagement with IHD may change depending on the gender and age of individuals as well as individuals' level of income, education level and the time they have had the IHD. For this reason, IHD producers and policy makers may potentially follow different strategies to positively change consumers' interaction and engagement with smart meter IHD technologies (see Section 9.5 for the practical recommendations).

Before summarising this chapter and moving to the conclusion chapter, the next section provides a detailed discussion on findings from the quantitative stage.

8.5 Discussion of Quantitative Results

This section provides a detailed discussion on the results of hypotheses testing (Section 8.4.2) and findings relating to control variables (Section 8.4.3). In this respect, the first subsections shed light on the relationship between personal motivations, namely susceptibility to normative influence (SNI), attitude to money (ATM) and green environmentalism (GE), perceived usefulness (PU) and perceived ease of use (PEOU) of smart meter in-home display (IHD) technologies, and three dimensions (i.e., aesthetics, usability and focused attention) of consumer-IHD engagement. Following this, later subsections talk about how certain demographic characteristics [i.e., gender, age, level of education (LOE), level of income (LOI) and length of relationship (LOR) with IHD] have the potential to change a consumer's engagement with an IHD.

To start with, the influence of personal motivations on PU of IHD is discussed next.

8.5.1 Personal Motivations and Perceived Usefulness (PU) of In-Home Display (IHD)

As stated earlier in Section 2.3.1, personal motivations are divided into two categories in this thesis: general motivations and context-specific (or context-dependent) motivations. Accordingly, while susceptibility to normative influence (SNI) is considered to be a general personal motivation influencing actions of a consumer, attitude to money (ATM) and green environmentalism (GE) are argued to affect a consumer's actions in different contexts relating to the internet of things (IoT) technologies.

Elaborating on this, Table 8.26 in Section 8.4.2 shows that there is a positive direct relationship between the level of SNI and perceived usefulness (PU) of a specific IoT product (i.e., smart meter in-home display [IHD]). Therefore, the hypotheses testing supported that the higher the level of a consumer's SNI, the higher the level of PU of an IHD. This result also supports the findings from the qualitative stage (Section 6.3). When a consumer is more susceptible to the social norms and change his/her actions depending on what he/she perceives others expect him/her to do, he/she perceives various IoT products in general, and specifically – in this context – the IHD, as more useful. Moreover, similar to what the previous literature (Section 2.3.2) has discussed, SNI has the potential to influence consumer-technology engagement. In addition to the technology in general, this study also found that SNI is an important factor for interaction and engagement with IoT technologies (Section 4.2.1), such as energy-saving technologies (i.e., the IHD). However, unlike most of the earlier research, this study highlighted the potential indirect influence of SNI on the strength of IHD engagement through its effect on the level of PU of IHD. Thus, the current research showed that social actors in fact have very strong potential to affect a consumer's perception of a specific device. Especially in the IoT context,

comments of other people in the social environment may play a key role in understanding the overall technology engagement framework.

Compared to SNI and GE, ATM was found to have the strongest impact on the level of PU of IHD (Table 8.26). Based on this result, it can be argued that the money-saving feature of using an IHD is more important than getting social approval or involve in environment saving activities for how useful a consumer perceives the device. In Section 6.3, it was explained that most of the face-to-face interview participants stated that certain specifications (e.g., showing red figures when going over the budget, etc.) of IHD lead individuals to consider their device as useful because it helps them to save money. Likewise, the quantitative stage found that the higher the level of a consumer's ATM, the higher the level of PU of IHD. Thus, higher levels of ATM may positively influence the strength of consumer-IHD engagement. This finding is similar to the findings of the previous studies (Section 4.2.2) investigating the influence of financial motivations and engagement with IoT technologies. But, different from the earlier studies, similar to SNI, this study examined the direct influence of ATM on the level of PU of IHD and the potential indirect influence of ATM and consumer engagement (CE) with IHD.

Finally, among three personal motivations, GE was found to have the weakest influence on the level of PU of IHD (Table 8.26). Accordingly, despite the fact that ATM has the strongest impact on how useful a consumer perceives an IHD, the other context-specific personal motivation, GE has a much lower impact on the level of PU. Therefore, this study found that despite the fact that IHD is an environment-saving technology, its money saving benefits as well as potential to bring social acceptance may be more important for many people rather than getting positive environmental outcomes from using this device. Having said that, similar to previous studies investigating the influence of environment-friendly motivations on engagement with pro-environmental activities (Section 2.3.3) and the impact of environmental concerns and engagement with energy-saving devices (4.2.2), GE has the potential to affect the PU of IHD and, therefore, the strength of CE with IHD. In this respect, the quantitative results also support the qualitative finding (Section 6.4) that individuals' environmental concerns and energy-saving specifications of smart meter IHD may positively change the level of PU of IHD. Hence, the higher the level of a consumer's GE, the higher the level of PU of an IHD. Nevertheless, this study also investigated the potential impact of GE on IHD engagement in order to understand the specific relationship between the strength of actual IoT engagement, technology-related characteristics and motivational factors influencing CE with IoT technologies.

In conclusion, both general (i.e., SNI) and context-specific (i.e., ATM and GE) motivations may positively change how useful a consumer perceives an IHD. For this reason, all of these three motivations are important elements to increase the strength of CE with IHD. The quantitative results

indicate that the majority of the consumers' financial concerns and money attitudes have stronger impact on the PU of their IHD. Thus, there is more potential to improve consumer-IHD engagement if IHD provides more money-saving options and features to many people. Surprisingly, environmental values and GE has the weakest influence on consumers' perception of their IHD. There might be two reasons to explain this: First, individuals may not think that IHD is less useful for protecting the environment than reducing their energy spending. Second, financial concerns and approval from the social context may be more beneficial for them compared to saving the environment. Although personal motivations were found to have a positive direct relationship with the level of PU of IHD, all of these motivations' impact on PU was much weaker than the direct influence of PU and PEOU on different dimensions of engagement. Therefore, it can be argued that although different motivations have the potential positively influence a consumer's perception of IoT technologies, their impact may be weaker than the influence of PU and PEOU on the actual strength of engagement.

In the following sections, the results of hypotheses related to the influence of PU and PEOU on engagement are discussed. Before that, the following section talks about the direct effect of PEOU on PU of IHD.

8.5.2 Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) of In-Home Display (IHD)

According to the results of the hypotheses testing (Section 8.4.2), the level of perceived ease of use (PEOU) of a smart meter in-home display (IHD) has a very strong direct influence on the level of perceived usefulness (PU) of the device. Compared to all other relationships between latent variables (Section 7.2), Table 8.26 illustrates that the strongest relationship was between the PEOU and PU of IHD. Therefore, this finding supports what previous studies (Section 3.3) investigating the technology acceptance model (TAM) have suggested. Additionally, according to this result, it can be argued that the level of PEOU of a specific technology not only affects the level of PU of that technology at the adoption stage but also at the post-adoption stage as well. Similar to the previous studies (Section 4.2.3), this finding implies that the level of PEOU has the potential to impact the level of PU of various Internet of Things (IoT) technologies, including smart-grid products.

Considering the findings from the qualitative stage regarding technology-related characteristics of IHD (Section 6.3), the quantitative stage also supported that when a consumer perceives an IHD as more convenient (or easy) to use, that consumer also perceives that IHD as more beneficial to use and useful. Elaborating on this, certain aspects of an IHD (e.g., straightforward design of the device, user-friendly interface and easy-to-understand messaging/feedback system, etc.) that are considered as

important ease-of-use factors of the device may directly influence the level of PU of the IHD, and eventually the interaction and engagement between a consumer and IHD.

To summarise, similar to many other IoT technologies, the level of PEOU of smart energy devices holds a high potential to directly influence the level of PU of smart energy technologies. Thus, in order to have stronger consumer interactions with IoT products, and specifically energy-saving technologies at the post-adoption stage, PEOU of these technologies may play a very important role.

The following section discusses the influence of PU on different dimensions (i.e., aesthetics, usability and focused attention) of consumer-IHD engagement.

8.5.3 Perceived Usefulness (PU) of In-Home Display (IHD) and Dimensions of IHD Engagement

Based on the results from Table 8.26 in Section 8.4.2, it can be highlighted that the level of perceived usefulness (PU) of a smart meter in-home display (IHD) has the potential to positively increase the strength of a consumer's engagement with the device on all three different engagement dimensions, namely, aesthetics, usability and focused attention.

