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**ADOPTION OF AUGMENTED AND VIRTUAL REALITY IN RETAIL:  
INDIVIDUAL INTENTIONS**

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## ABSTRACT

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The objective of this research is to gain an in-depth understanding of the phenomenon of individual adoption of augmented and virtual reality technology in the retail industry context. Individual adoption intentions are examined using Unified Theory of Acceptance and Use of Technology (UTAUT) that is modified with personal innovativeness as moderating factor, hype as an additional construct of social influence and external variables that frame independent variables. Archival case study serves as the basis for adoption rate forecasting and data sample categorisation based on the theoretical moderator. The empirical composition of the study is based on triangulation, where structured interviews and archival case study contribute to intelligence gathering and subsequent mixed method analysis.

As a result, the descripto-explanatory study determines and explains the variance of intention adoption among categories of adopters based on their personal innovativeness. Grounded theory is brought out based on the comprehensive theoretical framework for future experimental research to take place in order to test the analytical generalisability of the proposed theory.

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## **LIST OF ABBREVIATIONS**

3D	Three-dimensional
A	Attitude toward using
AR	Augmented reality
BI	Behavioural intention to use
CAPI	Computer-aided personal interviewing
DR	Digital reality
EE	Effort expectancy
FC	Facilitating conditions
HMD	Head-mounted display
IDT	Innovation diffusion theory
MM	Motivational model
MPCU	Model of PC utilization
MR	Mixed reality
PE	Performance expectancy
PEOU	Perceived ease of use
PU	Perceived usefulness
SCT	Social cognitive theory
SI	Social influence
TAM	Technology acceptance model
TPB	Theory of planned behaviour
TRA	Theory of reasoned action
UTAUT	Unified theory of acceptance and use of technology
VR	Virtual reality

# 1 INTRODUCTION

The retail industry is developing at an accelerated rate due to the exponential growth of technological opportunities and evolving consumer behaviour. The pervasive utilisation of big data and integrating channels are not an exclusive competitive advantage any more, but a rather common set of industry standards. The industry is progressing on new emerging forces, such as virtual and augmented reality. (Grewal et al. 2017)

3D virtual worlds are gaining its momentum not only by significantly impacting how people interact and communicate with each other, but also how firms interact with their customers (Ke 2011). Market leaders across industries are actively capturing opportunities of digital reality. From being, to put it bluntly, a niche offering, during the recent decade both augmented and virtual reality are gradually becoming an innovative industrialisation phenomenon that is entering the mass market. Together with the extensive growth of technology application, a new era of customer engagement is emerging. Augmented and virtual reality is introducing new opportunities to transform organisational operations, particularly in the areas of communication and collaboration, customer service, as well as in the reinvention of customer experiences. (Kunkel et al. 2016)

While innovators across big retail players are implementing digital reality in its operations, it is still unclear if customers are ready to accept and adopt this disruptive innovation within their shopping routine. While it seems evident that the objective of the phenomena is making consumers' lives better and more intuitive, research does not indicate if potential consumers perceive it in the same way.

## 1.1 Background of the Thesis

Advantages and future potential of augmented and virtual reality have been broadly researched both in academia and consultancy. Nowadays, top innovative organisations are heavily investing their resources in the technology in order to enhance customer shopping experience and bring it to the entirely new level. The digital reality, in general, is currently considered as “consumer-facing” technology, which means that the technology supplements physical or online store journey with various gadgets, for example, interactive screens, online product visualisation and customisation, digital signboards, and so forth. Thus, augmented and virtual reality applications are quickly developing and are progressively utilised as a part

of retail operations. (Bonetti et al. 2018) In both AR and VR, the experiences of clicks and swipes on a flat screen are substituted by words, gestures, fidgeting, grabbing, pushing, a nod, or even a blink. Furthermore, a gesture (e.g. snap of a finger or the blink of an eye) could be employed to shift the perception of both time and scale, pausing or stopping time, stimulating outcomes, or even modifying the position and relationship of objects not constrained by physical realities. This generates an opportunity for enterprises to create environments that offer customised responses for individuals. (Kunkel et al. 2016)

Transforming interactions and moving it forward from screens and hardware to gestures and emotions companies have started to focus on AR/VR technology as a mission-critical application within their operations (Cook et al. 2018). According to International Data Corporation (IDC 2017) total spendings on AR and VR products and services will grow up to USD 160 billion by the year 2021, from USD 9.1 billion in 2017. It comprises approximately 113,2 percent of annual growth rate. Consumer-oriented investments are in the base of exponential technology development, with retail showcasing being the second biggest investment field (after onsite assembly and safety) with USD 250 million in 2017. The output of the aforementioned investments can be already seen in numerous mixed reality campaigns by top innovative market players (examples of such campaigns will be presented and discussed further in the literature review section).

Current trends of digital reality towards transparent interfaces, where a blend of voice, body, and object positioning abilities will make it possible for consumers to interact with data and the surrounding environment more natural, together with ubiquitous access to capability of “being connected” to AR/VR not only via mobile devices, but via wearables, are not something that can be achieved in a year or two, but needs a completely new skills and vision (Cook et al. 2018). The same can be said regarding AR/VR technology commercialisation and broader individual adoption. Even though device costs continue to decline, standards are being defined, and app ecosystems are beginning to emerge, the technology is still in its relative chasm phase and has not been entered its mass market phase, by remaining attractive with its niche applications only for innovators and early adopters. Thereby, it is crucial for organisations to understand how the technology is ready for active implementation within the retail scope.

The primary concern in these terms is that even though enterprises are able to determine concrete and relevant managerial implications of AR/VR adoption, it is not particularly the

case regarding consumers' acceptance and usage of new forms of such a technology. Thus, it is crucial to understand why while major innovative companies are heavily investing in AR/VR R&D in their retail operations, the majority of potential individual adopters are not on the same page. The research is planned to contribute to the literature on emerging technology adoption, in particular, virtual and augmented reality, with the base of consumer adoption intentions and behaviour.

## **1.2 Literature review**

This section contains a literature overview of the current research on augmented and virtual reality in retail, its fundamental adoption benefits and societal perception. The analysis of the existing literature will contribute to a research gap identification for the study to take over.

First, augmented reality focused research is examined. The technology of augmented reality originates back in 1968 when AR head-mounted display (HMD) system was created by Harvard computer scientists, which in the following decades was further developed by national agencies, lab universities and a number of companies (Javornik 2016). Even though the phenomenon was actively evolving in academia since its first initial introduction, marketing research on augmented reality commerce wise has only become a field of interest in the late 90s with one of the first studies by Brody and Gottsman (1999) named "Exploration of uses in augmented commerce". It can be characterised by the fact that the technology was not ready for commercial use until the 1990s, when mobile AR and portable computers began to be developed and utilised, gaining increasing attention in the field of computer science, as well as the field of VR, 3D technologies and mobile technologies (Javornik 2016). Together with the development of the technology itself, its application and adoption have also started to evolve and cover various industries, such as retail, entertainment, medicine, navigation and education.

Application of AR technologies in retail can be observed at a number of various steps within a customer journey, including physical, mobile and online touchpoints (Carmigniani et al. 2011). Experiential marketing is laying in the base of this integration (Bulearca and Tamarjan 2010), and making the technology a complementary element rather than an entirely new retail technique. It is also discussed in the earlier research on augmented reality (Brody and Gottsman 1999) that the technology is mainly foreseen to be utilised as a tool to complement and connect traditional and electronic retail, which has not been changed dramatically since

then. Experiential value of augmented reality was further researched in more recent papers (Chou 2009) with a focus on consumer satisfaction effect and positive consumer-brand relationships (Owyang 2010). Use of AR as a promotional tool was determined by Bulearca and Tamarjan (2010) to be advantageous for organisations concerning customer loyalty. The research shows that individual adoption of AR both in-store and online makes customers appeal and be more involved with retailers and a brand as a whole.

Functional and hedonic features of AR within retail environments were indicated back in the early 2000s (Sukaviriya et al. 2003) and were further examined in more details by several researchers (Pachoulakis and Kapetanakis 2012; Kang 2014; Poushneh and Vasquez-Parraga 2017). Fun, pleasant and personalised retail experience is the primary outcome that is highlighted by the studies with the focus on overall customer journey satisfaction enhancement. One of the study cases with AR virtual fitting rooms, where through a virtual changing room with the help of users' computer or phone camera it was possible to examine virtually how an outfit would fit, and "fun factor" of such a shopping experience was one of the main findings on customer satisfaction (Pachoulakis and Kapetanakis 2012).

Extensive expansion of personal mobile technology, including smartphones and tablets, facilitates the exponential development of AR technology as a whole. At Worldwide Developers Conference 2018, Apple has introduced its new feature of a "multiplayer" co-creation in AR within the upcoming iPhone operating system. By integrating more advanced features and exposing AR technology to mass market, Apple is making potential customers more familiar with the technology, which is gradually making AR more common and interactive for users, and thereby, increases the possibility of its acceptance within other industries. Personal mobile technology in its turn drives AR to a greater extent of personalisation, customisation and consumer-led interactions (Magrath and McCormick 2013).

IKEA AR application is a vivid example of the augmented reality phenomenon in retail, where the software measures width and height of a real-life room and allows users to "try" a piece of furniture in their interior through the camera of their gadgets. Another example is virtual technology company ModiFace, the leader in AR within beauty retail, which offers "beauty try-on simulations on live video, and to track the face and facial features in precise detail" (Modiface Inc. 2018). The company provide two AR beauty solution: AR software for mobile application and in-store mirrors. Both are simulating effects of real makeup, skincare

and teeth whitening products that can be further purchased from online or physical beauty retail stores. In mid-March 2018, ModiFace was fully acquired by L'oreal and became a part of its digital services R&D department (L'oreal Mediaroom 2018). Such AR solutions as IKEA AR and ModiFace provide an opportunity for customers to decrease commitment to purchase with “try-before-you-buy” feature. Research of mobile apps for shopping using AR shows that experiential benefits of the technology lead to higher user satisfaction and following advantages to retailers (Dacko 2017).

The first AR application for commercial purpose was a part of the BMW Mini model advertising campaign, created in 2008 by German agencies in Munich. The application was implying a printed magazine ad that when a user was exposing it in front of a computer's camera, the model of BMW Mini appeared on the screen. With its help, a user was able to rotate the car on the screen and observe it from various angles, by merely manoeuvring the piece of paper. This marketing campaign was one of the first AR employment in retail that allowed interaction with a digital prototype in real time. (Strauss 2008)

Further, existing research on virtual reality technology is examined and summarised. Regarding virtual reality, the technology takes its roots from the 1970s with application in the aviation industry (Bonetti et al. 2018). Similar to augmented, virtual reality has attracted the initial attention of marketing researchers starting with Gold's (1993) research on “Simulation of shopping environment”. With the extensive progress of virtual technologies and overall underlying power of computers, the application of VR has also been widespread across industries in the recent decade.

First retail alike VR simulation was created by MarketWare Simulation Services in the early 1990s purely for marketing research purposes. The system was called “Visionary Shopper” and implied a virtual shopping environment and experience simulation, where users were able to examine products on shelves, its packaging, labels and prices. The simulation was developed to test consumer behaviour towards various product concepts and retail layouts. Despite limited abilities and poorly developed graphics, shoppers characterised this experience as “fun and enjoyable”. (Gold 1993) One of the first adopters of VR technology in retail were such companies as Electrolux (a Belgian appliances manufacturer), which launched its VR showrooms for customers to test-market new appliances on a virtual kitchen (Williamson 1996); Sainsbury's (a UK supermarket chain) was using VR headset to optimise products layout, store design and overall development costs (Sainsbury 1995), and the same

was done by Burger King (an American chain of fast-food restaurants) in 1999 to test new retail store concept (Summerour 2001).

Virtual shopping interface is crucial when talking about consumer satisfaction and overall purchasing behaviour. According to Ballantine (2005), consumer behaviour online and satisfaction with shopping experience is profoundly affected by the level of interactivity and amount of information provided within a virtual interface, which means that when creating VR simulation companies should focus on consumer-friendly interfaces. Kim and Forsythe (2008) have also highlighted that VR applications concerning online retail context, boost the hedonic value of a customer shopping experience and make the customer interact more with a product. Even though VR simulation is actively used to test physical retail layout, it was revealed in a study that VR layout itself does not influence users' behaviour, and consumers immerse into virtual worlds mostly due to entertainment and socialising purposes (Vrechopoulos et al. 2009).

One of the latest and most noticeable VR retail examples is Alibaba's (a Chinese e-commerce retail) "Buy+" retail simulator. The "Buy+" VR experience implies an idea of a virtual mall, where customers are able to walk across "the shop", examine products and make instant purchases within the simulation. While people are expecting Alibaba to change "the game" of retail as a whole, the software is still prominently lacking in mass market affordability and technology readiness. (BBC News 2016)

To summarise, research on both augmented and virtual reality is stressing the importance of the experiential value of the technology. Adoption of immersive AR and creation of VR simulations are crucial for consumer engagement and overall experiential value. VR simulations that cause user enjoyment and engagement in a virtual store also impact purchasing intentions via user satisfaction (Papagiannidis et al. 2013). Social experience, a virtual trial of products with "buy-before-you-buy" ability and co-production and customisation opportunities are the main AR/VR features that enhance customers' experience (Gadalla et al. 2013).

However, even though most of the aforementioned research reveals positive effect from AR/VR on customers' shopping experience and brand perception, there is limited research that examines actual consumer intentions to use AR/VR in retail. After AR/VR systems and software failed to keep up with customer expectations as a result of public hype, individuals

are currently anticipating more advanced user experience and usability from AR/VR when considering its adoption (Alshaal et al. 2016). According to Centric Digital, virtual reality in retail is still in its low maturity stage with limited content and use cases being presented on the market (Khan 2016).

### 1.3 Objectives and research questions

Comprehensive development of AR/VR technology has attracted viable academic research interest, as well as subsequent technology development and applications extension. Being a research topic of interest for several decades with mainly exploratory focus, substantial consideration has only emerged recently both in academic literature and in practice. However, a fragmented body of existing academic research and limited evidence of practical uses of AR/VR in the retail context means that a coherent basis for further research is lacking. Based on the literature background that is reviewed in the previous section, the research gap was identified, and the main and investigative research questions were set and presented in Table 1.

**Table 1. Research questions**

<b>Main RQ</b>	What are intentions for individuals to adopt AR/VR in retail?
<b>RQ 1</b>	What is the current state of adoption of AR/VR technology in retail?
<b>RQ 2</b>	What are barriers for individual adoption of AR/VR technology in retail?
<b>RQ 3</b>	How personal innovativeness influences on individual technology adoption?
<b>RQ 4</b>	How hype around a product influences on individual technology adoption?

The primary objective of the research is to assess the potential of the technology via industry trends and adoption rate examination, determine consumer interest in technology and drivers of adoption intentions, and to identify perception that influences acceptance. In order to answer to the research questions presented above, it is necessary to explore the application of virtual and augmented reality in customer experience in retail industry and its current extent of acceptance and adoption by potential consumers.

## 1.4 Theoretical framework

In order to analyse how industry trends and individual perception influence overall customer acceptance to adopt AR/VR in their shopping experience, it is vital to understand current literature and research on customer acceptance theory. The theoretical framework that will be underlying in the research is the Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh et al. (2003). The model considers and measures technological innovations from consumers and enterprises point of view and their divergence between expected adoption and actual acceptance. Key elements that the framework includes is a causal relationship of independent variables (performance expectancy, effort expectancy, social influence and facilitating conditions) on adoption intentions and actual system of use.

Moreover, an individual's level of cognitive innovativeness play a significant role in influencing individual behaviour towards accepting and using the technology (Bonetti et al. 2018), thus, the UTAUT model was modified, and individuals are distinguished and considered according to their level of personal innovativeness (innovators, early adopters, early majority, late majority, laggards) (Rogers 2003). The comprehensive theoretical framework is presented further in the study.

## 1.5 Definitions of key concepts

This section gives an overview of contextual definitions that are used in the study and are relevant to the background of the research. The definitions are derived from the literature review, which was analysed in the previous section. Theoretical definitions are separately examined in more details in the theoretical background chapter.

*Digital reality (DR)* is a collective term for immersive technologies such as augmented reality, virtual reality, mixed reality, and 360° video. (Cook et al. 2018)

*Immersive* is the rationale of an intensely engaging, multisensory, digital experience, which can be achieved using various formats including VR, AR, 360° video, mixed reality, and other technologies. (Cook et al. 2018)

*Mixed reality (MR)* is technology that employs advanced sensors for spatial and gesture recognition to seamlessly combine a user's real-world physical environment and digitally

produced information in a way that provides the basis for both environments to coexist and interact. (Cook et al. 2018)

*Augmented reality (AR)* is a technique that allows blending real-world and computer-generated digital content into the user's view of the physical world in such a way they perform as one coherent environment. (Olsson et al. 2013) The overlay of the environments is reached via transparent optics and a viewable environment, where users are conscious of themselves and their surroundings. (Cook et al. 2018) AR compounds the virtual and real worlds, through a virtual layer of added images and videos, textual information, or other virtual components to the user's screening of the physical environment in real time scope (Carmigniani et al. 2011; Huang and Liao 2015). AR seizes real-world data, normally with a use of digital camera. In retail context, AR gives an opportunity to capture consumers' attention by allowing them to interact with virtual products with the help of smartphones, tablets, wearables (headsets), projectors or fixed interactive screens that serve as a connecting device component (McCormick et al. 2014; Reitmayr and Drummond 2006). Product simulation, content abundance, immersive sound effects, GPS data and videos create the initial experiential value. (McCormick et al. 2014)

*Virtual Reality (VR)* is technology that generates a fully rendered digital environment that completely substitutes user's real-world physical environment with the help of head-mounted display that blocks out "real world" sensory experiences and replaces it with a fully immersive 3D world with body and motion tracking interactive features (Cook et al. 2018). In the retail context, VR provides an engaging shopping environment for users' to take advantage of virtual effects. VR is also defined as a fully immersive and interactive computer simulation that makes a virtual environment to respond to user's actions through one or more senses, providing the sensation of being psychologically immersed in the simulation of a virtual world (Sherman and Craig 2002; Fuchs et al. 2011).

## **1.6 Delimitations**

Limitations of the study are indicated in order to obtain a clear perspective on the researched phenomenon. Contextual delimitations include narrowing down overall phenomenon of digital reality to augmented and virtual reality, where the focus bears a comparative characterisation of the research. The research is not considering enterprise adoption motives, in order to gain non-biased comprehension of individual adoption intentions. Thereby,

theoretical delimitations are indicated by the focus on individual technology and innovation adoption and acceptance literature. Cross-sectional design frames managerial implication of the study and makes it relevant within a limited period of time.

## 1.7 Research methodology and data collection plan

The underlying methodology of the study is determined by the cross-sectional inductive research approach with discripto-explanatory focus. Descriptive research is conducted to reflect on the current state of the market and technology adoption rate, which in its turn creates the basis for an explanation of individual adoption drivers and intentions. Triangulation is employed, where a mixed method of data collection and analysis is utilised to cover composite purposes and objectives of the study. Combination of methods and techniques is used to gain an in-depth perspective on individuals' perception of the particular technology, explain customer's adoption behaviour and gain a deeper understanding on overall AR/VR adoption phenomenon (Yin 2015). Structured interviews, participant observations, and secondary data case study serve as the basis of the empirical research. Grounded theory strategy is applied to determine causal relationships within the proposed comprehensive theoretical framework. The research methodology is visualised in Figure 1 and is described in more details in Chapter 4.

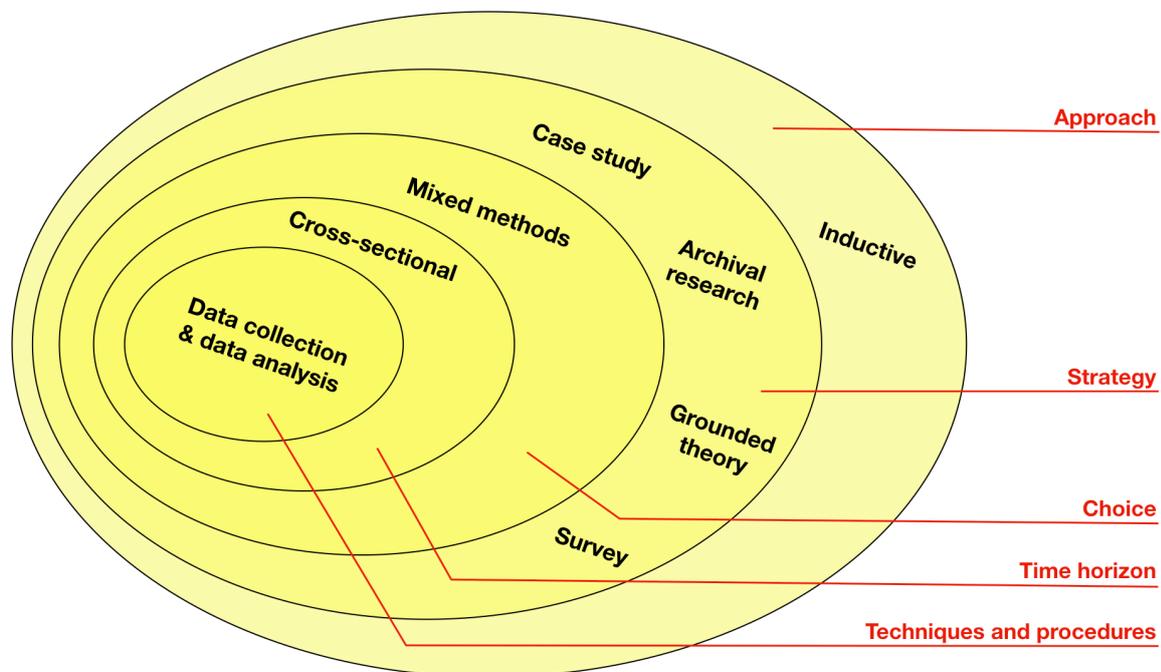


Figure 1. Research onion (Saunders et al. 2009)

## **1.8 Structure of the study**

The structure of the thesis is outlined in order to facilitate a coherent understanding of the process of the study being conducted. First, introduction chapter assists as a preamble of the research, where primary literature is reviewed to identify research gap and establish research objectives supported by the initial theoretical framework that in its turn is framed by research methodology and limitations.

Pervasive literature component of the study is occupied in Chapters 2 and 3. Chapter 2 imply an in-depth analysis of the AR/VR market as a whole and within the retail industry context, its current dynamics and trends, market segmentation, the current state of technology acceptance based on hype cycle curve, and adoption inherent barriers. Chapter 3 reflects on key theories and concepts of individual adoption and acceptance that in the end serve as a basis for the comprehensive theoretical framework proposition.

The empirical part of the study is commenced with Chapter 4, where research methodology indicates detailed prospect of the design of the study, methods and techniques utilised for primary and secondary data collection and its subsequent analysis. Chapter 5 contains composite interpretation of collected data and its primary analysis that reflects on forecasted AR/VR adoption rate, the extent of personal innovativeness among data sample, intentions based on the proposed theoretical framework, its independent variables and moderating factor of personal innovativeness, together with the individual perception of adoption barriers. The chapter is summarised in the end using the table for the following findings highlights. In Chapter 6 research questions are answered by reciprocal reflection on compound research findings and existing theoretical background. Managerial implications together with theoretical contribution are drawn based on the discussion. Chapter 7 serves as a bottom line of the thesis, where aggregate study derivation is done with following future research proposition based on the established limitations. The structure of the research is visualised below in Figure 2 with a detailed reflection on input and output factors of each of the aforementioned chapters.



*Figure 2. Structure of the thesis*

## **2 LITERATURE REVIEW**

Augmented and virtual reality is one of the top ten technology trends at the moment (Panetta 2016). Extensive smartphone penetration and advancement in internet connectivity and computing capabilities are the major factors driving the growth of the AR/VR market. Improvements in the technology as a whole drives consumer adoption, which is considered to be the primary revenue contributor within the market (P&S Market Research 2018).

In this chapter current AR/VR market, revenue growth potential, industry trends, industry segmentation and existing adoption barriers are examined. The analysis of the present situation will help to understand potential scalability and adoption of the technology and answer posed research questions.

### **2.1 Current market of augmented and virtual reality**

Augmented and virtual reality is still in its early stage of development, but started to gain momentum during the recent years and is gradually becoming a flourishing industry with vivid switching focus on practical applications and potential of becoming a new big computing platform. Currently, the AR/VR market is estimated to grow from USD 4.1 billion (2016) up to an accelerated case of USD 182 billion by 2025 (basic case of USD 80 billion) (Goldman Sachs 2016). The revenue is expected to grow significantly starting from 2019 (Digi-Capital 2018), and 60% of AR/VR software revenue will be driven by the consumer segment (Goldman Sachs 2016). Consumer AR/VR revenue in its turn is estimated to grow from USD 2.8 billion up to USD 39.3 billion by 2021, with AR revenue (USD 20.3 billion) slightly taking over VR (USD 19 billion) (SuperData 2018).

Digi-Capital (2018) is forecasting AR to represent 86% of the overall USD 105 billion AR/VR market with USD 90 billion share by the year 2023, and with VR capturing the rest of the market with USD 15 billion. Majority of experts expect AR market to outperform VR regarding the revenue within the next three years (Perkins Coie LLP 2018, 8). Moreover, mobile AR is expected to be the initial driver for the overall AR/VR market growth (Merel 2016). The reason why AR estimated to draw more extensive revenue is mainly connected with the fact that it has more potential to attract broader customer base with more practical applications, combined with a smoother combination of digital and physical worlds. The technology of augmented reality is nowadays widely accessible with mobile AR, for instance

for iPhone users via ARKit and Android users via ARCore platforms, which gives AR more accessible software base for scalability, mobility and flexibility (Perkins Coie LLP 2018; SuperData 2018). Meanwhile, VR with platforms such as HTC Vive, Oculus Rift, Sony Playstation VR, is targeted to a smaller installed base and users who are eager to have more immersive experience. Thus, mobile AR has a vivid dominance over VR regarding installed base, with 900 million in 2018, and forecasted growth of up to 3,5 billion by 2022 (Digi-Capital 2018).

Substantially, the AR/VR market is considered to be a trend in head-mounted-devices (HMDs) as a new computing form factor (Goldman Sachs 2016). Smart glasses with a high degree of mobility and flexibility is a new nascent and fast-growing HMDs' trend and the basis for long-term future of the AR/VR industry (P&S Market Research 2018). Digi-Capital (2018) forecasts smart glasses to be the second biggest revenue source after mobile AR in AR market by 2022. The experts anticipate Apple to launch new smart glasses in 2020 and boost the device from the current niche to large-scale mass market consumers by 2022. (Merel 2016; Digi-Capital 2018)

## **2.2 Industry segmentation**

There are ten industry sectors that AR/VR investments are mainly concentrated on: gaming, education, healthcare and medical devices, real estate, marketing and advertising, live events, military and defence, movies and television, retail, manufacturing and automotive. Gaming has been captivating and still is, the majority of investments in AR and VR technology. In 2016, 78% of the technology experts were expecting gaming to be the leading sector to draw the most investments. In 2018 the number of gaming investments moderately dropped, with the simultaneous growth of investments in such areas as marketing and advertising, retail, and manufacturing and automotive. (Perkins Coie LLP 2018) Even though currently gaming is the fundamental source of revenue for AR/VR market, mass market adoption will be accelerated by profound innovation and new emerging use cases from other industry sectors. Real estate, retail and healthcare are the industries that AR/VR is expected to disrupt in the upcoming years. (Goldman Sachs 2016)

In 2018 retail industry drawn twice as much attention from investors compared to the year 2016 since more practical AR/VR applications started to gain its momentum. Google director of AR and VR department noticed that gaming AR smartphone applications, such as

Pokemon GO, created the technology buzz and made customers to anticipate the same immersive experience in stores, while they shop. It has also formed a basis for more vivid reconnection of physical and digital retail for potential customers. (Perkins Coie LLP 2018). Retailers have started to invest in AR/VR technology to gain a competitive advantage in customer service with a distinct improvement in customer satisfaction via life-like immersive shopping experience. AR/VR in retail can potentially diminish the value of physical stores with decreasing the necessity of in-store display inventory by shifting it to a “home” experience with the help of mobile devices. (Goldman Sachs 2016) While Goldman Sachs (2016) forecast AR/VR in retail to be utilised for higher-ends and high involvement purchases, such as furniture and home appliance, automotive industries and apparel, Digi-Capital (2018) expect AR eCommerce to have an extensive application also in consumer electronics, office equipment, health and personal care, toys and hobbies, media, and food and drinks.

AR/VR in retail has an exponential potential of USD 3 billion market size with 1 billion online and in-store users with the focus on e-commerce as a revenue pool and assumption that the technology will be available to any shopper. Goldman Sachs (2016) forecasts AR/VR in retail to capture 1% of the total AR/VR market and reach USD 500 million revenue and 9,5 million users by 2020, and USD 1.6 billion in revenue and 31,5 million active users by 2025. Gartner Inc. in its turn predicts that there will be approximately 100 million AR shopping users by 2020 (Levy 2016).

Digi-Capital (2018) expects e-commerce to be one of the three biggest revenue drivers of the global augmented reality market in 2022. The technology had already demonstrated its potential in retail, when in 2017, there were one million users of AR-enabled feature on Houzz app (design and home renovation community), and those users have tended to be 11 times more likely to buy anything on the platform with 2,7 times higher total spendings (Lunden 2017). VR also considered to have the potential for revenue growth and user application regarding e-commerce sector, but the narrow installed base is currently limiting the subsequent broader adoption.

### **2.3 Current state of the technology acceptance**

To analyse acceptance of emerging technologies, AR/VR in the particular case, the hype cycle model will further be applied. Hype cycle or as it also called the hype curve, was

developed in 1995 by Gartner Group to describe an extent of expectations towards new emerging technologies on a time continuum starting from the initial R&D of a technology, to ascensive hype around it and subsequent public frustration, and an eventual launch to mass market with more realistic expectations. The model illustrates the typical evolution of emerging technologies on the market within five stages, with inherent characteristics to each of the stage. The hype cycle helps to understand a technologies' visibility in a market and evaluate when it is time to invest (Gartner Inc. 2003; O'Leary 2008).

The first stage on the cycle is the technology trigger, where technological breakthrough starts with initial research and development and first laboratory prototypes. First funding from venture capital is drawn during this stage to develop and launch first-generation products, which end up being with high inflated price and significant need in overall customisation.

The next stage is the peak of inflated expectations, when simultaneously with the primary R&D and first investments, suppliers' dissemination begins, attention from mass media starts to rise, and positive hype emerges. The press initiates interest among early adopters and makes them investigate the technology. With the over exaggerated hype throughout media, problems with first-generation products become visible to public and negative press starts to appear on the very peak of the expectations, which lead to the third stage of the trough of disillusionment.

Overinflated expectations commence to drop due to product failures, and subsequent rounds of venture capital funding take place during the downturn on the third stage. At the bottom of the slope, a second-generation product is developed with some extent of services, which generates the initial adoption by up to five percent of potential customers (innovators and early adopters).

The fourth stage is the slope of enlightenment, where potential adopters develop a better understanding of how technology can be applied, what are its risks and benefits. Together with the first adoption wave, methodologies and best practices developing, which lead to an introduction of third-generation products and potential to penetrate the mass market.

Last but not least, the fifth stage of the plateau of productivity. With vivid benefits of the technology adoption and reduced risks, the majority of the mass market starts to recognise and accept the product, which stimulates high-growth adoption with approximately 20 to 30 percent of adoption. (Gartner Inc. 2003) Further, development and consequent adoption of

AR/VR for the last couple of decades within the aforementioned hype cycle context will be considered (Figure 3).

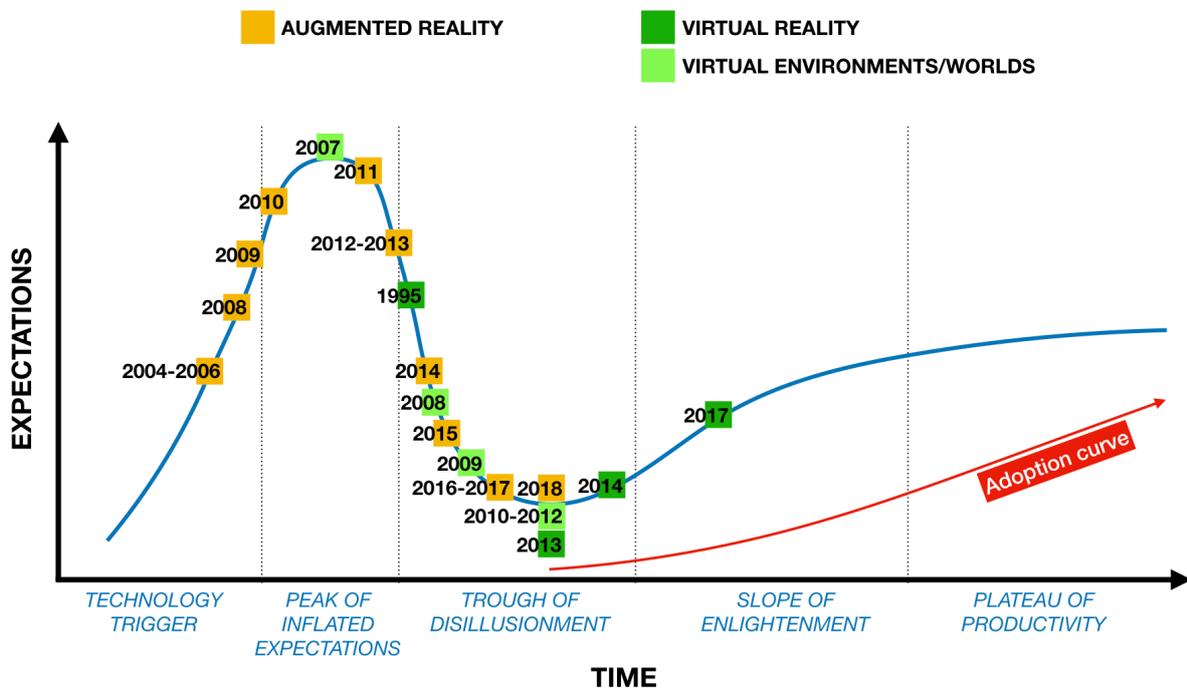


Figure 3. AR/VR Hype Cycle (Gartner 1995-2018)

Augmented reality first appeared on the hype cycle in 2004 and since then was considered on almost all annual hype cycle analysis under the same concept, except the year 2007. AR is the emerging technology that was consistently presented on the curve, which shows that the technology was following its predictable development on the market throughout the years. Currently, in 2018, AR is located in its trough of disillusionment stage, when third-generational products with supporting services are being developed, and initial adoption is starting to take place.

Virtual reality in its turn was first mentioned on the very first hype curve back in 1995, on the stage of sliding into the trough of disillusionment. The boom around virtual reality in the 1990s was due to the launch of 3D gaming and new immersive cyber-worlds. However, the technology was put “on hold” due to the failure in graphics, high prices, and low computing power to support the system, and, thus, became a “ghost” technology for the subsequent decade. (Goldman Sachs 2016) Such “ghost” technologies usually do not have enough interest from organisations and individuals to drive adoption at first, and potentially fall into a niche application before re-emerging back on the cycle. (Gartner Inc. 2003) VR military and

space training can be considered as the niche application in the late 90s and the early 2000s. With a new substantial target audience of gamers, VR appeared back on the very peak of the hype cycle under the name of virtual worlds or environments in 2007 and was considered under this concept up to 2012. In order to draw the following conclusions within the research, it is crucial to ensure conformity of virtual environments/worlds concept with the current notion of virtual reality. Schroeder (2008), with references on his earlier researches (1996, 2006), defined a virtual world as a virtual environment with a focus on interactive social space, and virtual environment in its turn as a synonym for virtual reality with a definition of “a computer generated display that allows or compels the user (or users) to have a sense of being present in an environment other than the one they are actually in, and to interact with that environment”. In 2013 virtual reality re-emerged as an original concept on the hype cycle at the climbing the slope stage and was gaining its adoption momentum since then. The resumed attention in the media was provoked mainly by Facebook acquiring Oculus (VR headset company) in 2014 for USD 2 billion, with the subsequent rise in AR/VR venture capital up to USD 3.5 billion (Goldman Sachs 2016). At the time of the year 2017, virtual reality was the closest to the plateau of productivity technology on the hype cycle, and in 2018 has not already been acknowledged within the model. In overall, both AR and VR are currently in its formative and experimental phase with strong confidence from the industry experts regarding the technology’s potential on the market (Perkins Coie LLP 2018, 2).

## **2.4 Barriers for AR/VR adoption**

As it was mentioned previously, the organisational customer base is actively growing with the tremendous amount of investments, but in the meanwhile, on the other side, the industry is facing concerns from the individuals’ perspective. Slow adoption is considered to be the fundamental issue for 71 percent of potential AR/VR investors, following with another issue of a lack of an established market for the technology. Experts highlight that there is a small fraction of innovators, who are considered to be target customers for the technology, and in order to fasten the adoption, the industry should appeal to the mass market in accordance to the customer group. One of the experts noticed that even though there is hype around AR and VR, not that many people are ready to dedicate their time indeed to understand and adopt the technology, which indicates that both AR and VR should be easier and more comfortable for the majority of people to accept it. (Perkins Coie LLP 2018) Current adoption is also limited

by mobility and battery life, with additional challenges in latency, display, and the technology being used mainly for video games (Goldman Sachs 2016).

Both Perkins Coie LLP (2018) and Goldman Sachs (2016) highlight six significant obstacles for AR/VR mass adoption, which is user experience of software drawbacks, inflated price point, lack of content offerings, organisational and individual unwillingness to adopt the technology, financing and investments, and risks connected with laws and regulations. User experience as an obstacle for AR/VR mass adoption is essentially connected with technical limitations, performance issues, bulky hardware and physical discomfort. VR by entirely isolating users from the real environment can cause nausea, motion sickness, stress and anxiety after using the system (P&S Market Research 2018).

While issues connected with user experience is remaining the main barrier for mass adoption for both AR and VR for the last couple of years, the price point concerns vary between the two technologies (Perkins Coie LLP 2018). Costs in VR context is a more profound barrier for adoption than for AR since VR requires a separate device/headset to be purchased in order to utilise the technology. Considering the issue for a while, many VR tech companies started to invest their efforts into making more affordable, faster and lighter VR devices in order to extend the user base. Price reduction in AR/VR technology is expected to follow the same curve as for PCs and smartphones with 5-10% of the annual drop in price point, which will drive substantial mass adoption in the near future (Goldman Sachs 2016).

AR in its turn is gradually becoming a common feature of many smartphones. Thus, AR is already available for the abundant amount of owners of smartphone supporting the feature, but together with this comes the issue of a lack of content offerings. The deceleration in content development is related to the issue of indirect network externalities, where lack of installed base cause developers to recede investments in AR/VR and consumers in their turn are waiting for a more extensive variety of content in order to adopt. (Mohr et al. 2010, 22; Goldman Sachs 2016) However, with the growing investments in AR platforms, such as Apple ARKit and Google ARCore, the experts forecast developers to concentrate their efforts on an extensive broadening of AR tools and applications for smartphones for the upcoming year. This boost in AR applications development is also based on a vivid technical improvement of phones and tablets supporting the technology, and the fact that well-established reputation of AR as purely a gaming centred technology is switching towards more functional and operational focus. (Perkins Coie LLP 2018)

Legal risks connected with AR/VR mainly focuses on consumer privacy and data security, product liability in regards of health and safety issues, intellectual property infringement, compliance with platform requirements in publishing content, technology and IP licensing, and export control issues. Concerns about legal issues have gained twice as much attention from experts for the last two years. Perkins Coie LLP corroborated this phenomenon with the fact that the market is getting more mature and more companies are entering various industries with AR/VR solutions. Nowadays, with numerous cyber attacks, privacy and data security is the crucial concern not only for AR/VR companies but almost all organisations worldwide. Majority of AR/VR organisations are managing the issue by limiting the amount of personal data collected, shared and used from users, strengthening overall data security systems, updating privacy policies and disclosures regarding consumer data (mainly after the entry of European Union's General Data Protection Regulation to the force in May 2018), and training employees on cyber and information security. (Perkins Coie LLP 2018)

### **3 THEORETICAL BACKGROUND**

Adoption and diffusion of an innovation is an uncertainty reduction process (Rogers 2003). The majority of innovation diffusion research is focused on technological ideas. There is a separate spotlight in the research dedicated to an individual acceptance of technology with such determinants as intention and usage at the core, which helps to understand how and why individuals adopt new technologies. The stronger the intention towards a specific behaviour, the more likely an individual will conduct an observable action, adoption of technology in the particular instance (Silva 2015). Thereby, intentions are fundamental in acceptance research as a predictor of adoption behaviour (Venkatesh et al. 2003).

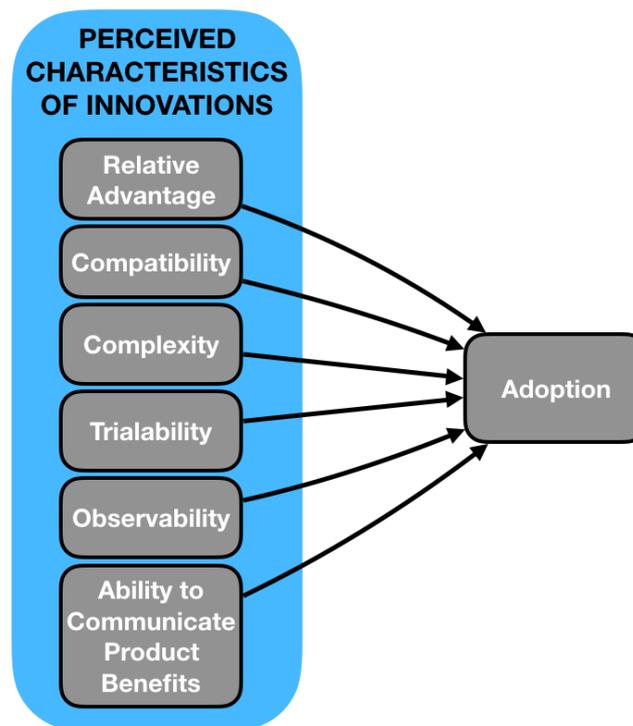
To constitute the fundamental theoretical base for the research paper and to analyse intentions for adoption from the individual level perspective, the most prominent technology adoption theories, such as Rogers' Innovation Diffusion Theory (IDT) (Rogers 1962), Technology Acceptance Model (TAM) (Davis 1989), Theory of Reasoned Action (Ajzen and Fishbein 1975) and Theory of Planned Behaviour (Ajzen 1991), and Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003) will be reviewed in this chapter. In the end, a comprehensive theoretical framework is proposed in order to be able to determine extrinsic and intrinsic factors that influence on intentions of individuals to accept and adopt the technology, AR/VR in particular.

#### **3.1 Innovation Diffusion Theory**

In order to understand drivers, intentions and barriers behind the adoption of innovation it is vital to examine Rogers' Innovation Diffusion Theory (IDT) (1962). The theory is fundamental to foresee potential reactions of customers to an innovation. The model allows to understand the attitudes and thereafter create a base for innovation positioning and its relevance to already established beliefs and experiences of potential adopters.

Customers' rate of innovation adoption differentiates according to perceived properties of the innovation itself. According to Rogers (2003), "the perceived attributes of innovation are one important explanation of the rate of adoption of an innovation". The fluctuation among the rate of adoption is determined by five perceived attributes of innovation: relative advantage, compatibility, complexity, trialability, and observability. Mohr et al. (2010) acknowledge the

sixth aspect in a customer's tendency to adopt new technology: the ability to communicate product benefits. The theory is illustrated in Figure 4.



*Figure 4. Innovation Diffusion Theory (Rogers 2003; Mohr et al. 2010)*

### **3.1.1 Relative advantage**

Relative advantage factor considers the correlation of benefits of new technology adoption and its associated costs. Costs, in this case, examine not only economic, or so-called monetary value, but also social, psychic and other related resources that customers contribute when adopting a technology. Uncertainty arising from consumers' emotional worry, doubt, fear, and ambiguity about whether technology will perform inherent benefits, and if a customer has needed skills and capabilities to realise and sufficiently utilise those benefits, can be the cost attributed to a relative advantage of technology adoption. (Rogers 2003, Mohr et al. 2010)

The status aspect of an innovation adoption is also referred to relative advantage as a motivation for customers to enhance social status. When researching on a status aspect influence on an innovation adoption, it is hard to observe and comprehend this variable, since respondents mainly do not directly confess on using a specific innovation as a part of social status boost. Nevertheless, generally, the status motivation behind an innovation adoption is

more vivid for such categories of adopters as innovators, early adopters, and early majority, and usually not the case for late majority and laggards (categories of adopters are described in more details in the Chapter 3.1.7). (Rogers 2003)

Social influence and dissemination of information about innovation and its relative advantages, in particular, is at the core of initial innovation diffusion and adoption. A message which demonstrates vivid examples of relative advantages and a degree to which these advantages are better to existing offerings makes potential adopters decrease their uncertainty and adopt at a faster pace. (Rogers 2003)

All in all, the majority of innovation diffusion research acknowledge relative advantage as one of the fundamental forecasters of innovations' rate of adoption and shows a positive relation between relative advantage and rate of adoption.

### **3.1.2 Compatibility**

Compatibility factor in individuals' adoption of an innovation context attributes to how this innovation fits into existing sociocultural values and beliefs, past experience and previously introduced ideas, and overall potential adopters' needs for the innovation. Compatibility presents direct proportional relation with the rate of adoption, where the more compatible an innovation is with an individual's case, the more likely the innovation will be adopted by the individual. Namely, a greater extent of compatibility, where an individual is able to refer a new technology to a familiar one and give it a constructive meaning of use, decreases customers' uncertainty towards an innovation. (Rogers 2003) If it requires an individual to invest a certain amount of resources in order to learn new behaviours to adopt and use an innovation, it will most probably cause deceleration in the diffusion of this innovation.