Accordingly, among these three dimensions, the level of PU was found to have the strongest impact on the aesthetics dimension of consumer-IHD engagement. Therefore, PU may be considered a more important factor to increase a consumer's perception of the physical appearance of the device rather than the actual usability of the device or the level of attention given to the device. While a consumer may find an IHD more aesthetically engaging if that consumer perceives the device as useful, it can also be argued that this finding supports the earlier findings from the qualitative stage (Section 6.3). When an IHD offers different benefits and uses to a user, that user sees the device as more appealing, similar to what O'Brien and Toms (2010) discussed in their paper about user engagement (Section 5.9). Additionally, similar to earlier studies (e.g., Katz, 2010; Sohn, 2017; Lazard and King, 2020) that have investigated the influence of PU on different engagement dimensions, the findings from this study supported the direct-positive relationship between PU and aesthetics of a specific object in the context of internet of things (IoT) technologies.

Considering the relationship between the level of PU of IHD and the strength of consumer engagement (CE) on the usability dimensions, it was found that the relationship was much weaker compared to the relationship between the level of PU and CE on the aesthetics dimension, but still strong (Table 8.26). Hence, the level of PU of an IHD has the potential to be a very significant factor in improving the CE with the device based on the actual usability of the device. In different studies (e.g., Smith 2008; Suki and Suki, 2011; Hsieh et al., 2018) exploring the interaction between the level of PU and actual

usability of a specific device, researchers have found that the level of PU of technology may have a direct or indirect influence on the actual usability of that technology. In parallel with these studies, this study demonstrated that the level of PU might have a direct impact on the usability dimension of CE with high-developed, energy-saving IoT technologies.

Finally, the level of PU of IHD may directly impact and strengthen the IHD engagement on the focused attention dimension. Despite the fact that the relationship between the focused attention dimension on the consumer-IHD engagement and PU of IHD was measured to be the weakest compared to the aesthetics and usability dimensions, the result of the hypotheses testing (Table 8.26) implies that PU is an important influence for a consumer to put more attention to the device he uses. In order to increase consumer attention to various products and technologies, PU has been found to be an effective factor in previous research (e.g., Menon et al., 2003; Jahangir and Begum, 2008; Grover et al., 2019). In other words, the higher the level of PU of a specific product or device, the higher the consumer attention to that product or device. Similarly, in the context of smart meter IHD technologies, the level of PU of IHD potentially improves a consumer's attention to the device, and hence, CE with the device on the focused attention dimension.

Even though the relationship between PU and different dimensions of engagement has been investigated by previous research, this study shows the influence of PU on three dimensions and assess the effect of PU on each of these three dimensions. Accordingly, it adds value to the technology literature by underlining the specific interplay between PU and significant engagement dimensions that have the potential to lead stronger technology engagement.

Following the influence of the level of PU on the dimensions of IHD engagement, the relationship between the level of PEOU and the specific dimensions of IHD engagement is explained next.

8.5.4 Perceived Ease of Use (PEOU) of In-Home Display (IHD) and Dimensions of IHD Engagement

Similar to the level of perceived usefulness (PU), the level of perceived ease of use of PEOU of smart meter in-home display (IHD) was found to have a positive, direct influence on two dimensions (e.g., aesthetics and usability) of consumer engagement (CE) with IHD (Table 8.26). However, compared to the relationship between the PEOU and the aesthetics dimension, the relationship between the PEOU of the IHD and the usability dimension of consumer-IHD engagement was measured to be much stronger than the influence of on the dimensions. Thus, this result indicates that although both the PU and PEOU are important factors influencing the overall strength of technology engagement positively, their influence on different dimensions of engagement may show differences.

Considering the influence of PEOU on the aesthetics dimension of engagement, the hypotheses testing results indicate that when a consumer perceives an IHD as more convenient or easier to use, that consumer also sees the device as more aesthetically appealing, consistent with the findings from the qualitative stage (Section 6.3). Elaborating on this, a high level of user-friendliness together with the easy-to-understand features of the IHD as explored in the qualitative stage actually lead a consumer to recognise the device as more attractive and have a stronger engagement with the device. Moreover, in the literature, a number of studies (e.g., Ramayah and Ignatius; 2005; Quispel et al., 2016; Xu and Schrier, 2019) have suggested that there is an interaction between the PEOU of a certain product or technology and physical attributes of that product or technology. In addition to these findings, the results of this study show the relationship between PEOU and attractiveness of technology, and thus, the engagement with that technology by investigating this relationship in the context of internet of things (IoT) technologies.

Moreover, the hypotheses testing results also point out that when a consumer perceives an IHD as easier to use, that consumer believes that the device has a higher level of usability and has stronger engagement with the device. Accordingly, the level of PEOU of IHD is a very significant factor for a consumer to use and interact with the device more as it leads that specific consumer to figure out different uses and overall usability of the device. Furthermore, in addition to what earlier research (e.g., Holden and Rada, 2011) have argued, there is a relationship between the level of PEOU and usability of a technology that leads to stronger CE with that technology in the context of energy-saving technologies as well.

In conclusion, both PU and PEOU of smart meter IHD are significant elements to affect the overall strength of CE with IHD technologies. While these two technology-related factors hold high potential to positively influence a consumer's interaction and engagement with smart energy-saving devices, it becomes clear from the findings that these two factors influence the different dimensions (e.g., aesthetics, usability and focused attention) of consumer-IoT engagement with more/less intensity.

In the following sections, findings relating to control variables (i.e., demographic characteristics) are explained. In this respect, the next section sheds light on gender and smart meter IHD engagement.

8.5.5 Gender and Consumer Engagement (CE) with In-Home Display (IHD)

In Section 8.4.3, it was underlined that there is an important difference between male and female consumers considering their interaction with a smart meter in-home display (IHD). While male consumers' level of attitude to money (ATM), on average, has a statistically significant influence on the level of perceived usefulness of an IHD, and therefore, on the strength of engagement with the

device, the level of ATM was not measured to be statistically significant for female consumers. As illustrated earlier in Figure 8.16, there is a wide gap between the influence of money attitude on how useful male and female consumers perceive their IHD.

In this sense, it can be discussed that male consumers, on average, believe that using an IHD helps them to provide financial benefits such as saving money by consuming less electricity or gas at home. On the other hand, female consumers do not think using an IHD regularly offers significant financial gains.

Falahati and Paim (2011) argued that compared to females, males generally have higher anxiety level when it comes to financial concerns and the level of ATM. Thus, similar to the discussion of Falahati and Paim (2011), a male consumer's financial anxiety and concern about money in the context of domestic energy consumption may lead that consumer to perceive his IHD as more useful compared to a female consumer. Thus, the current study argues that gender in fact is an important element in exploring the overall IoT engagement framework and assessing the actual strength of consumer IoT engagement.

Following gender, the relationship between age and consumer-IHD engagement is explained next.

8.5.6 Age and Consumer Engagement (CE) with In-Home Display (IHD)

Between consumers in two age categories (i.e., younger than 35; 35 and older), three differences were revealed considering the interaction and engagement with a smart meter in-home display (IHD) (Section 8.4.3).

First of all, the influence of attitude to money (ATM) on the perceived usefulness (PU) of IHD was found to be statistically significant only for the consumers who were 35 or older, on average. Considering this result, it can be argued that older consumers find their IHD as a useful device that may help them decrease their financial concerns and cut household energy spending. Taft et al. (2013) discussed that there is no correlation between a consumer's age and that consumer's financial concern. On the contrary, this study suggests that as people get older, they may be more concerned about their spending and aim to engage in money-saving activities such as consuming less energy in their homes.

Second, the influence of PU of IHD on the usability dimension of IHD engagement was also found to be statistically significant only for the older group. In this respect, Figure 8.19 in Section 8.4.3 demonstrates the wide gap between younger and older consumers considering the influence of PU of IHD on the usability dimension. Based on this result, it can be said that for younger consumers, on

average, the level of PU of IHD does not have a significant impact on the actual usefulness of the device, hence, on the overall strength of IHD engagement. Having said that, PU of IHD may be an important factor for an older consumer to engage more with an IHD. In literature, a number of studies (e.g., Chung et al., 2010; Zviran et al., 2016) have suggested that there is no supporting evidence to say that there is a relationship between a consumer's age and PU of a specific product or technology. However, the current research argues that the age of a consumer might be an important influence on how useful that consumer perceives an Internet of Things (IoT) technology and the strength of engagement with a specific IoT device such as IHD.

Third, as illustrated in Figure 8.20, similar to the usability dimension, the influence of PU of IHD was measured to be statistically significant for the older group of consumers only. This result might be that since the PU of an IHD has the potential to have a stronger impact on the actual usability of the device for an older consumer, that consumer may decide to pay more attention to understand the messages on the device. Another reason could be the time required to understand how the device works; it might be longer for an older consumer than a younger one. Nonetheless, this is not the scope of the current study. Therefore, further research may be conducted to understand the relationship between age, PU and engagement on the focused attention dimension (see implications for future research in Section 9.7 for details).