Compatibility of innovation in high technology markets requires exceptional attention. The matter of compatibility of interfaces to legacy systems or a specific technology with complementary products is of high importance for diffusion and adoption of high-tech innovations. (Mohr et al. 2010)

Previously introduced ideas can serve both as a base for rapid innovation adoption or also an obstacle for diffusion. As it was mentioned previously, individuals assess the compatibility of new technology based on the ones that are similar and familiar to them. It means that mental tools based on old ideas comprise the fundamental part in compatibility perception and how

individuals will interpret and handle an innovation. Hence, preceding experience determines an extent of uncertainty towards innovation and therefore its rate of adoption. On the other hand, a high degree of compatibility with existing practices and experience may cause an illusion of innovation absence in individuals' minds with no vivid change and, thus, a decrease in adoption. Highly compatible innovations are usually used as transitional ones for further systematic less compatible innovations. Previous experience can also have a negative connotation and result in innovation negativism. It means that potential adopters who have had a contradictory incident with one innovation, will most probably refuse to adopt future analogical innovations due to related suspicion of resembling failure. (Rogers 2003)

Needs of a potential adopter is another factor that determines compatibility. The extent of compatibility is directly connected to the extent of potential needs that can be met with one or another innovation. People do not usually recognise their so-called latent needs, thus, assistance with a high degree of empathy and mutual understanding is required to accurately determine and fulfil the aforementioned needs. If innovation is poorly exposed to potential adopters, they might never be aware of innovation and will not recognise that there is a need for one. (Rogers 2003)

### **3.1.3 Complexity**

The perception by a potential adopter of how difficult and demanding it is to use and understand innovation is determined under the complexity aspect of perceived properties of an innovation. Meanwhile, the aforementioned properties of relative advantage and compatibility mainly have the positive effect on the rate of adoption, complexity is the factor which is correlated negatively (the more complex an innovation is, the slower rate of adoption). However, it is vital to mention that complexity is not the most influential aspect to influence innovation diffusion. Nevertheless, it is still might be an obstacle for adoption for certain categories of adopters (e.g. for laggards). People who are innovative by their nature and are eager to try new things, will not consider complexity as a disincentive for adoption. (Rogers 2003)

High-tech products and services mostly tend to be on a sophisticated side of the complexity-simplicity continuum. Development process and marketing communication strategies play a critical role in how complexity is constructed and exposed to customers. Thompson et al. (2005) have noticed that individuals who are interested in adoption of a product with feature

complexity due to its broad needs fulfilment, experience mental and emotional strain regarding lack of competence and ability to learn how to use this feature-laden product. In the pre-adoption stage customers usually, extol the importance of more features over the difficulty of use. In most of the cases, such individuals further experience “feature fatigue”, where they have a negative backlash after adopting such innovation and not being able to cope with its complexity. Such adopters generally prefer to have more uncomplicated technology after experiencing the aforementioned backlash, and crucial to mention that it does not depend on innovativeness level of an adopter. (Mohr et al. 2010)

A negative backlash can also be caused by whether expectations on ease of use meet the reality after the factual adoption. Expectations on how easy it is to adopt and utilise an innovation can be set inadequately by a company or a salesperson, for example via marketing campaign or an in-store demo testing. After that, an individual might suppose that it is easy for them to use technology, when in reality after purchasing they are overwhelmed by complexity, which might further cause overall dissatisfaction and disincentive in future use. (Mohr et al. 2010)

#### **3.1.4 Trialability**

The degree to which an individual is able to try a product or service out in the pre-purchase stage is determined by trialability property of adoption and innovation diffusion. The ability to sample an innovation on a limited basis before the actual purchase allows individuals to decrease uncertainty by assessing an innovation’s complexity and compatibility without commitment and proper resource investment. (Mohr et al. 2010) Trialability also allows potential adopters to give meaning to an innovation, understand how it functions and customise it to an individual’s conditions. Importance of trialability opportunity varies across categories of adopters. Namely, innovators and early adopters consider trialability as a vital factor to adopt. Later adopters and laggards in their turn adopt based on an experience of earlier adopters and use it as their way of indirect trial. Innovations tend to be adopted more swiftly when perceived risks are reduced via trialability. Thus, there is a positive correlation between trialability and an innovation’s rate of adoption. (Rogers 2003)

#### **3.1.5 Observability**

Observability is the extent to which an innovation’s benefits are visible and describable to potential adopters. (Mohr et al. 2010) In these regards, observability can be considered from

two perspectives, demonstrability and visibility. Demonstrability implies tangible benefits and outcome of an innovation use, and visibility is the extent to which potential adopters are able to apply innovation within their personal settings. (Ram 1987; Moore and Benbasat 1991) When talking about high-tech innovations, observability of benefits for a software component of an innovation usually less vivid than in case of a hardware aspect. The more obvious benefits of innovation are, the more likely it will be adopted by individuals. It shows a positive correlation between observability and an innovation's rate of adoption. (Mohr et al. 2010; Rogers 2003)

### **3.1.6 Ability to communicate product benefits**

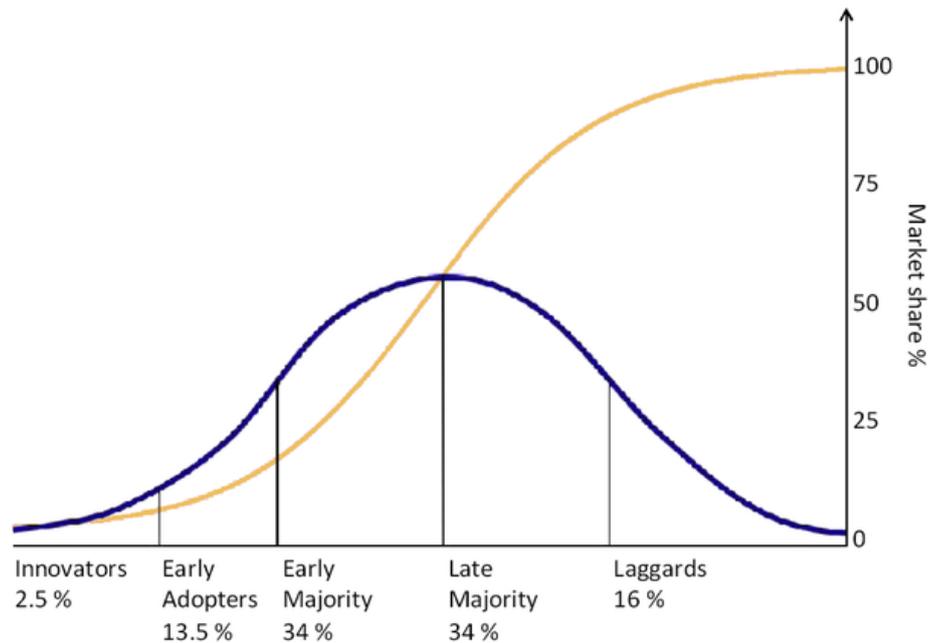
The factor of ability to communicate product benefits is in particular attributable to high-tech innovations. This property represents the extent of how easy it is to expose potential adopter to a technology's benefits so to influence an individual to make a purchase and adopt a technology (Mohr et al. 2010). Kotler (2006, 661) consider communicability of a product's or service's benefits as a part of observability aspect.

The issue of communicability is notably relatable to high-tech product and services, due to the fact that most of the innovations' benefits are attributed to its technical features and specifications, which are challenging to impart to potential adopters. Hence, marketers are obliged to be able to communicate specific technical terms into actual benefits that individuals potentially receive by adopting one or another innovation. (Mohr et al. 2010)

### **3.1.7 Innovativeness and categories of adopters**

Majority of innovation adoption research also focuses on individuals' distinction aspects and in particular on various levels of innovativeness. Innovativeness is the "the degree to which an individual (or other unit of adoption) is relatively earlier in adopting new ideas than other members of a system" (Rogers 2003, 267). Agarwal and Prasad (1998) also interpreted personal innovativeness as individuals' traits and willingness to try a new technology out. Since innovation diffusion takes place within an over-time sequence rather than simultaneously, Rogers (1962) classified adopters with the same degree of innovativeness into categories on the adoption over-time continuum. Each category is determined by a particular psychographic and social profile together with a characteristic response to nascent innovations (Moore 1991, 11). Characteristics of a particular potential category of adopters directly affect relative advantage that is crucial for a category (Rogers 2003, 229). Rogers

distinguished five categories of adopters: innovators, early adopter, early majority, late majority and laggards. Cumulatively all the groups comprise 100% market share on the continuum (Figure 5).



*Figure 5. Technology Adoption Lifecycle Curve (Rogers 2003)*

The first category on the continuum is the “innovators” or so-called technology enthusiasts (Mohr et al. 2010), who represent 2.5% of the total market share. This group of people is addicted to and tend to aggressively chase new arising innovations. The core characteristics of the category are venturesomeness, complex technical knowledge, and risky. Innovators possess substantial financial resources in order to satisfy a fundamental desire of exploring new technology and its features. (Rogers 2003) Consistently pursuing a new technology even before its formal marketing launch, innovators are continuously facing a high degree of uncertainty of possible innovation setback. They are inclined to cope with any possible glitches and problems of new technology, and even in some cases assist makeshift solutions to technical people in a company. Even though the category comprises a bare minimum of the total market share, it is crucial to capture innovators as a reference group in order to further ensure the following categories in innovation’s overall functionality. (Moore 1991; Mohr et al. 2010) Innovators serve a role of gatekeepers for the market (Rogers 2003).

The second category is the “early adopters” or so-called visionaries (Mohr et al. 2010), and they constitute 13.5% on the innovation diffusion continuum (Rogers 2003). Early adopters

substantially attracted by gaining competitive advantages from adopting a new high-reward technology, and ready to face inherent risks. This category of adopters is not price sensitive and tolerate a higher price in order to exploit psychological and substantive benefits from adoption. On the other hand, together with accepting a higher price, this group of people require personalised solutions and a quick-response from highly qualified sales and support. (Moore 1991, Mohr et al. 2010) Since early adopters are not as “technologists” as innovators are and mainly not excessively surpass an average individual’s innovativeness level, it allows them to possess a high degree of opinion leadership among their peers. It means that other individuals tend to consult with early adopters and ask for their advice before adopting new technology, thus decreasing an overall uncertainty about innovation and triggering the mass market. (Rogers 2003, Mohr et al. 2010)

The third category is the “early majority” or so-called pragmatists (Mohr et al. 2010), is the vital link in the overall diffusion process and represent the initial part of the mainstream market with the substantial market share of 34% (Rogers 2003). This group of people mainly adopt new technology in order to enhance their productivity and practicality (Moore 1991). Early majority actively communicate with other adopters, in order to gather well-established references with enough information to decrease uncertainty to ensure vindicated reliable applications, services and results before the actual adoption. Even though the group plays a dynamic role in the system, primarily, the early majority do not represent opinion leaders. (Rogers 2003)

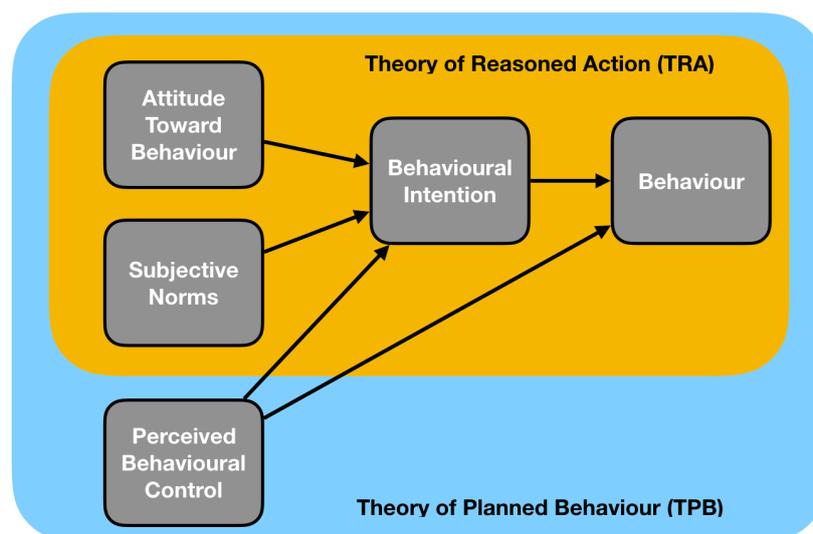
The fourth category is the “late majority” or so-called conservatives (Mohr et al. 2010), indicates the second half of the mainstream market with the identical market share of 34% (Rogers 2003). The primary motivation for this group of people to adopt is to be able to operate on a competitive level, or in many cases pressure from peers. The late majority is price sensitive group with scarce resources, that is why they commonly adopt preassembled, fail-safe solutions or even established standards (Moore 1991, Mohr et al. 2010). All concerns inherent to the group are similar to the ones that early majority has, but demonstrates an even higher demand for evidence of as low as possible uncertainty in order to safely averse any risks of adoption.

Last but not least, are the “laggards” or so-called skeptics (Mohr et al. 2010), who are located at the end of the innovation diffusion process continuum, and represent 16% of the total market share (Rogers 2003). This category of adopters avoid any purchases of new

technologies for personal and economic reasons and believe that innovations will not improve their productivity in any way. Laggards are loyal and satisfied with older technologies that they utilise and are afraid of time-consuming upgrades and cautious of suspicious innovations. This group of people mainly reference on the past and traditional values. The only motivation for laggards to adopt an innovation is to maintain their status quo, and in the case, when they are confident that older technology is objectively worse than existing alternatives, and these alternatives are solidly economically justified. (Moore 1991, Rogers 2003, Mohr et al. 2010)

### 3.2 Theory of Reasoned Action and Theory of Planned Behaviour

Theory of Reasoned Action (TRA) was proposed by Ajzen and Fishbein in 1967 based on studies in social psychology and became fundamental in determining and explaining overall human behaviour across various contexts (Davis et al. 1989). The theory is based on individuals' decision making rationality and methodical usage behaviour towards accessible information and assumes that people assess connotation of their actions before conducting one. (Ajzen and Fishbein 1980) Thereby, the purpose of the model is to understand what variables influence individuals' intentions towards an actual observable action. The behavioural intention in this regard functions as “ a measure of strength of one's intention to perform a specified behaviour” (Ajzen and Fishbein 1980, 6).



*Figure 6. Theory of Reasoned Action and Theory of Planned Behaviour (Ajzen and Fishbein 1975; Ajzen 1991)*

TRA defines attitude and subjective norms to be essential determinants of intentions, which in its turn define an action. Attitude toward behaviour is defined as the extent to which a person experiences positive or negative feelings toward executing a particular behaviour (Ajzen and Fishbein 1975, 216). Individual's attitudes are framed by personal beliefs in relation to the outcome of certain behaviour and actions, and whether it fits existing behavioural beliefs or not (Davis et al. 1989; Ajzen and Fishbein 1980).

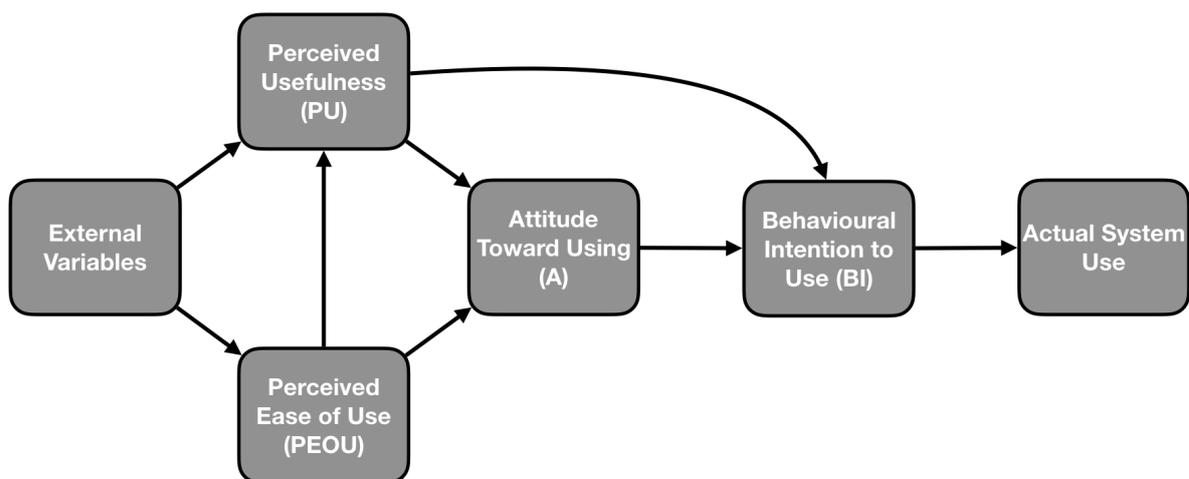
Subjective norms are the degree to which an individual perceives opinions of other people, whom they consider important, as a determinant towards performing a particular behaviour (Ajzen and Fishbein 1975, 302). This determinant is based on normative beliefs of compliance with social pressure. It means that an individual is more likely to carry out a specific act if prominent to them social environment wants them to do so (Lam et al. 2007).

In 1991, Ajzen proposed an extension of the existing TRA model in the form of the new theory of planned behaviour (TPB). The new model was amplified with an additional intention determinant - perceived behavioural control. The new construct implies the extent to which a user perceives a certain behaviour easy or difficult to perform with existing resources and opportunities (Ajzen 1991). Perceived behavioural control was introduced for a more in-depth understanding of individual behaviour in a particular context of not having absolute control over use. The limitation toward having the complete control over usage behaviour is represented in the form of self-efficacy and resource and technology facilitating conditions (e.g. expertise, time, money, assistance) (Venkatesh et al. 2003). Perceived behavioural control has a direct influence both on behavioural intention and behaviour itself. Figure 6 demonstrates relationships between all of the aforementioned constructs within TRA and TPB models.

Both TRA and TPB are widely used to analyse and predict intention and behaviour in numerous settings, especially in technology acceptance and usage research (Dillon and Morris 1996). Nevertheless, Ajzen and Fishbein (1980) highlight the importance of considering context specific external variables for a better understanding of behavioural intentions and usage.

### 3.3 Technology Acceptance Model

The technology acceptance model (TAM) was created by Fred Davis in 1986 as the adaptation of the aforementioned theory of reasoned action (Ajzen and Fishbein 1975) in order to particularly examine intentions towards a technology acceptance. The model is considered as fundamental and most widely used in technology acceptance and adoption research due to its high validity and applicability (Davis et al. 1989; Karahanna et al. 2006; Silva 2015). TAM examines and allows to understand how certain human factors, such as beliefs, intention to use and actual use of technology combined with external aspects, impact on individual's decision making towards or against acceptance and subsequent adoption and use of technology. Thereby, the model is particularly applicable for identification and prediction of reasons behind dismiss of adoption and therefore helps to draw corrective managerial implications based on the results. (Davis et al. 1989) Visual representation of the technology acceptance model and its construct relationships can be observed in Figure 7.



*Figure 7. Technology Acceptance Model (Davis et al. 1989)*

TAM is focused on understanding how external variables impact acceptance and actual use of technology, via examining internal factors of perceived usefulness and perceived ease of use. Davis (1989) described perceived usefulness as the extent of individual's beliefs regarding technology being able to improve their performance. Enhanced performance in its turn is associated by individuals with obtaining certain gains or rewards, which creates positive credibility and cause overall acceptance. Davis (1989) identified that perceived usefulness has the most pronounced influence on overall user's acceptance behaviour. The more an

individual perceives a technology is giving them a base for performance enhancement, the more probably they will adopt it. Perceived ease of use is defined as the extent to which an individual considers the use of technology with minimum stress and effort involved. This variable is widely utilised in a number of acceptance research papers. Venkatesh et al. (2003) highlight that in the case of initial lack of technical expertise and specific related knowledge, individuals rely on general information about the technology whether to adopt it or not.

Perceived usefulness variable implies that acceptance is accelerated if a potential user finds a technology improving their performance and decision-making process. Perceived ease of use in its turn influence perceived usefulness, in regards that even though users can see vivid benefits of technology, it might be challenging and demanding to actually use it. Thus, it means that if an effort to use a technology exceeds potential gain from technology, the probability of acceptance decreases, and vice versa.

Both of the aforementioned variables are dependent on another construct - external variables. Davis (1989) attributes external variables to factors of technology itself, such as design, functional features, technology structure, instructions and manuals, sustained with overall user support.

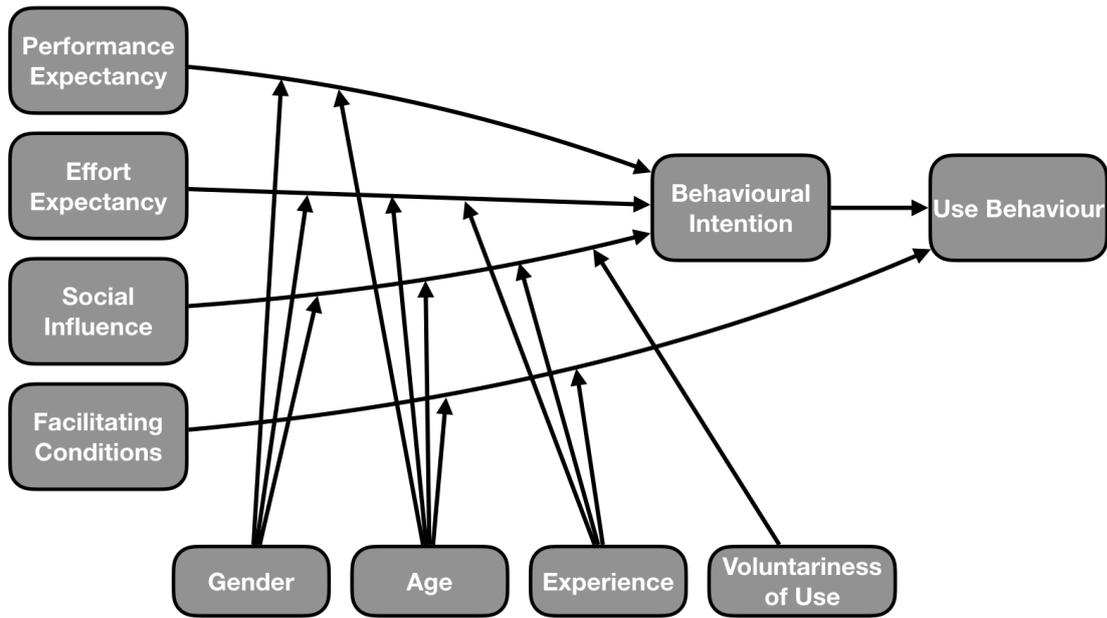
Davis (1989) also defined that the actual use of technology is influenced by an individual's behavioural intentions towards this use, which examines the extent of user intent to execute a particular behaviour in the future. Behavioural intention to use a technology is influenced by perceived usefulness and attitude towards using, in regards that positive feelings about a technology accelerate people's intentions to adopt. The attitude, intention and usage relationship was discussed in more details in TRA and TPB models. The attitude in TAM is in its turn determined both by perceived usefulness and perceived ease of use.

A significant amount of studies are based on the technology acceptance model when examining technology adoption, due to its simplicity and clarity. Nevertheless, the model is criticised to be flawed, since TAM constructs' relationships vary across various users and technology contexts. (King and He 2006) Thereby, the majority of TAM studies are complemented with one or more additional variables in order to correspond to certain settings.

### **3.4 Unified Theory of Acceptance and Use of Technology**

With new technologies recently emerging on a regular basis, the need for a more extended model that would capture a broader technology domain has arisen, in order to be able to understand users' attitude towards technology and intentions for acceptance, adoption or rejection more profoundly. Thereby, in 2003 Venkatesh, Morris, F. Davis and G.Davis proposed a new comprehensive model of technology acceptance, the unified theory of acceptance and use of technology (UTAUT), that is based on conceptual and empirical similarities of eight primary technology acceptance theoretical models. These include four previously examined models of the innovation diffusion theory (IDT), the theory of reasoned action (TRA), the theory of planned behaviour (TPB) the technology acceptance model (TAM), and others like the motivational model (MM), the model of PC utilisation (MPCU), the social cognitive theory (SCT), and the model combining TAM and TPB (C-TAM-TPB).

The model, as most of the acceptance theories, gives the basis to estimate the probability of acceptance and adoption of new technology and carry corrective actions out toward its improvement. UTAUT is broadly used both in research and organisational analysis, due to the fact that it is applicable to examine both simple and sophisticated technologies, and intentions of potential and actual adopters with various levels of technology experience within discrete stages of technology life cycle. Bagozzi (2007) emphasised that UTAUT is one of the most powerful models due to its provident structure and significant explanatory power of covering up to 70 percent of the variance in intention.



*Figure 8. Unified Theory of Acceptance and Use of Technology (Venkatesh et al. 2003)*

After an aggregate cross-sectional analysis of the aforementioned models and its various user acceptance determinants, Venkatesh et al. formulated and validated the theory based on three core elements that directly define intention to use technology, which are performance expectancy (PE), effort expectancy (EE), and social influence (SI), and two dependent variables of behavioural intention and and facilitating conditions (FC) that determine actual usage behaviour. UTAUT demonstrates that behavioural acceptance intentions are determined by performance and effort expectancy, and social influence, and subsequently define usage behaviour. Facilitating conditions in its turn have a direct influence on technology usage behaviour. Four moderating factors such as gender, age, experience and voluntariness of use were integrated into the model to identify how it influences the relationship between the determinants. The impact will be further discussed in more details in the determinants analysis. Figure 8 illustrates the visual representation of the model and its relationship across variables.

Behavioural intention and attitude variables are previously examined in the paper in more details within the theory of reasoned action (TRA) and the theory of planned behaviour (TPB), and the technology acceptance model (TAM). Within the UTAUT study, attitude toward using technology was identified not to have a direct influence on acceptance intentions.

### **3.4.1 Performance expectancy**

Performance expectancy (PE) determinant examines the extent to which user believes that technology can improve their performance and bring subsequent gains out of it. This construct was proven to be the most potent predictor of individuals' intentions. Performance expectancy takes the basis from previous studies, which mainly cover the degree to which an individual perceives a particular system to enhance their performance, a technology being better than existing alternatives, and individual expectations towards a technology. This matter is covered in the innovation diffusion theory (IDT) under relative advantage variable, the technology acceptance model (TAM) with perceived usefulness variable, the motivational model (MM) with extrinsic motivation, the model of PC utilisation (MPCU) with job-fit, and the social cognitive theory (SCT) with outcome expectations. All the aforementioned primary constructs have overlapping similarities, and that is why were merged under unified determinant of performance expectancy in the UTAUT model. (Venkatesh et al. 2003)

The relationship between performance expectancy and behavioural intention is moderated by gender and age variables. Performance expectancy was asserted to have more vivid importance for younger men than for women. (Venkatesh et al. 2003) Levy (1988) highlighted the importance of analysing gender and age moderators in regards to each other, otherwise, study results can be misleading.

### **3.4.2 Effort expectancy**

Effort expectancy (EE) element implies the extent to which a user perceives a technology being easy and clear to understand and use with the minor effort involved. This determinant originates from primary constructs of perceived ease of use within the technology acceptance model (TAM), and complexity within the innovation diffusion theory (IDT) and the model of PC utilisation (MPCU). Effort expectancy has an especially explicit impact on behavioural intention when an individual is at their early stage of technology familiarity, and this impact gradually decreases in importance after the initial learning process and subsequent technology usage. (Venkatesh et al. 2003)

Gender and age moderating factors have a stronger effect on effort expectancy for women and older people (Moris and Venkatesh 2000). It is estimated that the older a person is, the more complex for them to understand and process a sophisticated technology, especially software-based systems. As it was mentioned previously, experience as a moderating factor is

more salient determinant in case of low technological experience and overall familiarity. Thus, the most pronounced effort expectancy and behavioural intention relationship impact can be observed in the case of older women with limited experience. (Venkatesh et al. 2003)

### **3.4.3 Social influence**

Social influence (SI) indicates the degree to which an adopter's behavioural intention to adopt is influenced by friends, family and other members of society, and their potential perception of social status gains from using technology. The determinant takes its roots from the concept of the subjective norms from the theory of reasoned action (TRA) and the theory of planned behaviour (TPB), the social factor from the model of PC utilisation (MPCU), and image from the innovation diffusion theory (IDT). It was validated that social influence has no particular effect on behavioural intention in voluntary settings, but rather has an impact on perception about a technology. While in mandatory context the construct has a direct influence on intentions due to related compliance. (Venkatesh et al. 2003)

All four moderating factors have an effect on the relationship between social influence and behavioural intention. Social influence has particular significance at the early stages of adoption with limited experience, especially within mandatory usage scope. In respect to gender, the determinant has a more vivid influence on women's intentions, since they tend to be more compliant with the public opinion. The impact of social influence is also more exponential for older adopters. Thus, the highest social influence impact can be observed for older women with low technology experience in mandatory context. In all the cases, the significance of the construct is decreasing with an accumulation of technology experience. (Venkatesh et al. 2003)

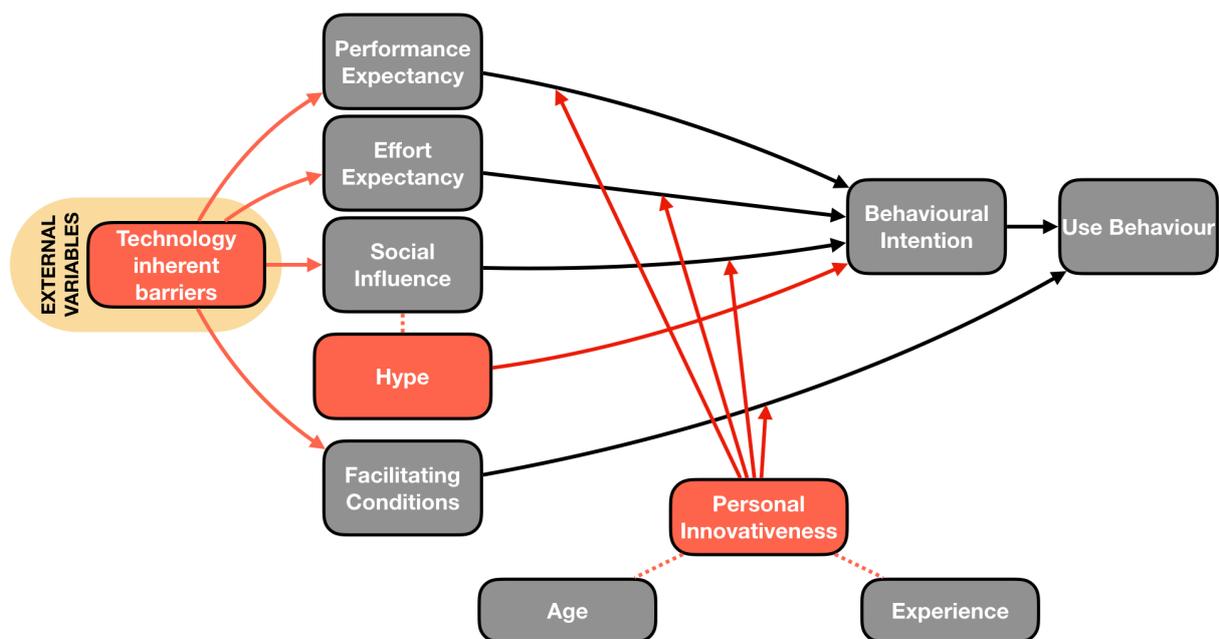
### **3.4.4 Facilitating conditions**

Facilitating conditions (FC) means the extent to which a user believes having an appropriate technical and organisational support to utilise technology. The concept is based on perceived behavioural control construct from the theory of planned behaviour (TPB), facilitating conditions from the model of PC utilisation (MPCU), and compatibility from the innovation diffusion theory (IDT). While prior determinants of perceived behavioural control and facilitating conditions are focusing on an individual's perception of having a proper technological and organisational environment for adoption facilitation, compatibility in its turn, as it was mentioned in Chapter 3.1.2, concentrates on an adopters perception of a

technology being in line with existing values, needs and experience. Nevertheless, it was validated that all of the three constructs have the same impact on usage behaviour, thus, were merged under the unified determinant of facilitating conditions. Venkatesh et al. (2003) also highlight the direct influence of facilitating conditions on behavioural intentions in case effort expectancy is not considered in a study.

Age as a moderating factor has the most noticeable impact for older adopters, who have a more pronounced need in assistance for technology use. The significance of facilitating conditions for usage behaviour also correspondingly increases with experience. It means that over the time individuals have a stronger need in facilitating support in order to sustain existing usage behaviour. (Venkatesh et al. 2003)

### 3.5 Comprehensive theoretical research framework



**Figure 9. Comprehensive Theoretical Research Framework**

Based on the literature and theoretical research analysis, the comprehensive theoretical research framework was formed (Figure 9). The subsequent empirical research will be conducted based on the UTAUT model with performance expectancy, effort expectancy, social influence and facilitating conditions as intention determinants. Fragmented focus on IDT, TPB and TAM studies in the basis will help to understand various aspects of individuals’ intentions and attitude towards AR/VR in retail. The aforementioned theories

will also allow to cover and examine intentions of potential adopters in active or passive acceptance decision-making process, those who are entirely new to the AR/VR technology and who have already accepted and adopted the technology.

Even though UTAUT examines a wide range of critical intentions' determinants, there is still a need for context-specific additional constructs for more in-depth understanding. In case of emerging technologies, AR/VR in particular, personal innovativeness, hype, and inherent technology obstacles (external variables determinant from TAM) were decided to be implemented as additional constructs within the comprehensive theoretical research framework.

Personal innovativeness as an additional domain of individual trait will frame relationships between existing intention determinants as a moderating factor, in order to increase the explanatory power of the framework within the new perspective. Due to the fact that AR and VR is the relatively new technological phenomenon, at the moment, the technology is in its early adoption phase, where innovators and early adopters are taking over the technology. Thereby, existing AR/VR experience will determine personal innovativeness. Age is considered in the framework as an attribute that frames personal innovativeness according to initial studies of adopters categories.

Hype as an inherent attribute of emerging technologies will be explored as an additional attribute within social influence determinant, in order to analyse the impact of extensive public attention towards the technology on individual adoption intentions. Last but not least, external variables construct from technology acceptance model will be added as the determinant of perception of performance expectancy, effort expectancy, social influence and facilitating conditions, in order to examine specific technology adoption barriers in the case of AR/VR in retail. All the additional constructs and projected relationships are presented and highlighted with the red colour in Figure 9.

Voluntariness as a moderating factor is not applicable in the particular case of individual adoption of AR/VR in retail. Thus, it is not considered in the framework, since no distinctive analysis with mandatory settings will be conducted. To summarise, the research intends to contribute to existing AR/VR acceptance and adoption research, since AR/VR technology individual acceptance had not been yet examined within UTAUT context on a comparative basis.

## **4 RESEARCH METHODOLOGY**

The section demonstrates methodological choice on how the empirical research is conducted, what techniques and procedures are utilised in order to obtain and analyse the collected data, with the theoretical basis implied throughout the whole process. Methodological aspects of the study were formed in order to properly address research objectives and theory development with coherent research design.

### **4.1 Research design**

The research design is crucial in framing research execution process, and corresponding research methods for data collection and subsequent analysis. The design has to be established in order to turn set research questions into an empirical project (Robson 2002). Figure 1 represents the research design of the study and the initial methodology being used.

First, the research approach is identified to frame successive research design and its configuration of strategies and techniques. The inductive research approach is used in order to correspond to the purpose of the study to develop a theoretical proposition based on empirical data analysis. It will help to understand and interpret the nature of AR/VR adoption in retail with social science as a fundamental principle of human behaviour in individual intentions context. (Easterby-Smith et al. 2008; Saunders et al. 2009)

Embedded mixed methods research design with a focus on concurrent triangulation is utilised, where both quantitative and qualitative data collection techniques are applied for the simultaneous support of each of the methodologies. Triangulation within data collection methods creates the basis to build more comprehensive and synergistic data analysis process to explore adoption intentions with greater diversity and a broader perspective on the following theoretical proposition. (Bryman and Bell 2015; Saunders et al. 2016) Analysis of the collected data in its turn is designated towards the qualitative method, with quantitative analysis taking a supporting role in the study (Creswell and Plano Clark 2011). The inductive study also implies the idea that qualitative data analysis is utilised in order to examine and constitute various perspectives of innovation diffusion phenomenon (Easterby-Smith et al. 2008).

The prioritisation of qualitative research is also reflected in the descripto-explanatory purpose of the study. Descriptive component of the research is targeted on the primary research

question and subquestions that start with “What”, which imply the objective to draw a rigorous profile of AR/VR adoption in retail across individuals with various innovativeness levels (Robson 2002). Explanatory nature of the study in its turn is represented via research questions formulation that starts with “How”, and focuses on determining the relationship between particular variables of individual technology adoption (Saunders et al. 2016). Thereby, a description of the current AR/VR adoption rate in retail and individuals intention to adopt will lead to an explanation of the phenomenon in the discussion section of the study.

Several strategies are employed throughout the research to facilitate the aforementioned diverse purposes of the study and to answer all set research questions. Selected research strategies create the methodological link for the following data collection and analysis (Denzin and Lincoln 2011). Case study strategy is fundamental throughout the study as a tool for empirical investigation of AR/VR adoption in retail as a holistic phenomenon, where real-life context is examined by utilising several data sources (Robson 2002; Yin 2014). This strategy allows embracing both descriptive and explanatory purposes and determined research objectives due to its widespread applicability (Yin 2014; Saunders et al. 2016). The case in the particular study is determined by retail industry, AR/VR as an emerging technology, and the innovation diffusion process. The in-depth case study will help to understand the synergy of technology adoption phenomenon in the retail context while giving extensive insights on individual adoption intentions and the reasons behind (Dubois and Gadde 2002). Mixed methods approach with the combination of qualitative and quantitative data collection is serving as the base for a proper in-depth case study (Saunders et al. 2016). The inductive case study is postulated by researchers to be one of the most effective methods to identify new patterns and build theoretical propositions both to generate new theories or extend existing ones (Ridder et al. 2014).

Survey strategy is used for primary data collection and is intended to cover the descriptive purpose of the study. Questionnaire method is the most common technique of the survey strategy, which allows collecting relevant and comparable qualitative and quantitative data across both limited and substantial samples. The strategy is fundamental in creating the basis for grounded theory formation and identifying a relationship between variables. Since the data collected under survey strategy is usually limited by a determined set of questions and research settings, personal observation or so-called ethnography is serving as the basis for an

in-depth understanding of the technology adoption across various adopters categories. (Saunders et al. 2016)

In order to identify the AR/VR adoption rate, archival and documentary research method is embedded within the case study strategy. Secondary qualitative and quantitative data is collected and utilised for analysis in order to fulfil the descripto-explanatory purpose of the study. Substantially, the method is used in order to answer one of the subquestions that focuses on identifying the current market situation and trends, based on which subsequent assumptions on adoption rate are drawn. Archival research makes it possible to study changes in the industry over the past years and project future adoption. (Saunders et al. 2009)

Last but not least, grounded theory strategy is employed in the study as a result of the research process in order to build a theoretical proposition based on primary and secondary data analysis. The strategy is utilised in order to explicate individuals adoption behaviour based on personal innovativeness, which in its turn will create a basis for exclusive theoretical insights on a conceptual level simultaneously taking existing theory into account. The core categories around which the grounded theory is developed are adopters categories and adoption intention determinants. (Saunders et al. 2009) The strategy is based on a basic research nature, where the focus is concentrated on complementing UTAUT model with new theoretical concepts (Easterby-Smith et al. 2008)

Research is conducted in cross-sectional time horizon or so-called social survey design. The design is applicable to analyse a phenomenon at a single point of time, in particular at early stages of AR/VR adoption curve. The cross-sectional design will also help to study technology adoption within multiple groups of people based on their innovativeness level, thus giving more in-depth insight on adoption intentions variation. (Bryman and Bell 2015; Saunders et al. 2016) Use of the aforementioned time horizon design is reflected in the applied nature of the research, where findings regarding AR/VR technology adoption have immediate time relevance for managerial implications to be undertaken. It allows to enhance understanding of the specific industry and its issues with practical implications being drawn at the end of the study, thus, insights acquired are essentially limited to the retail industry. (Hendrick et al. 1993)

## **4.2 Data collection**

The section reflects on how intelligence gathering process was conducted and what data collection methods were used based on the research questions and study objectives. The structured methodology of data collection using mixed method technique by combining quantitative and qualitative data collection methods are employed to be able to answer the main research question and its subquestions. Several data collection methods such as questionnaire, personal observations and secondary sources examination, ensure reliability and validity of the research findings. (Gill and Johnson 2002; Saunders et al. 2016)

### **4.2.1 Primary data**

Primary data collection was initially established during the organisation of research design, where survey strategy with the focus on a structured questionnaire with a predetermined order of questions was defined as an integral part of intelligence gathering. The method is intended to contribute both to the case study and grounded theory development. The cross-sectional design of the primary research implies the fact that data being gathered simultaneously in the form of a structured questionnaire. This method of data collection is in particular suitable to cover the descriptive and explanatory purposes of the research. (Saunders et al. 2016) The structured interview gives the opportunity to examine individual intentions in the coordinated setting, where respondents across the whole sample identically interpret questions posed (Robson 2011). Thereby, descriptive characteristic of the questionnaire method allows to define and analyse the variability of intentions across adopter categories within cause-and-effect relationships, while explanatory or analytical attribute enables comprehensive explication of the phenomenon (Saunders et al. 2016).

In order to meet set research descriptive and explanatory purposes, primary data collection is designed as an online social survey with a combination of a self-completed and interviewer-completed questionnaires (Bryman and Bell 2015; Saunders et al. 2016). Web questionnaire was delivered to potential respondents via social media channel (Facebook), accessed via hyperlink and completed on an anonymous basis. Reach of the sample via personal social media accounts provided the higher degree of assurance that the right group of people is reached and thereby increase the overall reliability of the study (Saunders et al. 2016). Google Forms online survey tool was utilised for primary data collection, storage and categorisation.

The divergence of collection methods utilised is based on characteristics variance between adopter categories and chosen sampling methods that are discussed later. The interviewer-administered face-to-face questionnaire using Skype was employed for extreme case sampling of innovators, early adopters and laggards, where respondents were interviewed, and data were collected on an individual basis. This method was used in order to ensure data is collected from the right person and ensure the reliability of the collected data. The interviewer-completed questionnaire also decreased uniformed response tendency from laggards that could be caused by lack of knowledge on the researched field, since respondents of the particular subgroup could be conceptually routed by the researcher in case of any perplexity caused by the technology concept itself. Computer-aided personal interviewing (CAPI) was utilised for early adopters and laggards, where questions were read from a computer and responses entered into the online survey form by the researcher. Innovators in their turn were completing the questionnaire themselves as a part of pilot testing (discussed in Chapter 4.4 in more details). Self-completed web questionnaire was utilised in order to capture mass market adopters (early majority and late majority) and simultaneously extend data sample, by sending a link to the electronic questionnaire to potential respondents and subsequently execute it without the researcher being present and involved during the initial process of survey filling. (Saunders et al. 2016)

Types of questions used are determined by data that need to be collected for particular research questions (Saunders et al. 2016, 452). Initially, questions were adopted from existing innovation diffusion and individual technology adoption studies and adapted to AR/VR in the retail context to answer the main research question. Novel questions were developed to collect data in order to answer set subquestions.

Factual data variable of age and experience that further framed moderating variable of personal innovativeness is collected via open-ended questions to determine perceived behavioural control over AR/VR devices and existing individual experience settings, and category questions for age, conceptual technology comprehension, and the technology usage frequency recognition. Previous experience is also examined via filter questions, which allowed respondents with no AR/VR experience to skip the subsequent related to the topic questions. (Saunders et al. 2016)

Attitude and opinion data variable, which is outlined by AR/VR in the retail context, is collected via Likert-style rating questions, where predetermined series of statements based on

the theoretical literature were exposed to respondents with a straight line of seven-point rating scale in order to identify the extent of agreement or disagreement towards these statements. This variable is intended to collect data on respondents' feelings and thoughts regarding the particular phenomenon. The numbering of the scale is defined as following: 1 = strongly disagree, 2 = moderately disagree, 3 = somewhat disagree, 4 = neutral (neither disagree nor agree), 5 = somewhat agree, 6 = moderately agree, 7 = strongly agree. The scale was balanced with an explicit neutral point (number 4) to allow respondents to decrease admission to the apparent agreement or disagreement. (Saunders et al. 2016)

Behaviour and event data variables that are also outlined by the particular context, and which define what people actually did in the past, are doing now or would do in the future, is obtained via aforementioned seven-point Likert-style rating questions, open question that examine predominant individual expectations to complement and give a broader insight on performance expectancy variable, and list question with predetermined list of possible adoption barriers, which experts consider relevant for the current state of adoption, to identify which are indeed relevant for individuals. "Other" option was added to the list to gather additional insights that were not previously recognised. (Dillman et al. 2014; Saunders et al. 2016)

Questions were constructed, logically ordered and grouped based on theoretical independent variables and moderating factor, which allowed to pre-code the questions that both collect quantitative and qualitative data. Each set of questions was accompanied with an open comment section, where respondents were able to write their additional comments and thoughts on the particular variable examined. Questions were exposed to respondents in the particular order on separate web pages, where respondents were not able to skip to the next section without answering questions presented on the page first. This allowed to decrease bias in the data collection process and create consistent intelligence gathering. (Saunders et al. 2016)

To meet research ethics, at the beginning of self-completed questionnaires covering letter where the topic of the research and instruction were presented to create informed consent by debriefing participant about the purpose of the research, their voluntary response, what their role and how collected data will be utilised. In the interviewer-completed questionnaire, the covering letter was paraphrased and verbally presented by the researcher in the form of short

introduction. Questionnaires were closed using follow-up of acknowledging gratitude for research contribution in order to comply with research ethics. (Saunders et al. 2016)

Together with primary data being collected via the structured questionnaire, behaviour and attribute variables were complimented with participant observation or so-called ethnography. Several research methodologies consider ethnography as a substantial and complex research strategy (Bryman and Bell 2015; Saunders et al. 2016), but in the study, the method mainly focuses on the initial observation and used as a complementary data collection technique rather than a separate strategy. The primary descriptive observation was conducted, where during “face-to-face” Skype interviews data on behaviour and attribute variables was collected in order to reflect on individuals’ emotions, characteristics and activities that will give broader insight on personal innovativeness. The secondary observation allowed to interpret the primary observation against theoretical determinants. (Robson 2002; Saunders et al. 2009).

#### **4.2.2 Sampling**

Based on the prioritisation of qualitative analysis within the study and requirement of a limited sample coverage to examine the case study and draw grounded theory with following theoretical propositions, non-probability or so-called non-random sampling with a focus on purposive sampling is utilised. Purposive homogeneous sampling technique is applied to gather data from selected subgroups based on personal innovativeness categorisation, where respondents of a particular subgroup possess similar characteristics. (Saunders et al. 2016) Purposive extreme case sampling approach is employed for informative insights on extreme cases of innovation diffusion continuum covering subgroups of innovators, early adopters and laggards. Extensive findings on extreme cases will in its turn create the foundation for better understanding of more typical cases, mass market adopters in particular. (Patton 2002) Purposive snowball sampling is employed to gather data from the remaining subgroups of the intended sample, in particular, early and late majority who represent mass market. Initial contact with mass market respondents was done so they distribute the questionnaire to the identical, homogeneous representatives of the subgroup (Lee 2000).