Having said that, similar to what a number of earlier studies have found (Madden et al., 1994; Zeef et al., 1996; McLaughlin et al., 2009), this study also supports a relationship between age and focused attention. Thus, the interaction between age and PU of IHD may affect the consumer-IHD engagement on a focused attention dimension which may change the overall strength of IHD engagement.

The relationship between the level of education (LOE), third demographic characteristics, and IHD engagement is discussed in the following section.

8.5.7 Level of Education (LOE) and Consumer Engagement (CE) with In-Home Display (IHD)

The results in Section 8.4.3 support that level of education (LOE) has the potential to affect the interaction between a consumer and the smart meter IHD. In this respect, two context-specific personal motivations, attitude to money (ATM) and green environmentalism (GE), were found to have a statistically significant influence on the level of perceived usefulness (PU) of IHD for consumers who were in the 'more educated' (i.e., consumers who have university undergraduate or higher-level degrees) category.

Accordingly, Figure 8.22 and 8.23 in Section 8.4.3 show the difference between ATM and GE's influence on PU of IHD with regards to the LOE of IHD consumers. It can be seen from these figures that there is a significant gap between the consumers in 'less educated' (i.e., consumers who have college or lower-level degrees) and 'more educated' categories.

Based on these findings, it can be discussed that there is a strong positive correlation between a consumer's LOE and how useful that consumer perceives his IHD to be, considering potential financial and environmental benefits he might get from using the device. In other words, a more educated consumer may see his IHD as more useful because the IHD might help him consume less energy and thus save money and protect the environment. In the end, this situation may lead to stronger IHD engagement for that consumer.

Consistent with the previous studies (e.g., Sabah, 2016; Wei and Ram, 2016; Kerzic et al., 2019) suggesting a relationship between LOE and PU of a specific product or technology, this study also found that LOE is an important factor for a consumer to how useful that consumer perceives an internet of things (IoT) technology.

Surprisingly, the influence of PU of IHD on the usability dimension of IHD engagement was measured to be statistically significant only for the consumers in the less educated category (Figure 8.24). Therefore, it can be said that while higher levels of context-specific personal motivations play a significant role for a consumer with a higher level of education to perceive an IHD as more useful, the level of PU of the device may be a very important variable for a consumer with a lower level of education to see the actual usability of the IHD, and therefore, have an overall stronger engagement with the device. Moreover, as explained earlier, this finding suggests that there might be a negative correlation between the actual usability of an IHD and the LOE of a consumer. One reason for this could be that a consumer with a high level of education does not necessarily need to perceive his IHD as highly useful for a higher usability experience because that consumer might have more knowledge to use the device than a consumer at a lower level of education.

In short, this study found supporting evidence for a relationship between a consumer's LOE and usability of a specific smart product in the context of IoT technologies. Thus, this study shows that a consumer's education level play a very significant role in shaping and changing the actual engagement with an IoT technology.

The following section talks about how a consumer's level of income (LOI) may influence the interaction with IHD.

8.5.8 Level of Income (LOI) and Consumer Engagement (CE) with In-Home Display (IHD)

According to the quantitative study results, the influence of susceptibility to normative influence (SNI) on perceived usefulness (PU) of an in-home display (IHD) was the only difference between low-income consumers (i.e., consumers with less than £40,000 annual gross domestic income) and high-income consumers (i.e., consumers with £40,000 and more annual gross domestic income), on average (Section 8.4.3 and Figure 8.26). The influence of SNI on PU of IHD was found to be statistically significant only for the high-income group.

Based on this result, it can be discussed that social norms are not significant factors for how useful a low-income consumer perceives an IHD to be. Contrarily, the level of SNI may have a direct positive influence on a high-income consumer's level of PU of his IHD. There may be an important reason for this result: a low-income consumer puts more attention on getting financial gains by using the device because of his/her financial concerns and high level of attitude to money (ATM) rather than following the social norms and what other he/she perceives others expect him/her to do. However, for a high-income consumer, doing what others in the social context tell him/her to do and getting social approval by using the IHD and reducing energy consumption might be more important. In other words, a high-income consumer may perceive the IHD as more useful because the device might improve that consumer's overall social status.

Other than many studies (e.g., Venkatesh and Morris, 2000; Risselada et al., 2014) that have investigated the relationship between the level of income, SNI and acceptance, adoption or use of high-technology products, the current research found supporting evidence for how these two variables, SNI and LOI, can interact with each other to indirectly affect consumer interaction with smart, energy-saving products at the post-adoption stage.

Following LOI, the relationship between the length of relationship (LOR) with an IHD and consumer engagement with the device in the final section of discussion of quantitative results.

8.5.9 Length of Relationship (LOR) with In-Home Display (IHD) and Consumer Engagement (CE) with (IHD)

Figure 8.28 in Section 8.4.3 illustrates that the influence of context-specific motivations, attitude to money (ATM), and green environmentalism (GE) on perceived usefulness (PU) of in-home display (IHD) show differences depending on the duration of the relationship between a consumer and that consumer's IHD.

Considering financial concerns and money attitudes, the level of ATM has the potential to influence a consumer's level of PU of IHD only when that consumer's length of relationship (LOR) with the device

is more than 12 months. On the other hand, considering environment-friendly attitudes, the level of GE has the potential to affect a consumer's level of PU of IHD only when that consumer's LOR with the device is 12 months or less. In this sense, the results imply that a consumer with an IHD for a relatively shorter period of time (i.e., up to a year) puts more importance and attention on the potential environmental benefits of using the device rather than financial gains he could get by using the device. But potential financial benefits play a more important role for a consumer who has an IHD for a relatively longer period of time (i.e., more than a year) to perceive the device as more useful, compared to saving the environment. Thus, it can be discussed that, in the short run, environment-related benefits may play a more important role in improving the level of PU of an IHD, and as time passes by, money-related benefits may start positively change the level of PU of an IHD. Section 9.5 talks about the managerial implications and recommendations of this finding (together with other findings) in more detail.

In summary, previous research has (e.g., Hart and Porter, 2004; Saade and Bahli, 2005; Khambari et al., 2017) suggested a strong connection between time spent using a device and how useful a consumer perceives that device to be. Likewise, the quantitative results demonstrate a relationship between the duration of using an IHD and the actual level of PU of IHD, which may generate a stronger consumer engagement (CE) with the device.

The next section provides a summary of findings and a discussion of the quantitative phase.

8.6 Summary

Similar to the findings from the qualitative stage, the quantitative results of this study highlight the high potential of the influence of different types of consumer-related motivations on how useful and easy to use consumers see their smart meter in-home display (IHD). The quantitative findings also showed similarity to the discussion made in the Technology Acceptance Model (Section 3.3) and Social Presence Theory (SPT) (Section 3.4) about the connection between certain human-related and non-human related variables in a specific interaction framework.

Accordingly, together with the potential direct influence of both perceived usefulness (PU) and perceived ease of use (PEOU) of IHD on the strength of consumer engagement (CE) with IHD, consumers' level of susceptibility to normative influence (SNI), attitude to money (ATM) and green environmentalism (GE) have the potential to influence the wider IHD engagement framework via their statistically significant, direct influence on how useful individuals perceive their IHD (or PU of IHD). Moreover, while both PU and PEOU of IHD influence each of the dimensions of IHD engagement (i.e.,

aesthetics, usability and focused attention) differently, all of these influences were found to be statistically significant.

In addition to these findings, the relationship between consumer-related motivations, characteristics of IHD and the strength of engagement with IHD may show a number of changes depending on individuals' demographic characteristics, including age, gender, income and education level. Besides, it was also found that the influence of context-specific consumer-related motivations (i.e., ATM and GE) on the level of PU of IHD may change depending on the time individuals have had a smart meter IHD in their residence.

Following the quantitative findings and discussion, the next chapter presents the main conclusions of this thesis.

Chapter 9: Conclusion

9.1 Introduction

The final chapter of this thesis presents the main conclusions of this thesis together with the theoretical and managerial contributions, practical recommendations for companies and policy makers, research limitations and potential directions for future research.

In this respect, before highlighting the key findings relative to research objectives and providing answers to research questions, this study's research objectives are revisited.

9.2 Restatement of Research Objectives

This section summarises the research objectives that are defined earlier in Section 1.4. Accordingly, this research had three main objectives:

RO1: To explore the main consumer-related (both general and context-dependent) drivers of IoT interaction and of their relative significance on consumers' engagement with IoT technologies in the context of energy consumption.

RO2: To explore the main technology-related drivers of IoT engagement and of their relative significance on consumers' engagement with IoT technologies in the context of energy consumption.

RO3: To investigate the interaction between consumer-related (both general and context-dependent) and technology-related drivers when influencing distinct dimensions of consumer engagement with IoT technologies in the context of energy consumption.

9.3 Findings and Conclusions Relating to Research Objectives

This section provides a detailed explanation by highlighting key findings relative to each of the research objectives.