According to Saunders et al. (2016, 297), a minimum sample size for data and theoretical saturation in case of grounded theory strategy accounts approximately from 20 to 35 respondents. The grounded theory study of legitimacy work among ethics and compliance

officers (Trevino et al. 2014) states that on average after 35th interview no new codes are identified. Thereby, the sample of 35 respondents was decided to be appropriate to define individual adoption intentions and create the basis for theoretical propositions. Data collection within a smaller sample also reflects on an integral characteristic of the inductive approach (Saunders et al. 2016). On the other hand, since non-probability sampling is utilised, no statistical generalisation can be made based on the study. The magnitude of the sample and its distinctive attributes are presented in Table 2. Methods used across the sample categories are also synthesised and defined in the table.

**Table 2. Sample description**

	Number of respondents	Age	Technology usage frequency	Comprehension of the technology	Data collection method	Sampling method
<b>Innovators</b>	4 (11,4%)	18 - 34	Daily basis (AR) - Once a month (VR)	In-depth understanding	Interviewer-administered questionnaire	Purposive extreme case sampling
<b>Early adopters</b>	6 (17,1%)	18 - 34	Once a month (AR) - Couple of times (VR)	Common understanding with confident distinction of the concepts	Computer-aided personal interviewing (CAPI) based on interviewer-administered questionnaire	Purposive extreme case sampling
<b>Early majority</b>	12 (34,3%)	18 - 34	Couple of time (AR) - Once (VR)	Superficial understanding of AR and common understanding of VR with low degree of misconception	Self-administered web questionnaire	Purposive snowball sampling
<b>Late majority</b>	6 (17,1%)	18 - 34	Once (AR) - Never (VR)	Poor understanding of AR and superficial understanding of VR with moderate misconception	Self-administered web questionnaire	Purposive snowball sampling
<b>Laggards</b>	7 (20%)	35 - 64	Never (AR/VR)	Poor understanding of both AR and VR with high degree of misconception	Computer-aided personal interviewing (CAPI) based on interviewer-administered questionnaire	Purposive extreme case sampling

Subgroups of the sample were categorised based on existing research on adopters categories and acquired data on personal innovativeness, which in its turn determined by individual existing expertise, technology usage frequency, and comprehension of the technology concept as a whole. Technology usage frequency was decided to have a diverse impact on the level of innovativeness, where extensive usage of AR is considered to have a less pronounced effect since the technology is more widespread due to smartphone and tablet devices adoption rate. Innovators' sample was precisely targeted by reaching out founders of virtual reality game zone in Helsinki and its customers, in order to gather extensive detailed data and base for an extensive managerial implication of the research.

### **4.2.3 Secondary data**

Secondary data collection is one of the most common methods used in a case study research strategy. Single study case with intensive analysis of AR/VR technology is considered as a part of findings triangulation method that supports primary data analysis. (Bryman and Bell 2015; Saunders et al. 2016)

Archival research is conducted with a focus based on a combination of document and survey compiled data. Web-based text and non-text document data including such categories as organisational sources, government sources and media (e.g. industry and market reports, online journals, articles and newspapers, regulatory news, strategy documents, statistics, organisations' websites, press releases, videos of companies' product presentations) were utilised to identify industry patterns and trends for subsequent reanalysis for the particular research purpose of identifying AR/VR current adoption rate and outline the future one using specific analysis methods discussed in the next section. Document secondary data in its nature imply primary data being also collected. Regular survey-based secondary data in its turn includes general-purpose AR/VR market researches mainly conducted by consultancy organisations. Combination of multiple data sources contributed to a broader understanding of the current market. (Saunders et al. 2016)

## **4.3 Data analysis**

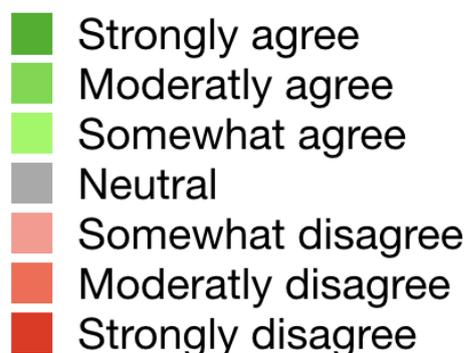
After qualitative and quantitative data is collected by applying previously examined methods, a combination of analytical techniques is employed in order to generate informed subjective description and explanation of the innovation diffusion and individual adoption phenomenon. The inductive research approach presumes that data is analysed mainly using an interrelated qualitative interpretation of the findings. (Saunders et al. 2016)

Questions theory-driven "a priori" coding was conducted and incorporated into questionnaire preceding to its entry into online survey system based on theoretical determinants and its grouping into distinct independent variables (Appendix 1). Quantitative data collected via rating questions are directly coded to numerical values via the online survey tool, while data collected via open questions are recorded verbatim and subsequently coded and analysed. Theory-driven codes were utilised for individual intentions pattern matching across adopters

categories while data-driven codes exploited for grounded theory development. (Saunders et al. 2016)

Qualitative data was pre grouped by questionnaire design based on theoretical independent variables, thus, coding of qualitative data collected from open-ended questions, comments and participant observations was mainly conducted in order to identify accurate links across variables. Axial coding is employed for collected qualitative data in order to identify relationships between variables, to explain the innovation adoption phenomenon and affirm theoretical development of the proposed framework. This coding method facilitated the basis for the explanatory study of relationships between observed determinants and factors affecting the technology adoption. After relationship patterns are recognised with related evidence (Appendix 3), the theoretical proposition is formulated for subsequent studies to be undertaken. (Strauss and Corbin 2008)

Numeric data collected via rating questions are analysed using scales in order to measure the extent of individual intentions for established theoretical independent variables. The scale or so-called resultant measure is defined by merging scale items of each of the rating questions into a composite score based on the aforementioned variables and its determinant factors (Schrauf and Navarro 2005; De Vaus 2014). Analysis of the composite score is conducted both on a comprehensive basis of individuals as a whole and on a single level of adopters categories. The score is visually represented via percentage component bar charts to show proportion distribution across determinants based on the colour coordinated scale presented below (Figure 10).



*Figure 10. Colour coordinated scale*

Cumulative mean value distribution together with qualitative findings is presented in a table at the end of the findings section to summarise data for independent variables moderated by personal innovativeness. The comparative analysis of AR and VR as a separate phenomenon regarding its adoption rate and individual adoption intentions is carried out throughout the study along with the initial analysis of the data collected.

Narrative analysis of the archival case study based on organisational and media documents was conducted to examine industry trends and identify the current adoption rate. The future adoption rate is analysed and prognosed with the help of predictive analytics. The estimations of cumulative adoption rate both for the technology itself and in particular instance of AR/VR adoption in retail, are done based on AR/VR industry reports from eMarketer (2018) and Goldman Sachs (2016), Gartner hype cycle (Figure 3), and Roger's S-shaped technology adoption lifecycle. The calculation is initially done using quantitative forecasting based on the time series method, where past adoption rate serves the foundation for future estimations. Base case adoption rate is done by using the statistical moving average technique in order to smooth average fluctuations in potential adoption rate. The accelerated adoption rate is estimated by using exponential smoothing technique, where the most recent industry events are taken into account as adoption facilitators. (Saunders et al. 2009; Bakshi 2017) Both of the aforementioned techniques in its turn are based on S-shaped innovation diffusion curve that is broadly accepted and utilised both in research and business up to these days (Meade and Islam 2006). Comprehensive analysis of the current and future adoption rate and findings reflection are illustrated using a multiple line chart.

#### **4.4 Reliability and validity**

Quality and credibility of the research findings are determined by its reliability and validity. Reliability defines replicability and consistency of the data being collected, and in its turn frame validity (Easterby-Smith 2008, 109). Validity outlines how accurate measures that are utilised for data collection, generalisability of the findings and veracity of the following analysis. (Saunders et al. 2016, 202)

Design of the primary data collection process via the prudent design of questions, visual presentation, display of research purpose, pilot testing and overall survey execution frame internal reliability and validity of the study as a whole. Internal reliability of the overall research consistency is ensured via using well-established methods of coding, data

interpretation and findings analysis. External reliability of the findings consistency and replicability is also framed by the accurate methodological design discussed in the previous sections. (Saunders et al. 2016) Accurate questions interpretation by the sample is one of the concerns of the study reliability. Questions wording is precisely considered and constructed by eliminating professional slang and describing words that potentially can be subject to a misconception in order to ensure that it both fits the research context and are properly interpreted by all sample subgroups and, thus, ensure the validity of the subsequent collected data. Visual examples of use cases of AR/VR in retail (Appendix 2) were exposed to respondents after the concept comprehension examination and before data collection on independent variables to ensure the reliability of coordinated phenomenon interpretation across participants. Reliability is also ensured via questionnaire design of using alternative form, where conceptually similar questions are used to compare and evaluate the consistency of gathered responses (Mitchell 1996). All interviews were conducted in English, so no lexical, idiomatic or experiential misconception impacts on the research reliability or validity.

The internal validity or so-called measurement validity of the questionnaire is determined by the collected data measure what it supposed to based on set research questions and accurately demonstrate the causal relationship between variables (Foddy 1994; Saunders et al. 2016). Validation is established in the research via triangulation, which both increases the reliability and validity of findings and following conclusions of the study (Kanter 1977). It also creates the basis for the external validity of findings generalisability that is established by mixed methods research design, where credibility is implied via the combination of qualitative and quantitative data collection for more complete recognition of individual adoption intentions. Content validity is determined by questions in the questionnaire providing appropriate coverage of the researched phenomenon in order to answer research questions. Construct validity in its turn is concerned whether questions measure the construct it is intended to. The questions used together with content and construct validity are framed by previously examined in the study literature review and theoretical background, and the use of the mixed method of data collection and analysis. (Saunders et al. 2016)

Pilot testing preceding to initial data collection was conducted in order to maximise response rates, validity and reliability of the primary data collected via the structured questionnaire. Pilot interviews were conducted by using Delphi technique, where people who are experts or are interested in AR/VR technology were interviewed to gather suggestions on questionnaire

improvement and detailed insights on individual adoption (Robson 2002). Ten respondents from sample subgroups of innovators and early adopters were decided to be interviewed for the particular pilot testing technique. Fink (2013) suggests having a minimum of ten respondents for a pilot of a smaller-scale survey. The testing was carried out to ensure content and face validity of questions and scales that are collecting necessary data to answer and logically reflect on research questions. Additionally, the testing allowed to refine questionnaire to make it clear for the following subgroups and minimise participant bias in subsequent interviews, and decrease technical failure across devices that can potentially be used to complete the questionnaire so that it is exposed in the same manner to all respondents.

Measurement validity and coverage of secondary data used for case study research are cautiously evaluated so measures and context used in the study comply with the ones reanalysed from secondary data in order to gather information necessary to answer the set research subquestion (Smith 2006). Overall reliability and validity of the case study and secondary data are based on and framed by sources of the data used. Sources were selected due to its authority and reputation, thereby initially, such proverbial research, consultancy and media organisations as Gartner, Goldman Sachs, eMarketer, Perkins Coie, Digi-Capital, TechCrunch and Forbes were exploited for document and survey-based data collection. Predictive or so-called criterion-related validity is related to the predictive analysis and forecasting being accurate based on the aforementioned valid and reliable secondary data (Saunders et al. 2016).

## 5 FINDINGS

In the chapter data collected using primary and secondary sources is presented and analysed. First, case study archival research is produced, where the AR/VR adoption rate is projected based on predictive analytics, in order to create the basis for the following analysis and explanation of individual level of innovativeness and adoption intentions. Second, primary data collected via structured interviews is interpreted using previously determined analysis methods. In the end, findings are synthesised for subsequent discussion and conclusions.

### 5.1 Case study: current and forecasted AR/VR adoption in retail

Based on the examined outlook of perception of AR/VR technology by the public and its extent of acceptance on the market in a certain period of time, together with a relative conception of future success, the current state of adoption and its future potential has been projected using predictive analytics (Figure 11). More detailed description of how the projection was conducted is previously reflected in the methodology chapter.

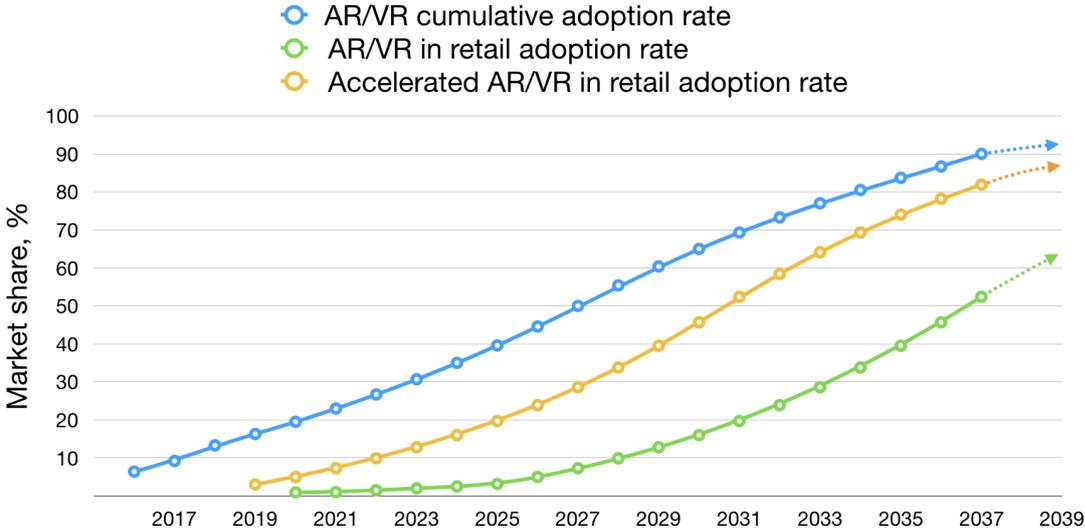


Figure 11. AR/VR adoption rate forecast

#### 5.1.1 Base case

Since both of the technologies entered its adoption cycle to one or another extent, the current rate of adoption of AR/VR technology is moderate with approximately 4% annual change in the market share. The technology is in its very beginning of adoption lifecycle, where

innovators and early adopters are taking over at present. Goldman Sachs (2016) is seeing the potential in AR/VR of not only stepping out of niche with narrow use cases to the mass market but to be as omnipresent as smartphones with the technology being lightweight and affordable in the upcoming decade. Nevertheless, unit adoption is forecasted to be slower than for smartphones and tablets, and have a gradual growth of the market share. Currently, AR/VR is not mature enough to be fully integrated within the human perception of capabilities, but the adoption rate will accelerate at a modest pace through 2020 (Panetta 2017). Gartner stated that VR will enter the mass market adoption within the next two to five years and AR in its turn within the next five to ten years (Petty 2018b).

AR/VR cumulative adoption is currently in the phase of crossing the chasm and is forecasted to enter the mass market in the near future of the year 2019 with up to 16% of market share captured. The technology found its single target market of “beachhead” in the form of the gaming industry, with which help it will further enter the mass market. Significant investments in AR/VR gaming results in overall technology development and improvement that generates the basis for other industries to grasp on the opportunity and enter the market with practical solutions.

With 1 billion of in-store and online potential users, AR/VR in retail, according to Goldman Sachs (2016), will account up to 1% of market share in 2020, and 3,15% by 2025. Thus, by 2025 AR/VR in retail will capture the majority of innovators and primary part of early adopters. By 2030 the technology is forecasted to capture up to 160 million users (approximately 16% of the market) and enter the mass market adoption, thereby entering accelerated adoption rate growth. In 2037 AR/VR adoption in retail will reach its mass market peak with 50% market share of 500 million users including innovators, early adopters and early majority. In subsequent years adoption rate will decelerate, and gradually late majority adopters will accept AR/VR in their shopping routines.

### **5.1.2 Accelerated case**

In 2016 experts were assuming that Apple has the most potential among other high-tech companies to drive mobile AR adoption (Merel 2016). At the 2017 Worldwide Developers Conference Apple has introduced its first augmented reality ARKit. After one year of the initial launch, in September 2018, during Apple’s new product line presentation, the company introduced the new AR Quick Look feature, which allows users to experience AR with the

help of Safari internet browser. Now customers will be able to browse for products in online stores, preview them in AR and buy directly from the browser with no need for additional apps to be installed. (O'Hara 2018) Shortly after AR Quick Look was introduced, many online stores have already started to capture the functional opportunity of the launch. As an example one of the biggest e-commerce platforms Shopify announced in September 2018 that the platform is already supporting the feature, which gives AR shopping capability for approximately 600 000 online stores (Porter 2018).

As a result of this, AR Quick Look feature allows not only to make online shopping more interactive but to overcome two major obstacles in the technology adoption: organisational investments in own AR smartphone app development and the subsequent user-installed app adoption by individuals. In regards to customers' adoption, AR Quick Look eliminates obstacles of personal efforts, such as expertise and time for a person to download an app, and technical effort in the form of available storage on a smartphone or tablet for AR app to be downloaded.

Even though AR Quick Look creates the substantial foundation for retailers to commercialise on AR technology and for the individual adoption of AR in retail to boost remarkably, it is crucial to mention that it still will take time to develop a proper AR content base for customers to actively utilise the feature. According to ThinkMobiles (2017), it takes from 250 to 500 hours to develop moderate augmented reality content with simultaneous localisation and mapping, which for example is used in IKEA AR app.

Thereby, by assuming that AR/VR adoption rate will be accelerated by the aforementioned industry trends within the near future and taking content development costs into account, the technology will capture the initial market of innovators and early adopters by the year 2024 with 16% of market share. In the next seven years, AR/VR in retail will be adopted by the first fraction of the mass market with the early majority being major adoption category. After reaching 50% of market share in 2031, adoption will moderately start to slow down by capturing the remaining market of the late majority and laggards.

Nevertheless, with the introduction of the new practical application, it is also crucial to mention that Apple ARKit presentation was still mainly focused on collaborative gaming sector. The field experts broadly agree with the fact that collaborative and social experience will be one of the main focus for AR/VR developers within the next year. Even though

gaming is the primary investment sector, future focus goes beyond gamers, towards collaboration between organisations and customers, and social events.

## **5.2 Individual adoption intentions of AR/VR in retail**

In the section, primary data collected via structured questionnaires are analysed based on the comprehensive theoretical framework. In the first instance, personal innovativeness of the sample is examined in order to define individual comprehension of the technology and previous experience that consequently create the basis for potential adopters categorisation. Onwards individual adoption intentions and perceived adoption barriers are analysed according to theoretical independent variables and the moderating factor of personal innovativeness.

### **5.2.1 Personal innovativeness**

Social and psychographic profiles of respondents were examined in order to categorise potential adopters based on their level of innovativeness. The recognition was done for subsequent analysis of intention determinants with personal innovativeness as a moderating factor in order to draw the grounded theory at the end of the study. Based on the conducted cross-sectional case study (Chapter 5.1), personal innovativeness was decided to be framed by the present individual experience with AR/VR technology, where innovators and early adopters are currently taking over the technology adoption. Age factor was taken into account as a part of Rogers' technology adoption lifecycle curve, where younger adopters have the tendency to be innovators and early adopters and older generation tends to represent laggards. Last but not least generic comprehension of AR/VR as a concept and perceived behavioural control were considered as an inherent component of personal innovativeness.

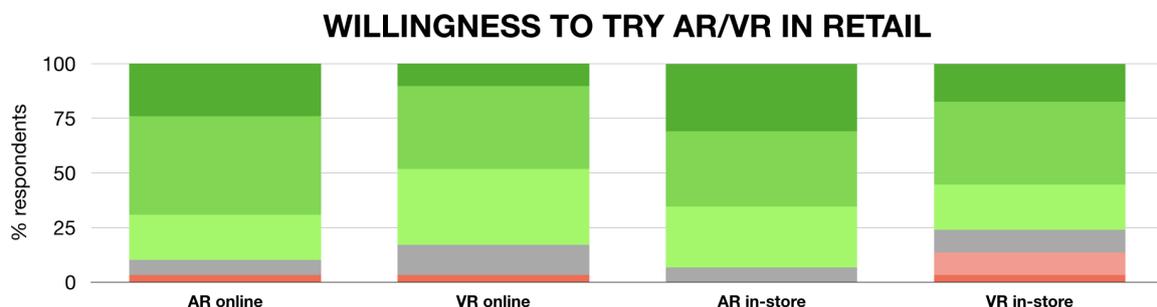
According to the empirical data collected, 62,1% have experienced AR before in one or another context and 55,2% in the case of VR. AR was previously initially utilised in mobile gaming (mainly Pokemon Go) and VR in arcade zones, business and technology fairs and events, and virtual museum exhibitions. It is crucial to notice that only one respondent has reported on their use of AR in social media (e.g. Snapchat selfie masks). This finding contributes towards the understanding of lack of awareness of AR technology as a whole. Nine respondents (25,7%) out of 35 have previously seen or experienced AR/VR in retail. The studied experience includes fitting various furniture in a living space via IKEA AR and

other interior mobile apps, trying AR makeup and hairstyles on via Maybelline online store and L'oreal mobile app, ZARA and Samsung in-store augmented reality campaigns and Arla Aamu AR cat. Those who have seen AR or VR in retail but did not utilise it noticed that there was no proper description or guidance on how the system supposed to work.

*“I have seen ZARA augmented reality campaign in their stores, but didn't try it myself since had no idea what it supposed to do and what I had to do to make the "augmented reality stand" work.” - Early majority*

Empirical data on comprehension of AR/VR concepts shows that 65,5% of respondents have an understanding of what AR is and 82,2% are familiar with the VR concept. The reason behind broader awareness of what VR is, is mainly connected with the fact that this technology is more straightforward in general identification and tangible awareness of inherent headset device. It was observed that late majority and laggards are initially not aware of what AR is, and were noticed to have a misconception of AR with general digital space (e.g. online games). The issue of lack of technical expertise has also resulted in laggards being neutral to a number of intention determinants further in the study.

Perceived behavioural control has examined personal innovativeness in the scope of whether potential adopters are aware of having access to AR/VR technology. 31 percent are not sure if they have a device that supports AR and 34,5 percent are confident that they do not possess a proper device for AR application. Based on data collected almost half of these respondents do actually have a smartphone that provides the proper software to utilise AR in any settings. Meanwhile, 6,9 percent have reported on having VR headset for personal use, and another 6,9 percent were not sure.

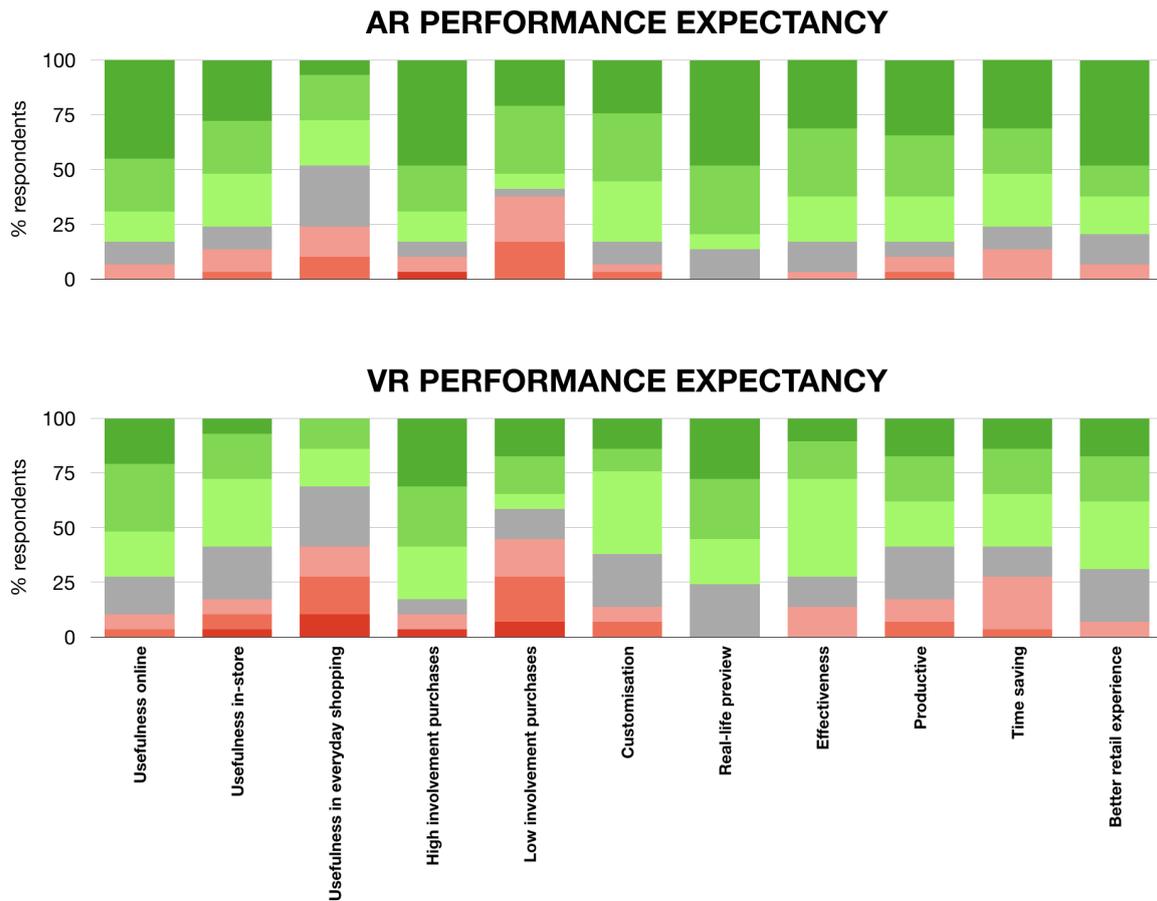


**Figure 12. Willingness to try AR/VR in retail**

As it was mentioned previously, Agarwal and Prasad (1998) determine personal innovativeness based on willingness to try a specific technology out. In the context of AR/VR in retail, the determinant turned up being impractical and inapplicable to frame potential adopters categories but rather contribute to overall attitude towards the implementation of the technology in retail. Majority of respondents have expressed the significant desire to try AR/VR both online and in-store. VR was observed being on the less pronounced willingness spectrum, especially in brick-and-mortar retail.

### **5.2.2 Performance expectancy**

Performance expectancy variable gives the insight whether particular adopter categories identify AR and VR in retail being applicable and advantageous to utilise, what attributes are more likely to provide performance gains and drive adoption. Following characteristics were examined for each augmented and virtual reality: perception of the technology being useful in online and in-store retail environment, for everyday shopping, for customisation, for real-life preview, to enhance shopping effectiveness, to decrease time being spent for shopping, enhancement of overall shopping experience, improve purchasing productivity, and being helpful in high and low involvement purchases. Visual representation of performance expectancy findings is illustrated below in Figure 13.



*Figure 13. AR/VR performance expectancy findings*

Collected data shows that perceived usefulness in online retail is higher for both AR and VR compared to traditional brick-and-mortar stores. Regarding the comparative side of the study, it can be observed that respondents generally show a higher degree of a positive attitude towards the usefulness of AR in retail rather than VR. AR was perceived to be more suitable in retail context than VR by all potential adopters categories. Innovators in their turn distinctively stress the entertaining utility of VR and its inflexibility within the retail scope. Late majority who tend to be on a sceptic side and believe AR and VR not being applicable to utilise in retail have had prior experience with AR in gaming settings (e.g. Pokemon Go) and rather expect from the technology in retail to provide “fun shopping experience”.

*“AR is the future of retail. VR may help in-store but its the future of entertainment, not retail.”- Innovator*

*“Talking about VR, I don't really see how it can help retailers or customers due to its' high costs. At the moment VR technology is not ready for the mass market in retail.” - Innovator*

*“Maybe, I would use VR in-store because I am interested in the technology itself, rather than how it might help me in my purchasing. In the case of AR, I might really use it as a productive tool to help me in my purchasing decisions.” - Early adopter*

*“If there is no AR offered by a retailer, then it could be the case that I use VR in a store. In general, if there is a choice available, then I for sure would choose AR.” - Laggard*

More respondents believe that AR would fit in their daily purchasing routine compared to VR. Approximately 30 percent of the sample could imagine using VR in retail on a daily basis. It is crucial to mention that the majority of the aforementioned 30 percent represent early adopters category, who have already tried VR before or have VR system in personal use. Another fraction of those who assume that VR would fit in their everyday shopping routine are laggards. It might be connected with the fact that they are not fully aware with VR functionality and instead express overall positive feelings toward the technology commonality. Innovators and early adopters have also highlighted the greater chance of using AR in retail on a daily basis due to the broader system availability via smartphones. This issue will further be discussed in facilitating conditions section.

Efficacy of AR and VR in retail is more vivid for individuals over high involvement purchases (e.g. automobile, furniture, electronic devices) rather than low involvement purchases (e.g. apparel, cosmetics, toiletries, food). AR/VR is expected to reduce effort invested in high involvement purchases and thereby make it more productive. As it was mentioned previously, those who believe the technology being inapplicable regardless of the purchasing context tend to have prior entertainment experience with either AR or VR.

*“How it can potentially help me with low involvement purchases? Maybe to show some kind of information about food products via AR when you put your phone on it, or what dishes to cook with this product. It can help, but I would not use it on a daily basis.” - Laggard*

One of the “laggards” respondents have noticed that he would rather use VR in such industries as real estate. It can be decrypted as an individual’s desire to exploit VR where full immersion into an environment is particularly crucial. In the retail context, it can be applicable for furniture retail, where more extensive reconstruction is being conducted. Experts in their turn interpret this inclination as a necessity of being more conscious and attached to existing reality while shopping.

*“It is essential to maintain the line of, let's call it 'a consciousness' during the selling process. A customer should feel that he's still in the real world and the product is improving that real world and is a part of that new reality that they (a customer) can create. It has to be as less invasive as possible, at least with the current technology. Hitting the uncanny valley may have the opposite result to what we want to achieve.” - Innovator*

*“I could imagine AR being useful for picturing products in use in reality, whereas I'm a bit more uncertain about VR, as I don't see it as equally beneficial because it does not give 'real world'-input to the purchasing.” - Early majority*

Based on the qualitative findings, the main consequences of AR/VR in retail adoption behaviour were enclosed in individuals' performance expectations of having fun and entertaining way of shopping, new exciting and advanced overall shopping experience, easier purchasing decision making, enhanced confidence in purchasing decisions, spending less time on examining and choosing between various options and alternatives, eliminating time to travel to an actual store to try things on, making wiser shopping decisions, easily visualising a product at a living space before buying it, being able to customise a product to own needs in a short period of time, fast and hygiene way of trying clothes on, decreasing emotional investment in purchasing process. Innovators and early adopters mainly expect the technology to complement traditional retail and improve online shopping by making it closer to reality/ in-store shopping. Mass market adopters anticipate AR/VR in retail to improve the overall shopping experience and make it more effective and entertaining at the same time, meanwhile, laggards stress the importance of spending less time to examine various product options and increase confidence in final purchasing decisions.

*“I would for sure use AR during my shopping, for example, to compare prices in real time, to show me related products to the one I'm holding in my hands, to show me the map of the store, to watch my favourite YouTuber reviewing the product which I want to buy.” - Innovator*

*“I would like AR/VR to make me spend less money for trying different things, like to eliminate a need to buy various options to see if I like it or not, and to invest less time to try different options. For example, no need to go to a store, or continuously put clothes on and off. In my case, it will also give me less mental stress because when trying clothes on I become very anxious when I can not find the right piece for a long time.” - Laggard*

Nevertheless, time-saving variable depends directly on effort expectancy and the extent of technology expertise. Late majority and laggards, on the contrary, might spend more time on their purchasing process while learning how the system operates and making it work to their own needs. It is crucial to take AR/VR learning curve into account when conducting a longitudinal study on laggards' adoption behaviour.

*“I expect an enhanced shopping experience, however, I know for sure that using these services would be extremely time-consuming. Customers will probably spend more time on decision making by examining the possibilities offered by this technology.” - Late majority*

When contemplating mass market need in a more enhanced shopping experience, integration of AR/VR in retail as the whole concept should be solely examined as an integral part of experiential marketing.

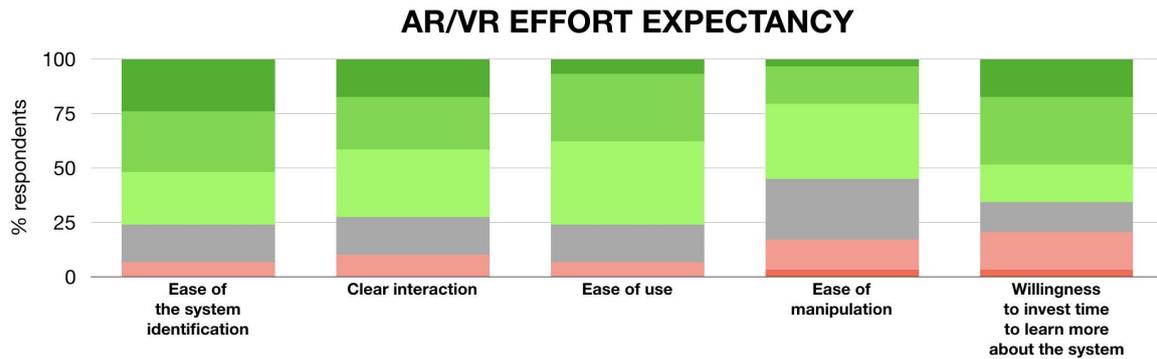
*“AR can be used very productively in marketing as well.” - Innovator*

Substantially, the strongest intention of using AR/VR in retail can be observed in the case of utilising the system to preview a product in a digital form before the actual purchase. No respondents have expressed negative feelings regarding this variable.

*“AR for me sounds like potential game changer in retail as it gives numerous possibilities for providers. It can help to see the final product online which is very helpful especially in car, furniture or clothes business.” - Innovator*

### **5.2.3 Effort expectancy**

Effort expectancy findings denote how individuals of a particular adoption category distinguish AR/VR in retail being easy to utilise. In more details the variable examines perception of how easy it is for potential adopters to identify AR/VR facility in retail, how clear and understandable an interaction with the system would be, how easy to actually use it, how easy to make the system do what individuals want them to do and whether they are eager to dedicate additional time to learn more about AR/VR in retail. Visual representation of effort expectancy findings is demonstrated in Figure 14.



**Figure 14. AR/VR effort expectancy findings**

According to the data collected, the majority of respondents assume that they would easily recognise AR/VR system in physical or online store if there is one available. VR is expected to be more perceptible due to its distinctive headset. Only 6 percent of the total sample, who represent late majority and laggards were self-aware of inability to identify the system. These respondents have also mentioned at the beginning of the survey that the overall concept of AR/VR is unfamiliar to them. Nevertheless, it was observed that a number of early majority respondents were not noticing AR/VR facility in retail since they were not familiar with how the system looks like and what its functions are. Mainly the issue was connected with a lack of in-store assistance and communication provided by retailers themselves.

*“In case of AR, I would notice or pay attention to a system and be interested in figuring out what it is. Regarding VR, I would probably recognise it by the helmet.” - Laggard*

AR/VR in retail is perceived to be clear, understandable and easy to utilise and interact with by up to 75 percent of potential adopters. Laggards and late majority who are generally sceptic towards using AR/VR in retail also consider it to be difficult for them to use the system. Innovators, who have extensive prior experience with the technology, highlight that VR might be more challenging than AR for potential adopters to understand and use since it requires more time to learn and adapt to the system. One of the laggards also noticed that she would need an assistant or somebody to explain how to make AR or VR work when using it for the first time, otherwise, it will be unattainable to understand and use the system. Importance of assistance will be discussed in more details in facilitating conditions section.

*“VR has specific equipment which requires guidance for newcomers. In that case, I think AR has a lower difficulty of usage.” - Innovator*

*“There can be no talk about the potential ease or difficulty. There's no other way to make it than making it so easy that the learning curve is a flat line.” - Innovator*

*“I have never used AR or VR before, therefore probably at first, I would not understand how to use it. If no assistance or description is given and I would need my own phone or tablet to use, it is unlikely that I understand what and how to use on my own.” - Laggard*

Ease of manipulation is less pronounced for potential adopters since, in addition to late majority and laggards who are generally not familiar with AR/VR utilisation, early majority respondents recognise that the technology might be inflexible for individual customisation.

*“The system will most probably work in a certain predetermined way, and if I want something else, it won't be able to adjust to my wishes.” - Early majority*

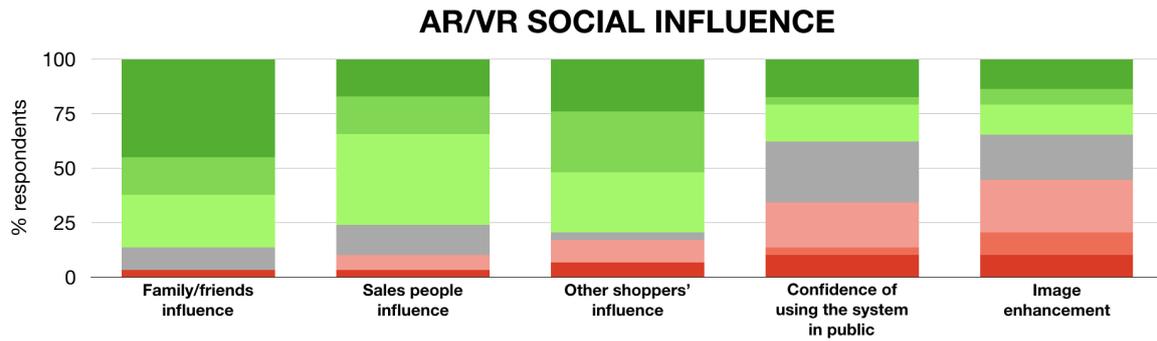
Willingness to learn more about AR/VR in retail was identified not to be moderated by an adopter category but rather overall attitude and perception of the technology. It was ascertained that early adopters and early majority who consider AR and VR having low-quality outcomes with unrealistic visuals, and expecting the technology not being effective in retail are not willing to dedicate their time to acquire more knowledge on AR/VR opportunity in retail. Laggards who as a general rule tend to deviate from investing their effort to learn new technologies, are contrariwise express strong desire to learn more about the utility of the technology in the retail context in order to be able to enhance their own performance in the future. Thereby, the overall complexity factor creates a mental confusion of desire to use feature-laden technology with no proper knowledge and expertise.

*“The fact that I am very keen on trying new services and things I haven't really experienced before, highly contributes to my eager to learn more about VR or AR.” - Early adopter*

*“Effort is not a problem. It is not like learning a new language.” - Laggard*

#### **5.2.4 Social influence**

Data collected on social influence variable respectively reveals how an individual's social system influences on adoption behaviour of AR/VR in retail. The effect of family and friends, salespeople, other shoppers, confidence in using the system around other people, and whether the adoption of technology tends to enhance social status were studied. Figure 15 illustrates the social influence findings regarding each of the aforementioned examined characteristics.



**Figure 15. AR/VR social influence findings**

Empirical data shows that substantially all members of the social system including family, friends, shop assistants, and other shoppers are facilitating AR/VR adoption in retail to one or another extent. Moderate negative or no influence was observed mainly in the case of early adopters who are highly confident in their own decisions and tend to be opinion leaders and thereby adoption facilitators themselves.

*“I would for sure try AR/VR if friends or family suggest(s), but only in case if I need a product/service itself. If assistant suggests to try AR/VR and I am already in store and interested in a product, but if they randomly come to me and ask to try something that I don't need, then no.” - Laggard*

It was observed during the study that extensive public attention or so-called hype has a negative impact on adoption intention for respondents with innovativeness inherent to later majority and laggards. A certain fraction of these adopter categories noticed that they would be embarrassed and feel uncomfortable to figure out how AR/VR in retail functions if there are other people who are eager to try the technology out. Laggards demonstrate the necessity of having personal and pressure free space to utilise the technology in the early stages of adoption when the confidence of using the system is low. The lack of knowledge on how the technology works is the most influential factor for adoption aversion in this case. Other adopters acknowledge that they might feel awkward using the technology in public but would still utilise if there are other shoppers who are willing to use the system.

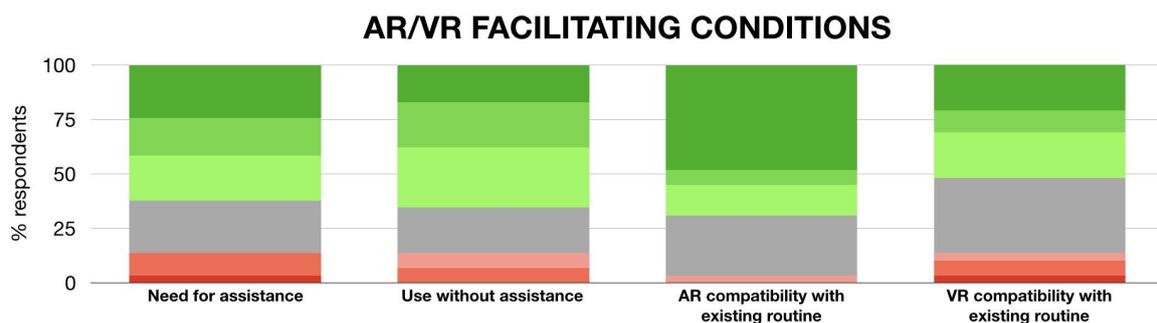
*“Most probably I won't even come close if there are a lot of people in a queue to try the system out. My lack of competence in technology would make me feel quite clumsy using VR when there are other people around.” - Late majority*

*“I would certainly try AR online because I can use it at home on my own and nobody would hurry me up, and I would not be shy to figure the technology out.” - Laggard*

Social image enhancement from using AR/VR in retail was identified to have a positive influence on adoption intention for early adopters and primary part of early majority who are tend to be opinion leaders. Innovators, the remaining mass market and laggards in their turn rather consider using AR/VR in retail due to interest in overall technology and its functionality.

### 5.2.5 Facilitating conditions

Facilitating conditions variable was examined to reflect on individuals’ perception of how external and internal environment aspects impact on AR/VR in retail adoption behaviour. External factors of facilitating conditions were observed from the perspective of assistance provided to potential adopters and the degree of its necessity to each of the adopters' categories. Internal factor is considered based on compatibility of AR/VR in retail with existing shopping routine that is based on individual values and beliefs. Perceived behavioural control, which was previously examined as a determinant of personal innovativeness, was also taken into account as a determinant of both internal and external behaviour constraints. Figure 16 screens facilitating conditions findings based on the collected data.



**Figure 16. AR/VR facilitating conditions findings**

Assistance has minor or no influence on adoption intentions in the case of innovators and early majority who tend to be opinion leaders. Innovators, early adopters and early majority are profoundly convinced that they would use AR/VR in retail if no assistance provided. Early adopters in their turn tend to be more neutral or expressing the need for unconstrained assistance in case of moderate difficulties that might emerge during utilisation of AR/VR in

retail. The initial fraction of the early majority considers personal assistance not being crucial for technology adoption but rather prefer usage instructions along with the AR/VR system.

*“I most probably won’t need personal assistance, but some detailed description will also work for me to be interested in using AR/VR in retail.” - Early majority*

Late majority and laggards with no previous experience in AR/VR settings signify assistance being exceedingly crucial for adoption. Laggards who noted that they most probably would not use AR/VR without proper advisory available tend to be the ones who are negatively influenced by the potential public hype around the system. It is mainly connected with the fact that these respondents are afraid of feeling awkward in front of other people in a store due to lack of expertise.

*“No proper description of what AR/VR suppose to do will make me not interested in dedicating my time to figure it out myself.” - Late majority*

*“I would for sure need a consultant or assistant to explain it to me. If no assistance provided, then I would stumble for a while and quit the idea of using the system.” - Laggard*

Personal assistance is also essential for the late majority and laggards in order to eliminate eventual innovation negativism. In case of no proper guidance, adoption attempt may cause the fact that people will use AR/VR incorrectly and have inconsistent negative experience that leads to overall dismiss of adoption. Even though a number of laggards believe that they will be able to utilise AR/VR in retail without the assistance provided, in reality, many of them do not even fully understand how to properly utilise their smartphones. Nevertheless, no prior incompatibility that has resulted in innovation negativism was identified among the studied respondents' sample. The absence of negative experience across potential adopter is mainly connected with the fact that the technology is in its early stages of adoption lifecycle and potential adopters who might have specific incidents due to lack of expertise have not yet experienced the technology.

*“I would attempt to use the service but will most probably fail to get the whole experience the technology offers and might not use it again.” - Late majority*

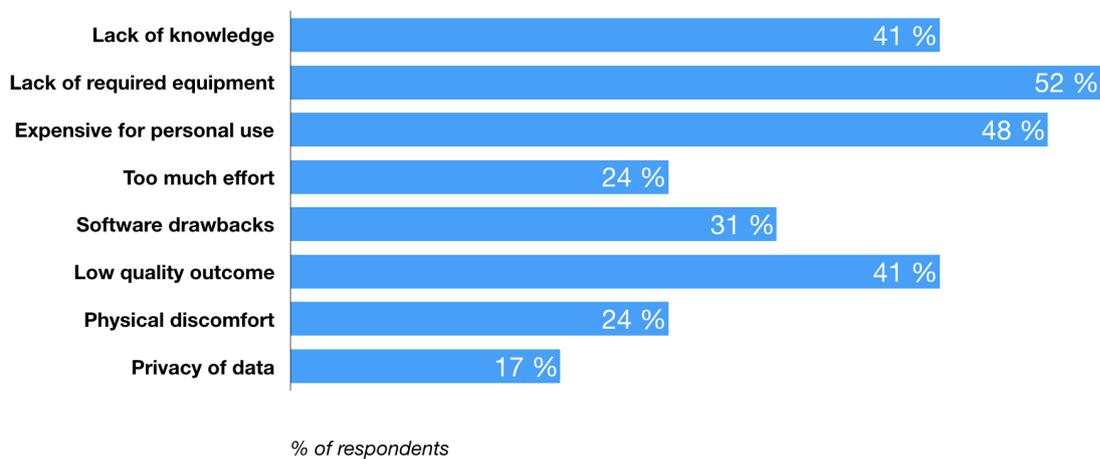
Substantially, AR in retail is considered to be more compatible with existing values and beliefs than VR. The latter has more obvious incompatibility for laggards who noted physical discomfort as the major obstacle for adoption.

Facilitating conditions of technical support, compatibility with devices in case of AR/VR, is indicated by personal innovativeness and perceived behavioural control. Since AR is an inherent part of an extensive amount of smartphones' and laptops' software systems that people already possess, innovators and early adopters emphasise the greater compatibility of AR with the present mass market.

*“I think AR is more suitable for everyday use in retail, since more customers most probably have a device that supports AR, than VR. AR now is a part of many smartphones, while VR requires a separate device or headset to have.” - Early adopter*

### 5.2.6 Adoption barriers

In this section, major AR/VR in retail adoption barriers will be summarised and framed based on the analysis of intention determinants and empirical data collected. Synthesis on perceived adoption obstacles is illustrated in Figure 17.