9.3.1 Conclusions Relating to RO1

In business and marketing studies, a large number of researchers have identified different consumer-related variables that have the potential to influence individuals' interaction and engagement with various Internet of Things (IoT) technologies. Having said that, while some of these studies have underlined specific motivations as key factors on the overall human-technology interaction, this study is the first to discuss that social, financial, and environmental motivations may potentially change the strength of consumer engagement (CE) with IoT products.

Marketing literature has identified different factors such as emotions, personality traits, and perceived interactivity as antecedents of CE with focal engagement objects in different contexts (Section 2.3.1). Previous research has also highlighted that motivations play an important role in consumer engagement in general (e.g., Tsai and Men, 2013; Bhatnagar and Kumra, 2020). Based on this, the findings from the qualitative stage (Chapter 6), together with the Social Presence Theory (SPT) (Section 3.4), also show that motivations are very important factors for CE with IoT technologies.

Elaborating on this, in addition to what the previous research has discussed, the current study identified three types of motivations, both general and context-specific, influencing consumer-IoT engagement. First, a social motivation, namely, susceptibility to normative influence (SNI); it was revealed that individuals in their social environment are usually influenced by the behaviour or actions of others. In many cases, a person decides to undertake a specific action if he/she perceives that action as something that is socially approvable by others. Second, a financial motivation, namely, attitude to money (ATM); this motivation refereed to individuals' overall concern about their financial situation and to what extent they are worried about the money in their lives. Third, green environmentalism (GE) is a context-specific, environmental motivation, given the focus of this on smart meter in-home displays (IHD) as specific IoT technologies; this motivation captures how important it is for a person to undertake environment-friendly actions and behaviours or use a specific product in order to protect the environment. Therefore, both general (i.e., SNI) and context-specific (i.e., ATM and GE) consumer-related factors were identified as significant factors that have the potential to play an important role in the IoT engagement framework (see Section 7.2).

Accordingly, drawing from the literature (Section 4.2.1 and Section 4.2.2) the findings related to consumer motivations can be applied to many other in-home devices such as smart thermostats, plugs or bulbs as these devices help consumers to save money, protect the environment and/or gain social approval from other people who are important in their social environment. However, although general motivations (i.e., SNI) may play a similar role in affecting the interaction between a consumer and an IoT devices in many contexts, context-specific motivations may show significant differences in the construction of the overall IoT engagement framework in various contexts.

In summary, it is important to examine antecedents to CE and how in different contexts, different factors become more important for consumers to engage with a specific object. Accordingly, drawing from the literature review, this study informs that in order to understand the dynamics behind consumer-IoT interaction, it plays a key role in investigating certain elements in the engagement process. In this respect, considering the dynamics in the overall IoT engagement framework, both

general and context-specific motivations were highlighted as relatively more important consumer-related influencers on the strength of consumer-IoT interaction at the post-adoption stage.

Following the conclusions relating to RO1, the conclusions relating to the second research objective (RO2), which is the exploration of consumers' perceptions of the main technology-related drivers (i.e., PU and PEOU of technology) of IoT engagement, and of their relative significance on consumers' engagement with IoT technologies in the context of energy consumption are explained next.

9.3.2 Conclusions Relating to RO2

In addition to the consumer-related factors (i.e., motivations) that may change the strength of consumer engagement (CE) with the Internet of Things (IoT) technologies, different technology-related variables were explored to have the potential to influence consumer-technology interaction at the post-adoption stage. Accordingly, perceived usefulness (PU) and perceived ease of use (PEOU) of technology were identified as key technology-related factors influencing CE with IoT products.

Based on the findings from the qualitative stage (Chapter 6) and drawing from the Technology Acceptance Model (TAM) (Section 3.3), this study explored the significant technology-related factors that may influence consumer-technology interaction at the post-adoption stage. Considering the relative importance, both PU and PEOU of IoT technologies were identified in the qualitative phase of this study to be more important antecedents of CE with IoT than other technology-related antecedents such as price, availability, or technical specifications of technology (Section 6.3). Moreover, it was also found that both of these factors have the potential to significantly influence individuals' openness to technology as well as intention to continuously use a technology. Therefore, both PU and PEOU of the IHD were found to have a high potential to positively and directly influence engagement with the IHD (see Table 6.2 in Section 6.5). Accordingly, while PU of the device influences the Aesthetics, Usability and Focused attention dimensions of the IHD engagement, PEOU of the device influences the Aesthetics and Usability dimensions of the IHD engagement. Elaborating on this, PU of the IHD is important for a person to perceives his/her device as more physically appealing while encouraging them to use the device more and spend more focus/undivided time using it. Similarly, PEOU of the IHD also leads a user to see the device as physically attractive and a product that he/she is encouraged to use. Eventually, all of these are important to strengthen the overall IoT engagement.

To conclude, supporting the literature covering consumer-technology interaction (Chapter 3), the qualitative phase of this research (Chapter 6) found that both consumer motivations and technology-related factors are important factors for a consumer-technology interaction at the post-adoption stage.

The following section provides the conclusions relating to the third and final research objective (RO3), which is the investigation of how exactly consumer-related (both general and context-dependent) and technology-related drivers interact with each other when influencing specific dimensions of consumer engagement with IoT technologies in the context of energy consumption.

9.3.3 Conclusions Relating to RO3

After the qualitative phase and final conceptual framework, quantitative data was collected to assess the specific relationship between drivers influencing different dimensions of consumer engagement (CE) with a specific Internet of Things (IoT) technology [i.e., smart meter in-home display (IHD)] and actual strength of consumer-IoT engagement.

The qualitative phase showed preliminary evidence that consumer-related drivers (motivations) and technology characteristics may influence each other (Section 6.3). In addition to that, motivations and technology characteristics may work together to create better technology usage experiences and stronger engagement with technology in the context of IoT technologies and especially the IHD. Accordingly, the qualitative phase provided more insight into the type/kind of relationships between the concepts identified and thus helped the researcher inform the design of the final conceptual framework (Section 7.2).

The quantitative findings (Section 8.4.2) showed that while consumer-related factors [i.e., susceptibility to normative influence (SNI), attitude to money (ATM) and green environmentalism (GE)] have an impact on the overall IHD engagement framework via their influence on the technology-related characteristic [i.e., perceived usefulness (PU)] of IHD, technology-related characteristics (i.e., both PU and PEOU) of IHD have a positive influence on different dimensions, and therefore, the overall strength of IHD engagement. In this respect, while PU and PEOU of IHD were found to have a direct influence on the strength of consumer-IHD engagement, a consumer's level of SNI, ATM and GE has the potential to indirectly affect the CE with IHD thanks to their influence on the level of PU of IHD. Among these three motivations, ATM generated a stronger impact on how useful a consumer perceives the device. Additionally, SNI and GE were found to have a very similar influence on the PU of the IHD.

Considering the dimensions of consumer-IHD engagement, while the Aesthetics dimension represents how attractive or physically appealing an IHD is, the Usability dimensions represents to what extent a consumer is encouraged to use their IHD. On the other hand, the Focused Attention dimension shows whether the IHD can get the direct attention of a consumer when they use the device. Accordingly, the results from the quantitative stage (Section 8.4.2) demonstrate that while the higher level of PU

of the IHD strengthens the engagement on the Aesthetics, Usability and Focused Attention dimensions, the higher level of PEOU of the device strengthens the engagement on the Aesthetics and Usability dimensions (see Section 9.3.2 for further discussion on these relationships).

Additionally, this study informs that the influence of both PU and PEOU on the distinct dimensions (i.e., aesthetics, usability and focused attention) of IoT engagement are stronger compared to the influence of personal motivations' influence on PU and PEOU of an IoT product (see Section 8.4.2 for details). Based on this finding, it can be argued that although consumer-related motivations are important for individuals to see how useful or easy-to-use their device is, technology-related drivers play a very important role in changing the actual strength of IoT engagement even without the influence of motivations.

Furthermore, the quantitative phase results also suggest that similar to the previous research studying the Technology Acceptance Model (TAM), the level of PEOU of a specific IoT device (i.e., IHD) has the potential to have a positive impact on the level of PU of that device. This impact was calculated to be the strongest in the consumer-IHD engagement framework. Therefore, the current study explicitly highlights that this impact is not only found at the adoption stage but also at the post-adoption stage of consumer-IoT interaction as well. In this respect, this study also highlighted the importance of well-established technology-interaction models on understanding the dynamics in the IoT engagement framework. Another key point taken away from this finding is that regardless of the differences in technologies, there is generally a strong interaction between two main technology-related drivers, and the strength of this relationship between PEOU and PU of the device may overcome the strength of interaction between any other drivers in consumer-IoT engagement. Thus, both PU and PEOU of IoT should not be ignored when measuring the overall strength of engagement.