**Figure 17. AR/VR adoption barriers findings**

Lack of proper knowledge and expertise was observed to be an obstacle essential for mass market and laggards, those who tend to be not entirely familiar with the AR/VR as a concept, have no or little previous experience with the technology and are inclined to have the misconception on perceived behavioural control.

Lack of required equipment to utilise AR/VR in retail is the most pronounced obstacle across all of the adopters' categories with 52% of respondents being concerned regarding the issue. Based on the aforementioned findings, lack of technical knowledge and lack of required equipment are interconnected based on perceived behavioural control, making the obstacle more explicit for late majority and laggards.

Expensive equipment being the second widespread barrier for adoption is mainly concern attributed to early and late majority. Nevertheless, laggards who consider the absence of a device supporting AR/VR as an obstacle for adoption also consider the technology being expensive for personal use.

Mass market representatives with minor AR/VR experience and vague understanding of the technology, perceive it to be demanding an extensive effort and thereby to be a hindrance for adoption. It is crucial to mention that laggards, who in theory tend to be the ones who avoid effort intensive technology, noticed to be less sensitive regarding the issue in the AR/VR in retail context.

Software drawbacks and low-quality outcomes in the form of unrealistic visuals was noted to be an issue for AR/VR in retail utilisation in case of early adopters and early majority who have already experience AR and VR in various settings (also in retail). The issue is mainly observed to be a factor for possible experiential dissatisfaction rather than an adoption barrier.

*“Not realistic enough picture will make me not enjoy an overall experience. “ - Early adopters*

Unrealistic visuals that are incompatible with real human manipulations might in its turn causes physical malaise. Physical discomfort is considered to be an individual characteristic related to physiological intolerance of virtual reality that causes vertigo and nausea. Nevertheless, this obstacle was observed to be more pronounced in VR context for late majority and laggards.

*“VR scares me, I'm not ready for a complete immersion into a different reality. AR with partial immersion seems more comfortable for me.” - Late majority*

*“AR, in general, is more convenient so that you just put your phone or tablet on a product, or stand in front of a mirror, and there is no need to put anything on. The whole problem with VR is its bulky helmet, which I don't want to put on.” - Laggard*

*“VR helmet does not look comfortable at all. Moreover, it can destroy my hairstyle or makeup. I also don't know how I would feel myself in a closed, dark space.” - Laggard*

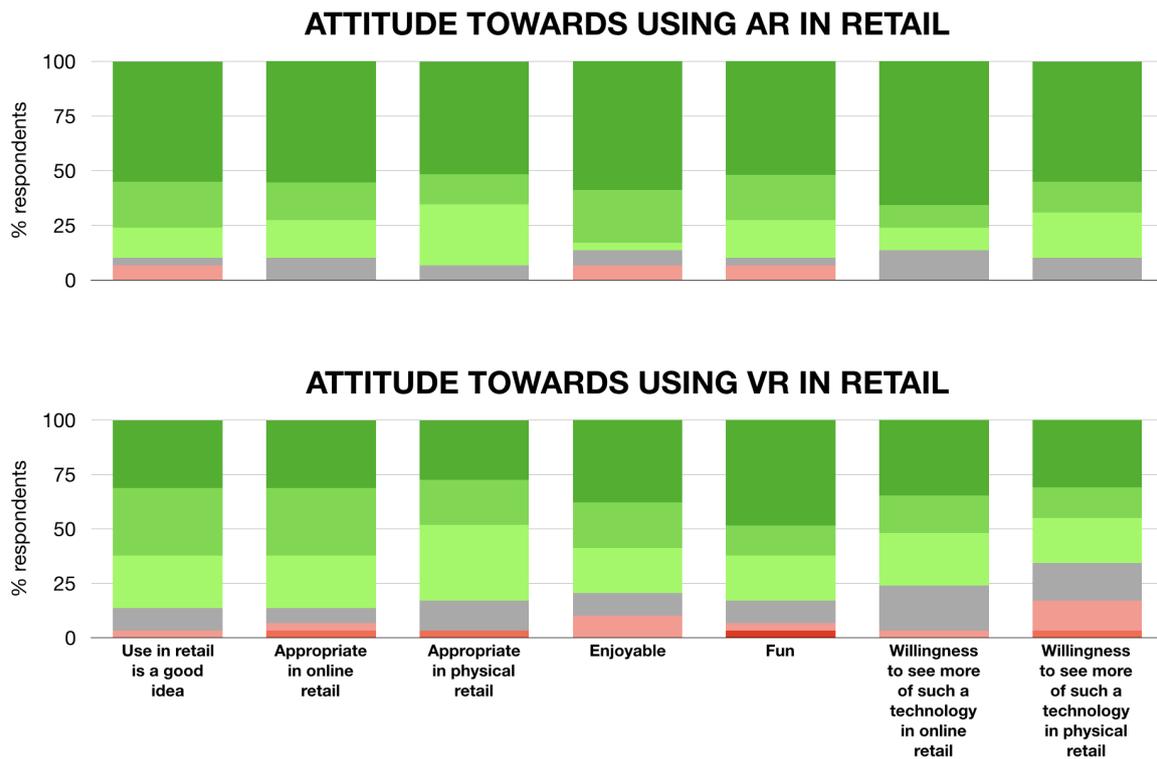
Innovators highlight the fact that VR is still in its early stages of technological development and will most probably not be presented on the market in the same way it is presented nowadays.

*“VR is very bulky, heavy and expensive for personal use, I honestly do not believe that it will survive in the form in which it is currently presented on the market, and especially it won't fit for retail purposes” - Innovator*

Privacy of data is the least evident adoption obstacle and have no distinct pattern among potential adopters. One of the early majority respondents noted the potential of artificial intelligence utilisation in AR/VR in retail in order to enhance purchasing productivity and effectiveness in long-term via collecting data about consumers' habits and decisions. The same respondent has not identified the privacy of data as a barrier for AR/VR adoption. It might be connected with the fact that organisations are already taking anticipatory actions to prevent privacy-related issues and make the obstacle as latent for individuals as possible (Perkins Coie LLP 2018).

### **5.2.7 Attitude towards AR/VR in retail**

To draw the bottom line of individual intentions to adopt AR/VR in retail, attitude towards the technology was examined on a comparative basis in order to have an in-depth understanding of the nature of potential adopters motives. The attitude construct reflects on individuals' affect regarding the technology appropriateness and overall implementation, and intrinsic motivation of whether potential adopters perceive AR/VR being enjoyable and fun to use in the retail context. Figure 18 depicts findings on respondents' attitude towards using AR/VR in retail.



*Figure 18. Attitude towards using AR/VR in retail findings*

The collected data shows that respondents principally feel positive about AR/VR being implemented in retail and consider it to be appropriate to utilise in the particular setting. Nevertheless, a small fraction of early adopters who tend to be opinion leaders moderately disagree with the fact that AR is a good idea in the retail context. Early majority, on the other hand, has neutral or negative feelings towards the overall idea of VR. People feel that they would improve their shopping experience with AR/VR, but not eager to prefer a retailer with AR/VR over the one without.

Regarding intrinsic motivation, mass market representatives who consider the technology is requiring too much effort to utilise, and laggards who have pronounced obstacle of physical discomfort to adopt VR, consider the technology not being enjoyable or fun to use in retail.

### **5.3 Findings synthesis**

The section demonstrates synthesised research findings based on the comprehensive theoretical research framework. The collected data is assembled according to four theoretical independent variables and the moderating element of personal innovativeness in order to

draw extensive theoretical proposition and create the basis for subsequent discussion and conclusion of the study.

To reflect on quantitative attribute values collected and draw central intention tendency across various adopters categories, mean value was calculated based on the seven-point Likert-style rating scale ( 1 = strongly disagree, 2 = moderately disagree, 3 = somewhat disagree, 4 = neutral (neither disagree nor agree), 5 = somewhat agree, 6 = moderately agree, 7 = strongly agree). The calculation is intended to show how intention determinants vary based on innovativeness level of adopters' categories. Table 3 illustrates the calculated numerical data.

Table 3. Findings synthesis

INDEPENDENT VARIABLES		PERSONAL INNOVATIVENESS (PI) MODERATOR									
		Innovators		Early adopters		Early majority		Late majority		Laggards	
		AR	VR	AR	VR	AR	VR	AR	VR	AR	VR
Performance expectancy (PU)	Usefulness online	6.8	6.5	5.7	5.2	5.5	4.7	5.5	5.5	6.7	5.7
	Usefulness in-store	6.8	4.5	5	4.3	5.3	4.3	4.2	4.3	6.6	5.7
	Usefulness in everyday shopping	6.5	1.5	4.7	4	4	3.1	4.8	4.3	4.4	4
	High involvement	6.8	5	5.5	5.5	5.6	5.4	5.3	5.3	6.4	6.1
	Low involvement	6.5	1.3	5.3	5.2	3.8	3.5	5.2	5	5.3	4.4
	Customisation	6.8	2	5.8	6.2	5.5	4.6	5.2	5	5.4	4.6
	Real-life preview	6.8	4.3	6.2	5.8	6	5.3	5.8	5.8	6.6	6
	Effectiveness	6.3	3	5.5	5.5	5.2	4.5	5.7	5.2	6.6	5.6
	Productive	5.3	4.5	6.3	6	5.3	4.4	5.2	4.7	6.4	5.6
	Time saving	5.3	2.5	5.7	5.2	4.7	4	5.5	5.2	6.4	5.7
	Better experience	7	5.3	6	6.3	5.7	5	5	4.5	6.4	5.4
	<b>TOTAL PU</b>	<b>6.4</b>	<b>3.7</b>	<b>5.6</b>	<b>5.4</b>	<b>5.1</b>	<b>4.4</b>	<b>5.2</b>	<b>5.0</b>	<b>6.1</b>	<b>5.4</b>
	<b>PU synthesis</b>	AR to complement traditional retail. VR considered to be inflexible for retail and high costs decrease the utility.		Adoption of AR as a productive tool, and VR as experience enhancement.		AR gives a greater sense of reality to preview products before purchasing.		Might be sceptic towards usefulness in retail, due to previous experience in gaming.		Adopt to save time on alternatives examination and enhance confidence in purchasing decisions. High perceived usefulness due to lack of expertise and knowledge about actual functionality.	
Effort expectancy (EE)	Ease of identification		7		6		5.9		4.8		5
	Clear interaction		6.5		5.8		5.4		4.7		4.9
	Ease of use		6.5		5.8		5.2		5		4.9
	Ease of manipulation		6		5.7		4.6		4.3		4
	Willingness to learn more about		5.3		5.7		4.1		5		6.1
	<b>TOTAL EE</b>		<b>6.3</b>		<b>5.8</b>		<b>5.1</b>		<b>5</b>		<b>5</b>
<b>EE synthesis</b>	High degree of expertise lead to positive impact on EE caused intentions. Stress the importance of assistance for other subgroups to decrease the negative impact of EE.		Curiosity in experiencing the technology significantly decreases negative EE influence.		No vivid impact on intentions. The lowest interest in learning more about the technology.		The most sensitive subgroup due to prior experience with the technology in a different setting and awareness of an effort and time to be invested.		The absence of expertise has a moderate negative influence on adoption intentions, but the subgroup is highly interested in getting familiar with the technology.		

<b>Social influence (SI)</b>	<i>Family/friends influence</i>	5,5		4,8		6,1		5,5		6,6	
	<i>Assistance influence</i>	4,5		4		5,3		5		5,7	
	<i>Shoppers influence</i>	5		4,5		5,6		5,8		5,1	
	<i>Pubic embarrassment</i>	1		3,7		3,7		3,5		4,7	
	<i>Image enhancement</i>	3		4,3		3,3		3,7		4,9	
	<b>TOTAL SI</b>	<b>4</b>		<b>4,3</b>		<b>4,8</b>		<b>4,7</b>		<b>5,4</b>	
	<b>SI synthesis</b>	Moderate positive influence from social references. No impact from hype.		Negative or no SI impact on adoption intentions. Negative impact in case of highly confident opinion leaders.		Positive influence from references. No or moderate positive influence from hype.		Positive influence from references. Lack of expertise makes hype having a negative impact on intention.		High positive influence from references. Lack of expertise makes hype having a negative impact on intention.	
<b>Facilitating conditions (FC)</b>	<i>Need for assistance</i>	2,8		4		4,7		5,2		6,6	
	<i>Use without assistance</i>	6,5		5,3		5,3		4,5		4,4	
	<i>Compatibility with routine</i>	7	4,3	5,5	5,5	5,5	4,3	5,2	4,8	6,4	5
	<b>TOTAL FC</b>	<b>5</b>	<b>4,5</b>	<b>4,9</b>	<b>4,9</b>	<b>5,2</b>	<b>4,8</b>	<b>4,9</b>	<b>4,8</b>	<b>5,8</b>	<b>5</b>
	<b>FC synthesis</b>	Assistance has no impact on adoption intentions.		Minor positive impact from assistance if any technical struggles emerge.		More positive impact from detailed written instructions over personal assistance.		Absence of assistance can have a negative impact on adoption intentions.		Assistance is of high importance for adoption facilitation (due to lack of expertise).	
<b>External variable</b>	<i>Adoption barriers (negative impact)</i>	Unrealistic/poorly developed visuals. VR with expensive and bulky equipment.		Lack of required equipment (VR) and low-quality software outcomes.		Expensive equipment and low-quality software outcomes		Expensive equipment, lack of proper knowledge and high extent of effort required		Lack of proper knowledge, physical discomfort and lack of required equipment	

## 6 DISCUSSION

To draw the bottom line of the findings, answers on the set research questions are synthesised and outlined in the section. Broader findings' managerial and theoretical implications are considered. Answers are presented in an order that creates comprehensive and synergistic insight on individual intentions to adopt AR/VR in retail. First questions that focus on initial individual adoption of AR/VR in retail phenomenon are examined with the context-specific managerial implication being drawn in the end. Following theoretical proposition, contribution, limitation and suggestions are done based on the comprehensive theoretical framework.

### 6.1 Individual adoption of AR/VR in retail

*MRQ: What are intentions for individuals to adopt AR/VR in retail?*

All potential adopters to one or another extent have expressed an extensive interest in the technology being implemented in retail. Online retail has a higher degree of perceived usefulness for AR/VR implementation compared to physical retail. The comparative side of the study reveals that intentions to adopt significantly vary between the two technologies. VR has received weaker intentions to be adopted by individuals in the retail context compared to AR since VR is perceived exclusively as a part of experiential marketing with limited use case application in high-involvement purchases where full immersion is crucial (e.g. real estate). Individuals signify the need for being conscious of existing reality while shopping in order to visualise how a product complement the reality. Thus, AR in its turn is intended for adoption as a potentially practical tool to create enhanced purchasing process via product visualisation, which create the basis for time and effort saving invested in a traditional purchasing decision making process. Even those who are not active buyers still perceive AR being productive and effective to use in retail.

Innovators and laggards were observed to have the highest effect on performance expectancy, with innovators having pronounced intention drivers from perceived usefulness attributes and laggards with relative advantages of time-saving, effectiveness and productivity enhancement.

Adoption intentions are also determined by perceived relative advantages of AR/VR utilisation in retail that are based on individual outcome expectations of the adoption itself.

The following outcomes have been identified to determine adoption intentions in the particular context: entertaining shopping experience, effortless and confident purchasing decision making, decreased purchasing commitment, agile options and alternatives visual examination before purchasing, time-saving, prompt customisation up to own needs, stressless purchasing process. The customisation aspect was observed to have a less pronounced impact on intention to adopt since adopters consider the technology being not easy to manipulate and to fully adjust to own needs. Nevertheless, variance in the extent and nature of customisation results in different extent of intentions. For instance, more people are ready to sacrifice actual physical interaction with a product before buying in the case of customisation design wise (e.g. sneakers), but not when it comes to highly customisable products (e.g. makeup foundation). Expectations vary across adopters categories and form a focus funnel. Innovators and early adopters have a fundamental outcome expectation of AR/VR complementing and improving traditional retail, while mass market concentrates on experiential improvement, and laggards with the most precise focus on time-saving.

AR shows high compatibility with shopping routines across all adopters categories, but only on an occasional utilisation basis. It is also reflected in more vivid intentions to adopt the technology in case of high involvement purchases over low involvement ones. Nevertheless, AR facilitating condition of existing behavioural control via smartphones and tablets create the basis for widespread adoption across adopters categories and potential daily basis utilisation.

Effort expectancy that is theoretically defined to take to have a negative impact, has no pronounced negative influence on intentions to adopt in the scope of AR/VR in retail. Nevertheless, the extent of perceived effort contribution has gradual increase down innovation diffusion lifecycle starting from innovators to laggards. Thereby, effort expectancy varies according to the level of technical expertise.

References from friends, family and shop assistants play a crucial role in adoption as intentions determinants. Social pressure, on the other hand, cause adoption dismiss in the case of late majority and laggards.

Late majority and laggards were identified not to express negative feelings about AR/VR in retail since they are not indeed familiar with the technical potential and its current technical limitations, but instead are interested in the phenomenon itself. Nevertheless, observation has

shown that laggards were not fully aware of how much the technology is developed, so they suppose that AR/VR as a concept itself is widely applicable in a number of retail scenarios. Thereby, lack of knowledge and overall expertise serves as an obstacle for technology adoption but influences positively on initial attitude.

It is evident that desirability and acceptance of technology vary across adopters categories, but what drivers for adoption for each segment are, examined in more details in the form of the grounded theoretical proposition in Chapter 6.2.

*What are barriers in individual adoption of AR/VR technology in retail?*

Lack of expertise and lack of required equipment is acknowledged to be the major obstacle for individual adoption. Even though lack of required equipment and high price disturb adoption for the vast fraction of the mass market, economic costs in AR/VR in retail context are mainly an aspect imputable to online retail, where customers have to have proper, suitable equipment in personal use in order to be able to exploit an offered service. However, in-store service in retail, which assumes a customer's possession of a device that supports AR system is also practised in the industry (if a retail distributor does not provide one). Brick-and-mortar retailers can decrease the negative impact of the lack of technology facilitating conditions by providing the required equipment in-store for individual utilisation. Thus, adoption obstacle of AR/VR in retail regarding lack of required equipment and high price varies across the scope the technology is exposed to adopters.

Additionally, Venkatesh et al. (2012) proposed UTAUT 2 model that in particular examine customer acceptance and use of technology by extending the original model with three new constructs of hedonic motivation, price value and habit. Price value variable determines individual perception on whether technology is reasonably priced and is of good value for the current price. Since price value of AR/VR equipment was identified to be the obstacle for adoption for particular adopters categories, UTAUT 2 model is still considered to be inapplicable to examine the established study objectives and purposes, since price sensitivity across adopters categories is determined by Innovation Diffusion Theory (Rogers 2003) that serves as the basis for personal innovativeness moderator in the comprehensive theoretical framework, which make the two theories overlap. Additionally, the physical retail context where in-store AR/VR system is installed and does not require individuals to possess any equipment in personal use make UTAUT 2 price value variable irrelevant for examination.

Last but not least, price value as intention determinant play an insignificant role within AR scope since the technology is the inherent software feature of the majority of smartphones.

Perceived adoption barriers are distinct to each of the adopters' categories. Innovators' adoption barriers are mainly rooted into industry maturity level with the concern of AR/VR providing unrealistic or poorly developed visuals for its productive utilisation. The category is also skeptical on VR mass market applicability due to expensive and bulky equipment. Early adopters and early majority consider lack of required equipment for VR and overall low-quality software outcomes being obstacles to adopt. According to Rogers' (2003) laggards are the most price sensitive adopters category and collected data reveals the theory being also applicable for mass market adopters in the AR/VR in the retail context. Mass market as a whole (early and late majority) contemplate technology being expensive for personal use that explains the current adoption rate, where the technology is facing the chasm by lacking appealing factors for the market to take advantage. Late majority also stress lack of proper knowledge and high extent of effort required serve as adoption disincentive. Additionally, existing gaming experience among late majority can also be a barrier, where applicability perception is limited to the particular use case. Last but not least, laggards major concerns are lack of proper knowledge, physical discomfort and lack of required equipment. VR in its turn received more skepticism from laggards due to physical discomfort obstacle in the form of headset and fear of complete immersion into a different reality.

### **6.1.1 Industry trends**

*What is the current state of adoption of AR/VR technology in retail?*

AR/VR technology as a whole has entered the initial market by capturing innovators and early adopters with niche use cases application with 4% annual change in the market share. Mass market adoption is expected to gain its momentum in the next two to five years in case of VR and the next five to ten years for AR. Nevertheless, technology maturity and limited content offerings can be the obstacle for both enterprise and individual adoption that can potentially detain the technology in the chasm phase with the gaming industry being the single established market. It is also observed in the primary data findings that the initial mass market (early majority) is currently of low interest in learning more about the technology. AR/VR in retail in its turn is only starting to enter the market with less than 1% market share

captured by the moment, and expected to enter mass market by the year 2037 in the base case and by 2031 in the accelerated case.

The primary finding derived from the forecasting of the accelerated case shows that industry trends fundamentally determine individual intentions. The significant AR/VR industry trend that might disrupt individual intentions for the technology adoption is the previously mentioned in the literature review anticipated launch of Apple smart glasses in 2020. The smart glasses are forecasted not only to exponentially boost immersive technology market growth but to change individual perceptions and adoption intentions. (Rogowsky 2017) The device is expected to provide a high degree of mobility and flexibility of the HMD, and, thereby, substitute the existing bulky VR headsets and bring AR to a new advanced level. Rogers (2003) emphasised that decrease in discomfort as a relative advantage is more important for individuals than economic profitability. Thus, smart glasses will positively impact on performance and effort expectancy by decreasing existing technology barriers of physical discomfort. Another intention determinant that might be influenced by the smart glasses trend is the status aspect of the innovation. The findings show that image enhancement factor plays an insignificant role in individual AR/VR adoption in retail. Smart glasses in its turn is the potential turning point for social influence variable since the device is attributed to wearables or so-called “fashionable technology”, which people tend to utilise to gain social status. Thereby, smart glasses will have a positive impact on image enhancement determinant of adoption intention. Additionally, the trend of smart glasses can also potentially merge conceptual definitions of virtual and augmented reality into unified concept mixed reality and thereby switch research focus.

### **6.1.2 Managerial implications**

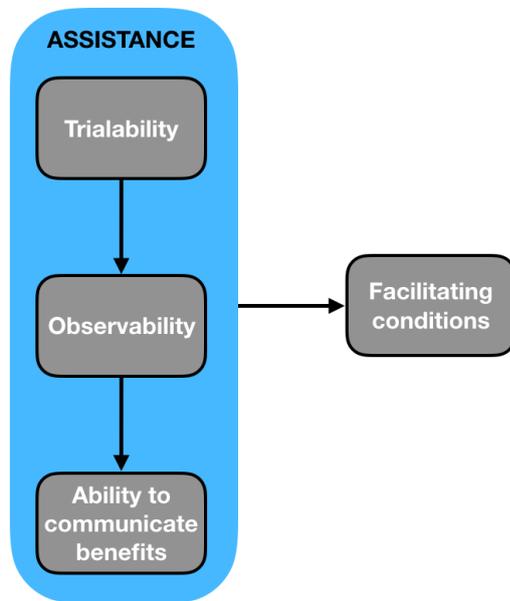
Technology acceptance is fundamental for its adoption (Rogers 2003). According to the findings, the majority of potential adopters independently of their innovativeness level have a relatively high degree of AR/VR acceptance in the retail scope. Nevertheless, there are specific barriers that dismiss actual adoption to one or another extent.