Moreover, the findings from the quantitative stage also point out that the outcome of specific relationships between engagement drivers and dimensions may change depending on certain demographic characteristics of individuals such as gender, age, level of education (LOE), level of income (LOI), and length of relationship (LOR) with the IHD (Section 8.4.3). In this respect, while male IHD users believe that they gain financial benefits from using their IHD, female users do not think they can be financially better off by using their IHD. Unlike younger users, older users believe that the device may help them save money and the PU of the device play a significant role for them to focus more on the device when they use it and see their device as more usable. Considering LOE, the results from the quantitative stage show that together with the environmental motivations, financial concerns lead individuals with higher LOE to perceive their IHD as more useful because they believe that the IHD may help them save money and undertake more environment-friendly actions. For

individuals with lower LOE, there is a relationship between how useful they perceive their IHD and the actual usability of the device, even though this relationship was not found for users with higher LOE. Hence, not surprisingly, the results indicate that there is a negative correlation between the LOE of IHD users and the complexity of using the device. The quantitative results also demonstrate that social motivation (i.e., SNI) has an influence on the PU of IHD for high-income users. This might be because users in the high-income category may see their device as more useful as long as it helps them gain social benefits. Finally, while financial motivations have more influence on the PU of IHD for individuals who have been using their device for more than 12 months, environmental motivations have more impact on the PU of IHD for individuals who have been using their device for a year or less. Accordingly, these findings suggest that as time passes by, financial concerns and potential financial gains from using the device become more important or more evident for the users, whereas environmental benefits of using the device are generally more important for users when they start using their device.

To conclude, drawing from the Technology Acceptance Model (TAM) (Section 3.3) and Social Presence Theory (SPT) (Section 3.4) the current research elaborately investigated how various consumer-related and technology-related characteristics may influence the specific interaction and engagement between consumers and smart IoT products in the context of domestic energy consumption. Supporting and expanding the previous literature and findings from the qualitative stage, significant relationships between motivations, PU and PEOU of IHD and distinct dimensions of IHD engagement were revealed.

9.4 Theoretical Contribution

This study theoretically contributes to the general consumer engagement (CE) and, more specifically, CE with technology literature in many ways.

First of all, differently from previous studies focusing on how individuals accept and adopt certain high-technology products (e.g., Taherdoost, 2018; Sun et al., 2020), this research investigated the consumer-technology interaction at the post-adoption stage. In particular, this study added value to the existing consumer-technology engagement literature (Section 3.2) by exploring and examining the influence of consumer-related motivations (i.e., an important antecedent of CE as discussed in Section 2.3.1) on the strength of CE in the context of a specific Internet of Things (IoT) technology [i.e., smart meter in-home display (IHD)]. Accordingly, in terms of motivations, the influence of three important motivations, namely susceptibility to normative influence (SNI), attitude to money (ATM) and green environmentalism (GE), in the consumer-IoT engagement was explored. In other words, although the impact of some of these motivational factors on consumer-technology engagement has been already studied in earlier research (Chapter 4), for the first time in marketing literature, the connection between social, financial, environmental motivations and IoT engagement was examined in detail in this study. In this respect, this research significantly contributes to the literature discussing different antecedents of CE with specific engagement objects such as technology and the IoT.

Second, unlike many other studies that aim to show the importance of the technology acceptance model (TAM) during the adoption stage of consumer-technology interaction (Section 3.3), the TAM was adopted to show the potential impact of two significant technology-related drivers [i.e., perceived usefulness (PU) and perceived ease of use (PEOU) of technology] on CE with technology at the post-adoption stage. In this sense, this study found that the TAM is not only a significant model for technology acceptance but also for technology engagement, and specifically the IoT engagement as well. Thus, while this study supported that the TAM is a very useful model in order to understand the post-adoption stage of consumer-technology interaction (i.e., both PU and PEOU of IHD have the potential to influence the strength of IHD engagement on different dimensions – Section 8.4.2), it also showed that certain consumer-related variables (i.e., motivations) might be connected to the TAM in order to expand the model. So, the second theoretical contribution is made to the specific literature studying consumer-technology relationship models.

Third, drawing from a key human-technology interaction theory, namely the Social Presence Theory (SPT) (Section 3.4), this study contributes to the consumer-technology interaction literature. Elaborating on this, the SPT, together with the TAM helped the researcher to uniquely explore how different variables affect the consumer-IoT engagement model. Accordingly, when applied in the IoT

setting, the SPT may potentially guide researchers to understand the significant roles of both consumer and IoT products in the overall IoT engagement framework. Accordingly, a high level of social presence generated by IoT technologies, have the potential to play a very important role for a strong consumer-IoT interaction to take place at the post-adoption stage (similar to many other technologies such as computers or online communities as explained in Section 3.4). For instance, this research found that the IoT technology may adopt a social role and act like 'the voice of others'. By doing that, IoT products may lead individuals to perceive these devices more useful (by improving the relationship between SNI and PU of IoT), and potentially increase the strength of consumer-IoT engagement.

Fourth, this research looked at the specific components of technology engagement. Rather than mainly discussing how human-related (i.e., emotional, cognitive, and behavioural – Section 2.2.2) elements may affect the overall strength of CE with technology, both technology-specific (i.e., aesthetics and usability) and human-specific (i.e., focused attention) dimensions of IoT engagement were adopted to measure the strength of engagement. Accordingly, compared to prior conceptualisation and measurement efforts, the current research shows that in order to better measure the strength of technology engagement in general and IoT in particular, specific dimensions measuring the human-related elements, as well as the technology-related elements, should be considered. Elaborating on this, this study added new dimensions to the IoT engagement and looked at the CE with IoT framework using a completely new lens. The quantitative findings (Section 8.4.2) also supported that technology-related characteristics can significantly change the intensity of CE on these specific dimensions, and therefore the overall strength of engagement.

Additionally, despite the fact that this study is not the first to use aesthetics, usability and focused-attention dimensions to measure CE with technology, these dimensions of engagement were adopted for the first time in IoT engagement, especially in the specific energy-saving technology context. In this manner, the originality of the current study lies in the fact that, to the best of the researcher's knowledge, it is the first study to investigate the potential influence of various motivations on technology-related characteristics (i.e., PU) and understand how these motivations may affect the overall consumer engagement framework, together with the direct influence of PU and PEOU of an IoT [i.e., smart meter in-home display (IHD)] context by focusing on the distinct dimensions (namely aesthetics, usability, focused attention) of consumer-IoT engagement. In other words, looking from the consumer engagement perspective, this study is the first to specifically assess the impact of significant consumer-related antecedents (i.e., motivations) discussed in the literature (Section 2.3.1) on the PU of IoT technology, and thus expanded the consumer-IoT engagement model as explained

earlier. Accordingly, this is the first time CE in marketing has been conceptualised as aesthetics, usability, and focused attention.

Fifth, as explained earlier in Section 8.5.3, previous research has also investigated the influence of aesthetics of a specific product or technology on the level of PU of that product or technology. Adding to this, the quantitative results of the current research imply that this relationship may be reversed as well and how useful a consumer perceives a high-technology product may potentially affect how aesthetically appealing that consumer perceives that product. As a result, it was also found that the level of PU may directly influence the aesthetics dimension of IHD engagement, and therefore the overall strength of IHD engagement. Based on the findings from the quantitative stage, a similar relationship between the level of PEOU of IHD and the strength of IHD engagement can be highlighted (Section 8.5.4). Thus, this study contributes to the literature by showing that a consumer's perception of the device's usefulness and ease-of-use influence the device's attractiveness for the consumer, and eventually, the actual strength of engagement with the device.

Moreover, this study contributes to the literature investigating antecedents of CE with technology by investigating the significant interplay between various demographic characteristics and drivers of engagement. In this case, age, gender, level of education (LOE), level of income (LOI) and length of relationship (LOR) with the IHD were the explored demographic variables. In this manner, this research is one of the first to explain the relationship between the LOR with IHD and the influence of personal motivations on the technology-related characteristics of the IHD, and thus the impact of motivations on the overall IoT engagement framework.. Moreover, adding to the majority of the earlier studies in the area of consumer-technology interaction that mainly focus on gender or age as demographic variables, this study showed the importance of other key variables, including education and income and used all of these demographic characteristics in a single study. In this respect, Section 8.5.5, 8.5.6, 8.5.7, 8.5.8, and 8.5.9 explain the specific relationship between demographic factors and CE with IHD, while Section 9.5 talks about practical implications relating to demographics in order to improve CE with IoT. For instance, this research showed that the LOR with the device has a stronger influence on individuals with higher-level ATMs and a weaker influence on individuals who are more willing to undertake environment-friendly actions. Considering the LOI, it was found that the income level of consumers may change the influence of SNI on the PU of the device (see Section 8.4.3 for findings relating to control variables). Therefore, this study allowed the researcher to reveal the importance of different demographic characteristics on the strength of IoT engagement and add to the literature by investigating the influence of specific variables (e.g. LOR) that previous research did not examine before.

Finally, the current study also showed that smart meter IHD and similar in-home IoT products might show differences in terms of which factors influence consumer engagement with these devices. For example, despite the fact that social, financial, and environmental motivations were all found to have the potential to influence how useful a consumer perceive the IHD, they may not significantly influence the PU of another IoT technology. In this sense, this research made a specific contribution to the IoT technologies in the context of in-home technologies. Moreover, the final theoretical model (Section 7.2) made an important contribution to the marketing literature by showing the significant interplay of consumer-related factors, technology-related variables, and different dimensions of IoT engagement. Therefore, any researcher interested in further exploring this topic can use this model and add new variables to evaluate their influence on the overall IoT engagement framework.

In conclusion, this study contributed to the theory by showing the potential influence of significant antecedents (i.e., motivations and technology-related factors) on CE with IoT, expanding the TAM model and applying it to the post-adoption stage, and highlight how different demographic elements may change the strength of IoT engagement.

Following the theoretical contribution, managerial implications are discussed in the next section.

9.5 Managerial Implications

In terms of managerial contribution, the findings of this research have the potential to provide beneficial information for policy makers, companies, Internet of Things (IoT) producers, and service providers to understand how to reach individuals with different social, financial, and environmental motivations in a most effective way to improve their engagement with various IoT products. Accordingly, there are different approaches decision-makers may take in order to improve consumer-IoT engagement, and specifically consumer engagement with smart meter in-home displays (IHD).

First, it is important for decision-makers to ensure that different targeted messages are delivered to IoT users depending on their social, financial, and environmental motivations. While a message focusing on the potential financial outcomes of using an IoT product could be a better strategy to positively influence the IoT engagement of a consumer that is more concerned about his financial situation and budget, a consumer who is more interested in protecting the environment might be more willing to engage with the display more if it shows information about the environment-friendly aspect of using that specific IoT product. Moreover, for a consumer who cares more about social approval and social norms, it could be a good strategy to provide more information on other neighbours' or similar households' energy consumption and how well that consumer has been doing compared to others in terms of domestic energy consumption.

Therefore, the researcher advises decision-makers to better profile their consumers based on what type of motivation is more important to them and design the customer-interfacing elements of their IoT products to give more information that aligns more with consumers' specific motivations or priorities. For instance, if someone is more concerned about money, an IHD may provide some suggestions to save money by using that IoT device.

In addition to motivation-based messages, different strategies can be implemented to change the strength of engagement with IHD based on a consumer's gender, age, level of education (LOE), level of income (LOI), and length of relationship (LOR) with IHD. In other words, consumers should be profiled for stronger engagements with the device. For instance, based on the results in Section 8.4.3, it might be a good strategy to give more information related to the potential financial benefits of using an IoT product to male consumers. Thus, for males, a strategy that is financial motivation-triggering and explaining the useful and easy-to-use nature of the IoT product may work well. It is suggested for females to increase the strength of IoT engagement by stating how useful and easy it is to use a specific IoT product instead of implementing motivation-triggering strategies. In another example, together with the promotion of the ease-of-use of an IoT product, a strategy showing the potential social benefits (e.g., consuming less energy compared to other similar households, etc.) is suggested to

implement in order to strengthen the IoT engagement of a consumer who has a higher level of annual income as the level of social motivation is a very significant factor for a consumer with high LOI to perceive his IoT to be useful, and therefore something worth to engage more with. For a consumer with lower LOI, decision-makers may generate strategies to increase that consumer's perception of an IoT device's usefulness and ease of use to lead that consumer to have stronger engagement with the device.

Furthermore, focusing on the domestic energy consumption context, as the time a consumer spends using IHD increases, that consumer starts putting more attention to the potential financial gains from using the device while environmental benefits of using an IHD at home becomes less important for the overall strength of IHD engagement. Accordingly, for a consumer who has been using an IHD for more than 12 months, it is recommended to undertake strategies that shed light on the financial benefits of regularly using the IHD. In this respect, sending an email or a letter to that customer with the potential saving on energy consumption if he/she follows the information on the display and change his/her energy consumption based on that information can be considered a potential strategy. For example, a comparison between the actual money spent on energy and how much could be saved by following the information on the device can be used in the email or letter to have an impact on financial motivations: "You spent £95 on energy last month. By following the alerts on your smart meter in-home display you could easily see when you exceed your daily budget and reduce your energy consumption. This way you may save up to 10% on your monthly energy cost." In addition to the message, a visual showing the red alert on the IHD and explaining what it means (as well as showing how to set daily energy consumption limits/budgets on the device) might be helpful to increase the effectiveness of the message. Another strategy could be giving real-life examples about how much money other people save on energy by engaging more with their IHD: "On average, I used to spend £60 on electricity in my home. However, after I got a smart meter installed in my home and started using the in-home display I started saving around £6-7 on my energy consumption each month."

For a consumer who has been using their IHD for 12 months or less, messages and information related to the pro-environmental aspect of owning and continuously using a smart meter IHD might work better to increase that consumer's engagement with his IHD. Thus, for this consumer the letter/email sent should aim to impact environmental motivations for a stronger engagement with the device. In this sense, a message telling her that she could protect the forests, lakes, and seas by checking her IHD, following the alerts on it, and understanding her energy consumption might increase her engagement with the device: "Every year millions of trees die because of really high carbon emission rates. By following your energy consumption on your smart meter in-home display and understand

whether you are using more energy then your daily limit, you can help us to protect our resources." Two images, one showing people happily walking/playing in a park and another showing deserted land can be used with this message to trigger the environment-friendly thoughts of this person.

In order to keep a consumer updated about the device and keep that consumer's interest in the device to the highest potential level, it is also advised for decision-makers to send informative letters or emails to their consumers at least once every six months.

Besides, both PU and PEOU levels of IHD were found to significantly affect the IoT engagement for consumers regardless of the time spent using the device. Hence, decision-makers should not ignore these two elements when they prepare different strategies to improve overall IoT engagement for consumers based on their LOR with the device. Therefore, it is advised to regularly inform consumers about the easy-to-use nature and potential benefits of the IHD whenever they are contacted via letters or emails. One strategy could be showing two images. While a person trying to read the numbers on a traditional meter in the basement of his apartment can be put in the first image, a person checking the energy consumption on the IHD, to see the actual results and understand whether he is below the daily budget or over it, in the convenience of his home (while watching the TV, cooking the dinner, or simply relaxing in the living room, etc.) can be shown in the second image.

Following managerial implications, the next section of this chapter explains the limitations of this research.

9.6 Research Limitations

Even though this study adds both theoretical and managerial value to the consumer engagement (CE) area, it is not free of limitations.

In terms of conceptual limitations, although previous research has shown that certain psychological factors such as satisfaction (e.g., Kim et al., 2013), self-enhancement (e.g., Muhammad et al., 2021), self-regulation and self-esteem (e.g., Pellas, 2014), and persistence (e.g., Martin et al., 2020) have potential to influence the overall strength of consumer-technology and consumer-IoT engagement, these factors were not included in this study. This is because one of the main objectives of this research was to investigate the potential influence of motivations on consumer engagement (CE) with IoT technologies as well as how motivations – without any other human-related factors – interact with technology-related variables to change the strength of IoT engagement. Moreover, based on the discussion of previous research (Chapter 2 and 3) and the findings from the qualitative phase (Chapter 6), it was evident that motivations had relatively more importance on the strength of consumer-technology engagement in general and IoT engagement in particular. In this respect, it can be said that this study focused on the influence of motivations on consumer-IoT engagement and the researcher believed that other specific personality factors were beyond the scope of this study.

In terms of methodological limitations, first, this study focused on engagement with smart meter in-home display (IHD) and examined this in detail, but CE with other types of IoT technologies may be very different because consumer-related motivations may be context-specific. Second, it is important to underline that consumer interaction and engagement with technology is a dynamic process, and the relationship between individuals and different focal engagement objects together with the engagement trends may show significant differences when they are investigated for a more extended period of times. However, this was a cross-sectional study, capturing these relationships in a specific moment in time, but long-term investigations and longitudinal studies may be particularly valuable to examine the engagement between consumers and IoT (especially the IHD) over the years.

Finally, while the British Government has been giving a significant amount of attention to guide individuals to regularly use and engage more with their IHD to reduce energy consumption and save the environment, the IHD engagement may be different in other countries where smart meters and similar devices with environment-friendly potential are not being promoted as much. Accordingly, as the current study only focused on British consumers' experience with their device, most of the findings may be mainly useful to understand the potential ways to increase IHD engagement for the British residents only.

The following section discusses the future research directions emerging from this thesis.

9.7 Future Research Directions

In this section, guidance for potential directions for future research is provided. Hopefully, while this research has the potential to provide significant benefit for other researchers to understand the dynamics between different drivers in the overall consumer engagement (CE) with the Internet of things (IoT) technologies, it may also lead future research to investigate the different underexplored aspects of consumer-IoT interaction and engagement.

First of all, it is highly recommended for future studies to adopt a longitudinal research approach to CE with IoT in order to explore how the influence of motivations (e.g., social, financial, environmental, etc.) and technology-related factors [e.g., perceived usefulness (PU) and perceived ease of use (PEOU) of IoT] on the strength of IoT engagement may change with the passing of time.

Second, as explained in Section 9.6, the primary data for this study was collected only from IHD users living in the UK at the time of interviews and an online survey. Hence, future research may expand this study by collecting data from individuals living in different parts of the world. In order to do that, data can be collected both from individuals that are part of individualistic and collectivist societies to understand the connection between socio-demographic background, culture and different types of motivations to interact with IHD in particular, as well as the influence of culture and demographic variables on the overall consumer-IoT engagement process. In addition to that, a study investigating consumers living in different countries might be beneficial for better understanding how various external elements such as government policies on energy consumption have the potential to influence consumer-IHD engagement.

Finally, this study has shown that the Technology Acceptance Model (TAM), a very significant theory focusing on the adoption stage of consumer-technology interaction, can be adopted to explain the influence of technology-related characteristics (i.e., PU and PEOU) on the overall strength of CE with specific IoT products. In a similar vein, future research may study whether other key consumer-technology interaction models and theories, such as the Consumer Acceptance of Technology (CAT) model or Unified Theory of Acceptance and Use of Technology (UTAUT), may work effectively at the post-adoption stage of technology interaction as well. In this respect, by adapting different technology-interaction theories, future research could explore the concept of “engagement ecosystem” (e.g., Breidbach et al., 2014, Maslowska et al., 2016; Fredericks et al., 2020) further in order to identify and understand how technology engagement can mediate or moderate consumer value-co creation behaviours and experiences.

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Appendices

Appendix A - Smart Meter In-Home Display (IHD) and Feedback from IHD

Smart meters provided by different suppliers, for example Scottish Power, clearly shows pence per hour, consumed kW and $KgCO_2$, and current tariff (day) on their IHDs. However, the monetary values written on IHDs are just guides to give consumer an understanding how much their energy use is costing. These values do not take into account any potential discounts people may receive or any additional tax. As a result, consumers' energy bills may be slightly different than the amount on the display. Consumers can change between fuels by pressing on their display. While electricity is shown as a plug, gas is shown as a flame at the top of display screen. If a consumer has only one fuel provided from Scottish Power, IHD will only show information for that fuel. In order to change the time and see their energy consumption history for the day, week, month or year, consumers have to continue to press calendar logo on the screen. There are three coloured lights used to give consumers an indication of the electricity they are using in their home right now. Green light indicates low energy use, amber light indicates medium level of energy use, and red indicates high level of energy use. Depending on consumers' previous week's consumption, IHDs can learn the amount of electricity they use in their home. If the light is red, consumers may want to start considering the ways to reduce their energy use. Consumers can also set a budget to track against their energy consumption and IHD can sound an alarm if they go over this set amount (Scottish Power, 2018).

A number of studies have found that it is easier to convince consumers to change their actions by addressing specific behaviours rather than general behaviours since every behaviour has its different reasons and constraints. Similarly, information provided by smart meters may work more effectively if it can demonstrate consumers a way to fill the gap between current and more favourable activities. Therefore, IHDs are usually designed in a way to provide tailored feedback to the consumers' specific profile and behaviours. The desired objective is generally very clear to the consumer, tailored to the specific users and gives instructions for how to reach the goal. On the other hand, information format is a critical design principle as well. For instance, since financial savings may not be a long-term motivator for behaviour changes all the time, IHDs may opt for historical feedback over feedback that compares a consumer's achievements with other consumers (Spagnolli et al., 2011).

The use of visual and alarming monitoring devices provides immediate and significant information to smart meter consumers. Compared with written feedbacks such as paper bills, electronic devices provide much faster and more frequent feedback, and better inform the consumers of the consequences of their actions (Midden et al., 2007). Through device-specific feedback, consumers can understand how a certain device affects the amount of energy resource consumed. This helps

consumers to curb undesirable practices and to use devices more efficiently to shift towards more environment friendly, sustainable consumption actions (Fischer, 2008). In this concept, Kappel and Grechenig (2009) developed a water meter display that demonstrates the amount of water consumed during one shower in the form of LEDs assembled on a stick.

They found that when consumers were able to see their actual water consumption on a display, there was a decrease in the mean water consumption of nearly 10 litres. In another experiment Willis et al., (2010) found that the installation of shower monitor generated a statistically significant mean water consumption reduction of nearly 15 litres (27%) in shower events. Furthermore, monetary savings resulting from water and energy conservation resulted in a 1.65-year payback period for the specific metering device.

According to their conservative modelling, Willis et al., (2010) also indicated that the citywide implementation of the device may yield 3% and 2.5% savings in total water and energy use, respectively.

Appendix B - Topic Guide for Qualitative Interviews

Introduction

- Welcome, introduce yourself

- Explain the nature of the research project, objectives, why the participant is selected

- Underline that you are not going to declare the participant's identity

- Emphasise you are going to use the data for academic purposes only

- Ask for the participant's agreement to record the interview and consent before moving on

Background of the participant's home and domestic energy usage

- Size of the participant's home

- Method of heating and hot water supply at home

- Average spending on utilities in the last six months

- Energy efficiency at home (the participant's opinion about his/her energy consumption at home)

The participant's experience with the smart meter in-home display monitors (IHD)

- Name of the utility company provided the IHD?

- When did the participant get the IHD?

- Why did the participant decide to get an IHD? Main motives, etc.

- Changing the location of IHD (where was it in the beginning? If the location has been changed, why?)

- Their attitude towards it (frequency of checking it, correctness of the information shown on IHD, ease of understanding information and the way information is delivered)

- How do they check the information on IHD?

- What specifications do the participant like?

- Change in the participant's energy use behaviour after getting the IHD?

- The participant's experience with the IHD over the last 7 days

Design of IHD (*Only general, broad questions to get the participant's opinion***)**

- What do they feel about the user interface of the IHD?

Probe: User friendly; complicated to understand; needs more visual, etc.

- What can be improved?

Probe: More explanation; better graphs; comparative charts, etc.

Summary

- The participant's overall satisfaction with the IHD

General questions about money attitudes, technology acceptance and use, social norms, etc.

- What do the participant think about money?

- The participant's attitude towards money.

- Is the participant concerned about the money?

- Information on the participant's socio-economic position.

- What type of technology do the participant use (computer, phones, etc.)?

- Is the participant inclined to try new technologies?

- What motivates the participant to try new technology?

- The participant's opinion on information from technology

- The participant's view on other people's energy consumption and comments of other people on the participant's domestic energy consumption

- The participant's opinion on comparative feedback (energy use of their home vs. similar home)

The participant's belief about environment-friendly values and activities

- What does the participant know about green consumerism.

- Is the participant concerned about the environment?

- Purchase of products made with sustainable and recyclable ingredients (shopping behaviour at grocery stores, label reading, etc.)

- The participant's recycling behaviour at home

- The participant's overall opinion on gas/fuel consumption etc.

Ending

- Thank the participant

- Tell the participant to contact the researcher if he/she needs to add or ask anything

Appendix C - Original Scales Adopted in Survey Questionnaire

Construct	***Source***	***Number of Items***	***Cronbach's Alpha (CA)***
Engagement	*O'Brien and Toms (2010)*	*Aesthetics - 5* *Perceived Usability - 5* *Focused Attention - 5* *Endurability - 2* *Novelty - 2*	*91* *83* *89* *83* *85*
Technology Characteristics	*Ghazal et al. (2016)*	*App Usefulness - 3* *App Usage Characteristics - 3*	*0.94* *0.93*
Financial Motivation	*Lim and Teo (1997)*	*Budget - 5*	*0.79*
Social Motivation	*Gopinath and Nyer (2009)*	*SNI -6*	*0.92*
Environmental Motivation	*Haws et al. (2010)*	*Green Consumer Values - 6*	*0.89*

Appendix D – Online Survey Questionnaire

Q1 - Age

Q2 - Gender

Q3 - Level of education (LOE)

Q4 - Number of adults living in the household

Q5 - Number of children living in the household

Q6 - Gross household Income (Level of Income - LOI)

Q7 - Length of relationship with in-home display (LOR with IHD)

Q8 - Engagement with IHD

Q9 - Perceived usefulness and perceived ease of use of IHD (PU and PEOU of IHD)

Q10 - Susceptibility to normative influence (SNI)

Q11 - Green environmentalism (GE)

Q12 - Attitude to money (ATM)

Q1) How old are you?

- ○ Under 18
- ○ 18 - 24
- ○ 25 - 34
- ○ 35 - 44
- ○ 45 - 54
- ○ 55 - 64

Q2) What is your gender?

- ○ Male
- ○ Female
- ○ Other

Q3) What is the highest level of education you have completed?

- ○ High school
- ○ College
- ○ University undergraduate degree
- ○ University postgraduate degree
- ○ Doctorate

Q4) How many adults (over 18 years old) including yourself are in your household?

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ More than 4

Q5) How many children (under 18) are in your household?

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ More than 3

Q6) Which of these describes your gross (i.e. before tax) household income?

- ○ Less than £20,000
- ○ £20,000 -£39,999
- ○ £40,000 - £59,999
- ○ £60,000 - £79,999
- ○ £80,000 - £100,000
- ○ More than £100,000

Q7) How long have you been using your smart meter in-home display (IHD)?

- ○ Less than 6 months
- ○ 6 months - 12 months
- ○ More than 12 months

Q8) Thinking about your experience with the smart meter in-home display (IHD) you use, how much do you agree or disagree with the following statements on a scale from 1 to 5?

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
My smart meter in-home display (IHD) is aesthetically appealing	○	○	○	○	○
When I am using my IHD, I lose track of the world around me	○	○	○	○	○
My IHD appeals to my senses	○	○	○	○	○
I would recommend that others use a similar IHD	○	○	○	○	○
When checking my IHD, I am absorbed in my task	○	○	○	○	○
My IHD is attractive	○	○	○	○	○
I feel frustrated while using my IHD	○	○	○	○	○
Please tick Strongly Disagree	○	○	○	○	○
I like the graphics and images used on my IHD	○	○	○	○	○
When checking my IHD, I am so involved that I lose track of time	○	○	○	○	○

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I feel annoyed while using my IHD	○	○	○	○	○
I block out things around me when I am using my IHD	○	○	○	○	○
I find the screen layout of my IHD to be visually pleasing	○	○	○	○	○
Using my IHD is stimulating	○	○	○	○	○
I continue to use my IHD out of curiosity	○	○	○	○	○
When using my IHD, I lose myself in this experience	○	○	○	○	○
I feel discouraged while using my IHD	○	○	○	○	○
Using my IHD is taxing	○	○	○	○	○
The content of my IHD incites my curiosity	○	○	○	○	○
Using my IHD is worthwhile	○	○	○	○	○

Q9) Considering your smart meter in-home display (IHD), how much do you agree or disagree with these statements on a scale from 1 to 5?

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Using my smart meter in-home display (IHD) increases energy conservation	○	○	○	○	○
My IHD seems easy to learn	○	○	○	○	○
Using my IHD improves control over energy consumption	○	○	○	○	○
It seems easy to get my IHD to do what I want it to do	○	○	○	○	○
Using my IHD saves money	○	○	○	○	○
My IHD seems easy to use	○	○	○	○	○

Q10) Please answer each of the statements on a scale from 1 to 5.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
If I want to be like someone, I often try to behave like them	○	○	○	○	○
It is important that others like the choices I make	○	○	○	○	○
I often identify with other people by basing my actions on theirs	○	○	○	○	○
I generally do things that I think others will approve of	○	○	○	○	○
Please tick Strongly Agree	○	○	○	○	○
I like to know how to make a good impression on others	○	○	○	○	○
I achieve a sense of belonging with others by thinking like them	○	○	○	○	○

Q11) Thinking about your overall attitude towards the environment, please indicate how much do you agree or disagree with the following statements on a scale from 1 to 5.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
It is important to me that the products I use do not harm the environment	○	○	○	○	○
I consider the potential environmental impact of my actions when making many of my decisions	○	○	○	○	○
My purchase habits are affected by my concern for our environment	○	○	○	○	○
I am concerned about wasting the resources of our planet	○	○	○	○	○
I would describe myself as environmentally responsible	○	○	○	○	○
I am willing to be inconvenienced in order to take actions that are more environmentally friendly	○	○	○	○	○

Q12) In general how much do you agree or disagree with the following statements on a scale from 1 to 5?

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I am proud of my ability to save money	○	○	○	○	○
I budget my money very well	○	○	○	○	○
I use my money very carefully	○	○	○	○	○
I prefer to save money because I'm never sure when things will collapse, and I'll need the cash	○	○	○	○	○
I feel compelled to argue or bargain about the cost of almost everything that I buy	○	○	○	○	○

Appendix E – Full Exploratory Factor Analysis (EFA) on Latent Variables

1) EFA with 36 Items

Pattern Matrix[a]

	Factor							
	1	2	3	4	5	6	7	8
Using my smart meter in-home display (IHD) increases energy conservation								.361
My IHD seems easy to learn						.897		
It seems easy to get my IHD to do what I want it to do						.686		
Using my IHD improves control over energy consumption								.492
Using my IHD saves money								.915
My IHD seems easy to use						.755		
If I want to be like someone, I often try to behave like them			.605					
It is important that others like the choices I make			.711					
I often identify with other people by basing my actions on theirs			.667					
I generally do things that I think others will approve of			.822					
I like to know how to make a good impression on others			.663					
I achieve a sense of belonging with others by thinking like them			.732					
It is important to me that the products I use do not harm the environment	.776							

I consider the potential environmental impact of my actions when making many of my decisions	.791							
My purchase habits are affected by my concern for our environment	.800							
I am concerned about wasting the resources of our planet	.763							
I would describe myself as environmentally responsible	.846							
I am willing to be inconvenienced in order to take actions that are more environmentally friendly	.778							
I am proud of my ability to save money				.855				
I budget my money very well				.866				
I use my money very carefully				.846				
I prefer to save money because I'm never sure when things will collapse and I'll need the cash				.685				
I feel compelled to argue or bargain about the cost of almost everything that I buy				.309				
My smart meter in-home display (IHD) is aesthetically appealing		.867						
My IHD appeals to my senses		.498						
My IHD is attractive		.835						
I like the graphics and images used on my IHD		.649						

When checking my IHD, I am so involved that I lose track of time							.766	
When I am using my IHD, I lose track of the world around me							.755	
When checking my IHD, I am absorbed in my task							.561	
I feel frustrated while using my IHD					.491			
I find the screen layout of my IHD to be visually pleasing		.631						
I block out things around me when I am using my IHD							.519	
I feel annoyed while using my IHD					.849			
I feel discouraged while using my IHD					.721			
Using my IHD is taxing					.659			

Extraction Method: Maximum Likelihood.

Rotation Method: Promax with Kaiser Normalization.[a]

a. Rotation converged in 7 iterations.

2) EFA with 35 Items

Pattern Matrix[a]

	Factor							
	1	2	3	4	5	6	7	8
Using my smart meter in-home display (IHD) increases energy conservation								.358
My IHD seems easy to learn						.899		
It seems easy to get my IHD to do what I want it to do						.684		
Using my IHD improves control over energy consumption								.494
Using my IHD saves money								.918
My IHD seems easy to use						.755		
If I want to be like someone, I often try to behave like them			.606					
It is important that others like the choices I make			.712					
I often identify with other people by basing my actions on theirs			.668					
I generally do things that I think others will approve of			.819					
I like to know how to make a good impression on others			.662					
I achieve a sense of belonging with others by thinking like them			.733					
It is important to me that the products I use do not harm the environment	.776							
I consider the potential environmental impact of my actions when making many of my decisions	.791							
My purchase habits are affected by my concern for our environment	.800							
I am concerned about wasting the resources of our planet	.762							

I would describe myself as environmentally responsible	.846							
I am willing to be inconvenienced in order to take actions that are more environmentally friendly	.778							
I am proud of my ability to save money				.852				
I budget my money very well				.869				
I use my money very carefully				.846				
I prefer to save money because I'm never sure when things will collapse and I'll need the cash				.682				
My smart meter in-home display (IHD) is aesthetically appealing		.868						
My IHD appeals to my senses		.501						
My IHD is attractive		.836						
I like the graphics and images used on my IHD		.649						
When checking my IHD, I am so involved that I lose track of time							.770	
When I am using my IHD, I lose track of the world around me							.755	
When checking my IHD, I am absorbed in my task							.548	
I feel frustrated while using my IHD					.493			
I find the screen layout of my IHD to be visually pleasing		.632						
I block out things around me when I am using my IHD							.513	
I feel annoyed while using my IHD					.847			
I feel discouraged while using my IHD					.718			
Using my IHD is taxing					.659			