First, the hype around the technology and extensive investment in AR/VR gaming industry that make a certain fraction of adopters to perceive the technology as exclusively applicable in gaming use cases only. One of the first managerial implications that can be brought out of the study is that there is a pronounced need in “rebranding” of AR/VR from entertainment

positioning of the technology to the practical tool. Rogers (2003) highlighted that individuals are not behaving toward a new idea in the same way as they behave to a previous similar idea. Thereby, the current positioning of AR/VR technology in the gaming scope should be adjusted to the retail context, and individuals should be accordingly reeducated based on different application functionality. It can potentially be done via extensive, informative exposures and facilitated trials. Trialability provided by retailers is also crucial for better communication of technology benefits. AR/VR system demonstration should be conducted in person in physical stores and online through educational videos and supported by accurate explanations and instructions in order to build realistic consumer performance and effort expectancy. Informative, educational exposure of the technology functionality and utilisation can also have a positive influence on perceived behavioural control. For instance, with a launch of AR/VR in retail, assistance is vital to help potential adopters to try the technology for the first time, so they will be more confident in using it by themselves in the future. Assistance can also be utilised as part of trailability to eliminate subsequent innovation negativism.

To summarise, in the knowledge stage in the innovation-decision process, individuals are active on seeking information on innovation functionality and its relative advantages in order to decrease innovation acceptance uncertainty (Roger 2003). Even though adoption benefits of AR/VR in retail might seem vivid for the majority of the market, facilitating condition in the form of assistance is required to decrease possible uncertainty and create the basis for observability and proper product benefits communication. Assisted trialability in-store can be utilised in order to activate consumers', generate buzz, build emotional preference and make customers remember the experience and adopt it on their own at home (move from in-store to own equipment). Nielsen (2016) found out that even 120 seconds video about AR/VR technology increases individuals interest and probability to purchase a hardware. Short informative content exposure also makes a certain amount of people search for more information about the technology. Exposure to informational experience is extremely crucial for AR/VR adoption acceleration. Nevertheless, the information should be thoughtfully created and presented to potential adopters. Informative content about AR/VR which covers more practical application rather than gaming context is more likely to lead to a positive increase in usage intentions.

High degree of willingness to try the technology out is anchored by lack of knowledge on actual utilisation, thus, assisted trialability is needed to generate the need for adoption and push its further use. To summarise, assistance will create the basis for positive enhancement of facilitating condition. The managerial implication is visualised in Figure 19.



*Figure 19. Managerial implication*

Another barrier that can potentially be covered by managerial implication in order to decrease its negative impact on individual adoption is the misconception of the technology as a whole. Findings of the research identify that interest in the technology potential adoption is higher than actual knowledge about it. The factor was the most pronounced in the case of AR, where respondents reflect on the high degree of willingness to try AR in retail out and simultaneously showed the poor understanding of AR as a concept. Nielsen (2016) study has also shown that individuals perception and intended behaviour toward emerging technology tend to be stronger than actual knowledge of the technology functionality. The majority of mass market individuals are using AR on a daily basis (e.g. social media AR photo filters), but many of them do not realise the technology as a concept. The initial mass market positioning of the technology in the gaming industry also cause technology misconception on the distinctive basis that inhibits subsequent adoption in other use cases, such as retail showcasing. In this case, naming of the technology structure individual perception and create the basis for the poor understanding of the innovation functionality. Rogers (2003) stress the importance of the impact of innovation naming on its perceived compatibility and overall rate of adoption. Thereby, retailers should create explicit communication of the technology

benefits united with its naming for individuals to reflect on the clear conception both of the technology functionality and concept as a whole.

## **6.2 Theoretical contribution and proposition**

Prior research on technology acceptance and adoption that incorporated personal innovativeness as an additional research item were examining the variable as intention determinant rather than moderating factor, as it is proposed in the study. Koivisto et al. (2016) extended the technology acceptance model with personal trait construct of personal innovativeness as an independent variable with a positive influence on perceived ease of use and use intention. Turan et al. (2015) have formed a theoretical proposition of using personal innovativeness as an antecedent of UTAUT model, where original independent variables of performance expectancy, effort expectancy, social influence and facilitating conditions become dependent on personal innovativeness.

Thereby, the theoretical contribution of the study is focused on extending the explanatory power of the UTAUT model by extending the theory using personal innovativeness as the moderating factor of relationships between independent variables and adoption intentions. The research is conducted under grounded theory strategy and is intended to give a theoretical basis for subsequent research of the framework and its applicability. Context wise, individual adoption of AR/VR in retail has never been previously examined using the UTAUT model with the comparative analysis in the basis, thus, the study contributes to overall generalisability of the original UTAUT model by accounting emerging technology, AR/VR in particular, into contextual behaviour variance scope.

The grounded theoretical proposition is based on primary data collected to answer questions that focus on the proposed comprehensive theoretical framework. The UTAUT model was extended by three additional factors of personal innovativeness as the moderator, hype as a complementary to social influence intention determinant, and external variables of technology inherent obstacles as framing factor of existing theoretical independent variables. Set subquestions are answered below in order to draw theoretical conclusions based on the research findings.

### *How personal innovativeness influences on individual technology adoption?*

The original UTAUT model that determines age, gender, experience and voluntariness of use as moderators of behavioural intentions and adoption itself, was proposed for modification to examine distinction of individual emerging technology adoption intentions based on the interchange of personal innovativeness as a moderating variable. Independent variables in its turn were observed to be framed by external and attribute variables that vary with a context. The study shows that personal innovativeness as it is determined by Agarwal and Prasad (1998) under the willingness of an individual to try a new technology was observed not valid in emerging technology context. According to data analysis willingness is instead established by the overall individual attitude towards the technology and the extent of transparency and perception of adoption benefits.

According to the findings analysis, performance expectancy has a stronger positive effect on adoption intention for innovators and laggards. Rogers (2003) previously noticed that relative advantage perception is directly influenced by characteristics of an adopter category. The study identified this characteristic being inherent to the extreme cases of technical knowledge as an external variable, with innovators who possess extensive and complex comprehension of technology, and laggards who are the ones lacking technical knowledge. Innovators' impact can be explained by their ample desire to profoundly explore emerging innovations, which makes performance expectancy overstated. In the case of laggards, lack of technical knowledge diffuse perception of technology functionality and make performance expectancy be framed by an attitude towards a technology concept as a whole. It was observed in a vivid variance between performance expectancy of examined technologies in the case of innovators.

Effort expectancy has a stronger negative effect for laggards and late majority with insignificant experience. Nevertheless, laggards express the highest degree of interest and willingness to learn more about technology in its early stages of the diffusion process. Late majority in their turn who occasionally experienced technology in a disruptive use case scope tend to perceive the proper adoption being of high effort investment. It is also connected with a reasonable presumption of technology being applicable only in the scope the prior experience occurred, which in its turn creates sceptic perception and acceptance dismiss on other possible use cases in order to eliminate uncertainty connected with applicability confusion.

Social influence has a stronger positive effect for laggards and insignificant negative effect for early adopters with strong opinion leadership tendencies. Laggards with high performance expectancy and high willingness to learn more about technology have a positive influence on adoption intentions from social references, including family, friends and shop assistants. The impact is observed to be particularly positive if technology has a high degree of observability and applicability in a needed scope. Early adopters who have an active position of opinion leadership might have a negative effect on adoption intentions in case of social influence. It is connected with the fact that such adopters have an aspiration to introduce people around them to innovations, and the contrary scenario might cause adoption aversion. Rogers (2003) stated that social influence from friends and family is one of the major driving forces for late majority to adopt. It was observed not to be fully applicable in the diffusion of emerging technology context.

Facilitating condition of assistance has significant positive influence and moderate negative influence in case of its absence for laggards with a positive attitude towards technology. High extent of willingness to learn more about technology significantly facilitates adoption by providing proper assistance at the beginning of the adoption process. Compatibility factor of facilitating conditions was observed to be nonsignificant for personal innovativeness moderator, and rather shows being dependent on overall attitude.

#### *How hype around a product influences on individual adoption intentions?*

Public hype has a negative impact on late majority and laggards caused by fear of public embarrassment to be exposed to technology with little or no knowledge about the particular innovation and the way of its utilisation. New, unfamiliar territory with a high degree of perceived public pressure generate adoption aversion. The embarrassment of adoption is directly influenced by the lack of expertise and physical discomfort external barriers. In the case of early adopters and early majority, hype can have positive influence on adoption intentions by facilitating interest in investigating the technology.

To summarise, developed grounded theory show the enhancement of the explanatory power of the UTAUT model using personal innovativeness as the moderating factor. Age as a moderator is becoming more blurred as a concept to determine technology adoption intentions since the current generation grown in the Digital Age has a higher degree of technology acceptance as a whole, which will make age to lose its moderating power in the

future. Gender as a complex psychological and sociological construct in its turn is influenced by masculinity and femininity aspects of “psychological gender” and subsequent gender roles issue, which is gaining incremental attention in acceptance research as a phenomenon that requires exclusive consideration (Venkatesh et al. 2003). Results of the theoretical proposition are summarised in Table 4.

*Table 4. Theoretical proposition summary*

<b>Moderator</b>	<b>Dependent Variables</b>	<b>Independent Variables</b>	<b>Explanation</b>
<b>Personal innovativeness</b>	Behavioural intention	Performance expectancy	Stronger positive effect for innovators and laggards
	Behavioural intention	Effort expectancy	Stronger negative effect for laggards and late majority with insignificant experience
	Behavioural intention	Social influence	Stronger positive effect for laggards and insignificant negative effect for early adopters with strong opinion leadership tendencies
	Behavioural intention	Hype	Stronger negative effect for late majority and laggards and positive effect for early adopter and early majority
	Usage	Facilitating conditions	Significant positive influence and moderate negative influence in case of assistance absence for laggards with a positive attitude

### **6.3 Limitations and recommendations for further research**

The study imposed by several contextual and theoretical limitations that create the basis for future research to take place. First, the study coverage is limited by emerging technology context, AR/VR market in particular. Even though the research partially covers the AR/VR market as a whole, the initial case study is limited by the scope of the retail industry. Thereby, limited contextual generalisability of the study requires to test the proposed comprehensive theoretical framework with simpler technology and across a variety of industry scopes. Broad and at the same time distinctive practical applicability of AR/VR within various industry segments makes it crucial to examine the adoption phenomenon with a precise focus on each of the segments in order to constitute proper contextual and analytical generalisation.

Cross-sectional design implies relevance of the study being limited to the particular time horizon. A longitudinal study should be conducted to examine the AR/VR adoption phenomenon over time. A cohort study of the particular sample has to be carried out to

contribute to a deeper understanding of emerging industry trends influence on changing individual intentions.

The initial direction for future research is based on the grounded theory research strategy that has resulted in the previously examined extensive theoretical proposition. Subsequent research with the limitation on individual adoption intentions based on comprehensive theoretical framework should be conducted in experimental research design, where quantitative testing of variables correlation and extent of moderating power is examined. Additionally, utilisation of grounded theory strategy with the focus on purposive sampling requires future research to extend data sample in order to make a generalisation on a statistical representation of the total population.

Web questionnaire facilitated the sample to be geographically dispersed and cover such nationalities as Russian, Hungarian, American, Dutch, Finnish, French, German, Mauritian, Nigerian, Polish, Vietnamese. With globalisation and internalisation of companies, the cultural factor is currently playing a prominent role in technology adoption intentions and overall system of use. Since the study was conducted with no cultural focus, future research should examine the cultural influence on technology acceptance and adoption.

The variance of the phenomenon from the local perspective should be considered not only on the individual level but on corporate as well. Enterprises facilitate individual adoption across countries by providing facilitating conditions with a diverse degree of integration. One of such examples is fast fashion retail company Zara, which in spring 2018 launched in-store augmented reality campaign in selected countries (e.g. was introduced in France, but was not presented in Russia) (Matera 2018). Thereby, it is fundamental to examine cultural aspect to understand drivers of enterprise adoption of AR/VR technology, which in its turn will contribute to the comprehension of individual adoption intentions.

Last but not least, gender moderating factor was excluded from the original UTAUT model since the impact of masculinity and femininity on psychological gender requires a separate in-depth examination. Since the perception of masculinity and femininity varies across cultures, Porter's five forces are proposed as one of the possible additional constructs to examine individual technology adoption with the cultural aspect as a focal point.

## 7 CONCLUSION

Acceptance is fundamental for adoption. Intentions in its turn reflected in an individual's behaviour, which is determined by specific cognitive and affective events. (Rogers 2003) Following the findings derived from the study, it was revealed that individuals have a high degree of acceptance of AR/VR in retail, which creates a facilitated basis for adoption. With technology improvement, declining prices, and broader applications, AR/VR is going to change how people are doing things, starting from watching an event to buying a new house (Goldman Sachs 2016). Flowing investments in the technology are expected to improve the technology and make it affordable for mass market to adopt extensively. The experts stress the importance of making enterprises aware of AR/VR as a practical tool to solve customers' problems in a better, faster, cheaper and more effective way (Perkins Coie LLP 2016). Current enterprise adoption frames the future individual adoption in the retail context.

Previous research was examining augmented and virtual reality as a collective phenomenon of immersive technology. Primary data findings show that innovators strongly convinced that such comprehensive conceptualisation misleads the primary overlook on each of the technologies as a separate entity. Thus, while industry experts predict AR/VR gradually penetrate the mass market at a modest pace, it can be not particularly true when considering augmented and virtual reality market on an individual basis. The comparative focus of the research identified that eCommerce is the primary potential for AR/VR adoption in retail, with mobile AR being the fundamental driver. Mobile AR is expected to develop beyond its deep-seated scope of smartphones and tablets and evolve and insinuate into a well known for innovators and early adopters emerging technology of smart glasses. (Tractica 2017)

Nevertheless, disruptive use cases, such as Pokemon Go and social media selfie masks, push AR into a scattered adoption where the process is not gradually covering the market following the traditional innovation diffusion lifecycle, but rather simultaneously fractionally capturing a small percentage of all potential adopters categories. Thus, both aforementioned disruptive and analysed accelerated cases show that industry trends can completely change the market as a whole in a short period of time. Thereby, individual intentions towards the adoption of the emerging technology that is framed by the industry itself can also be disrupted by emerging industry trends. Such behaviour in its turn undermines the well-established theory of technology adoption lifecycle (Rogers 2003).

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## APPENDICES

### Appendix 1. Pre-coded data set

#### Personal Innovativeness (PI)

<b>Age (PI-A)</b>	<p>1 = under 18;                  2 = 18-24;                  3 = 25-34;                  4 = 35-44;                  5 = 45-54;                  6 = 55-64;                  7 = 65 or older.</p>
<b>Experience (PI-E)</b>	<ol style="list-style-type: none"> <li>1. Does AR concept understandable for you?</li> <li>2. Does VR concept understandable for you?</li> <li>3. Have you ever tried AR/VR before? (If yes, how often/many times? In what settings?)                         <ol style="list-style-type: none"> <li>a. If yes, how many times did you use AR before?</li> <li>b. If yes, how many times did you use VR before?</li> </ol> </li> <li>4. Have you seen any AR/VR campaigns in retail?                         <ol style="list-style-type: none"> <li>a. If yes, where or in what circumstances did you use AR/VR previously?</li> <li>b. Describe what AR/VR campaign you saw in retail and if you used/tried it (if applicable).</li> </ol> </li> </ol>

#### Facilitating Conditions (FC)

<b>Perceived Behavioural Control (FC-PBC)</b>	<ol style="list-style-type: none"> <li>1. Do you have a device that supports AR?</li> <li>2. If you have a smartphone, what model do you have?</li> <li>3. Do you have VR system for personal use?</li> </ol>
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Intentions to use

<b>Behavioural Intention to Use (BI)</b>	<ol style="list-style-type: none"><li>1. If I see AR in an online retail store I would you use/try it.</li><li>2. If I see VR in an online retail store I would you use/try it.</li><li>3. If I see AR in a physical retail store I would you use/try it.</li><li>4. If I see VR in a physical retail store I would you use/try it.</li><li>5. I would use AR to customise products.</li><li>6. I would use VR to customise products.</li><li>7. I would use AR to see how a product would look like in real life before buying it.</li><li>8. I would use VR to see how a product would look like in real life before buying it.</li></ol>
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Performance expectancy (PE)

<b>Perceived Usefulness (PU)</b>	<ol style="list-style-type: none"><li>1. I believe that AR will help me to shop online.</li><li>2. I believe that VR will help me to shop online.</li><li>3. I believe that AR will help me to shop in-store.</li><li>4. I believe that VR will help me to shop in-store.</li><li>5. I believe that AR will help me in everyday shopping.</li><li>6. I believe that VR will help me in everyday shopping.</li><li>7. I believe that AR will help me with high involvement purchases (products or services that require more time to decide, money and other personal resources.) (e.g. car, furniture, electronic devices etc).</li><li>8. I believe that VR will help me with high involvement purchases (products or services that require more time to decide, money and other personal resources.) (e.g. car, furniture, electronic devices etc).</li><li>9. I believe that AR will help me with low involvement purchases (products or services that require less time to decide, money and other personal resources.) (e.g. clothes, cosmetics, toiletries, food etc).</li><li>10. I believe that VR will help me with low involvement purchases (products or services that require less time to decide, money and other personal resources.) (e.g. clothes, cosmetics, toiletries, food etc).</li></ol>
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Effort expectancy (EE)

<b>Perceived Ease of Use (EE-PEOU)</b>	<ol style="list-style-type: none"><li>1. It will be easy for me to identify AR/VR system in physical or online store.</li><li>2. My interaction with AR/VR in retail will be clear and understandable.</li><li>3. It will be easy for me to use AR/VR in retail.</li><li>4. It will be easy for me to make AR/VR system do what I want it to do.</li></ol>
<b>Complexity (EE-C)</b>	<ol style="list-style-type: none"><li>1. I would dedicate my time to learn more about AR/VR system in retail.</li><li>2. What obstacles do you think you would face when using AR/VR in retail? (you can choose more than one)<ol style="list-style-type: none"><li>a. Lack of knowledge about the technology</li><li>b. Lack of required equipment</li><li>c. Too much effort</li><li>d. Software drawbacks</li><li>e. Unrealistic visuals (low quality outcome)</li><li>f. Physical discomfort</li><li>g. Expensive for personal use</li><li>h. Privacy of data</li><li>i. Other: ___</li></ol></li></ol>

Performance expectancy (PE)

<b>Relative Advantage (PE-RA)</b>	<ol style="list-style-type: none"><li>1. I believe that AR in retail will make my purchasing choice more effective.</li><li>2. I believe that VR in retail will make my purchasing choice more effective.</li><li>3. I believe that AR in retail will make my decision making quicker.</li><li>4. I believe that VR in retail will make my decision making quicker.</li><li>5. I believe that AR in retail will improve my overall shopping experience.</li><li>6. I believe that VR in retail will improve my overall shopping experience.</li><li>7. I believe that AR in retail will make my shopping more</li></ol>
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	<p>productive.</p> <p>8. I believe that VR in retail will make my shopping more productive.</p>
<p><b>Outcome Expectations (PE-OE)</b></p>	<p>1. What do you expect from using AR/VR in retail?</p>

Social Influence (SI)

<p><b>Subjective Norm (SI-SN)</b></p>	<p>1. I would use AR/VR in retail if my friends/family suggest(s).</p>
<p><b>Social Factors (SI-SF)</b></p>	<p>1. I would use AR/VR in retail if a shop assistant suggests.</p> <p>2. I would use AR/VR in retail if other shoppers use it.</p>
<p><b>Image (SI-I)</b></p>	<p>1. I believe the use of AR/VR in retail will make me look more prestigious or on trend.</p> <p>2. I believe I will feel awkward using AR/VR in retail in public.</p>

Facilitating Conditions (FC)

<p><b>Facilitating Conditions (FC-A)</b></p>	<p>1. I will need an assistant/someone explain to me how to use AR/VR in a retail store.</p> <p>2. I would use AR/VR in retail on my own (if no assistance provided).</p>
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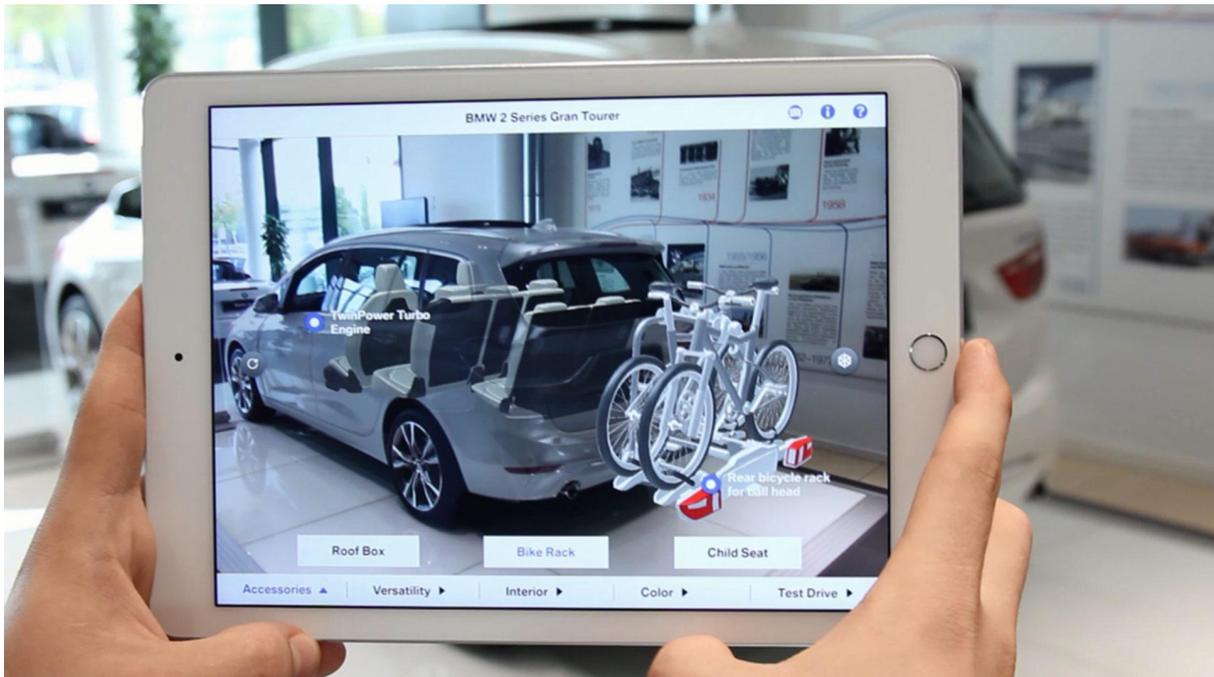
Attitude toward using technology

<b>Attitude Toward Using</b> <b>(A)</b>	<ol style="list-style-type: none"> <li>1. I believe use of AR in retail is a good idea.</li> <li>2. I believe use of VR in retail is a good idea.</li> </ol>
<b>Intrinsic Motivation</b> <b>(A-IN)</b>	<ol style="list-style-type: none"> <li>1. I believe AR in retail will make my online or in-store shopping more enjoyable.</li> <li>2. I believe VR in retail will make my online or in-store shopping more enjoyable.</li> <li>3. I believe AR in retail will make my online or in-store shopping more fun.</li> <li>4. I believe VR in retail will make my online or in-store shopping more fun.</li> </ol>
<b>Affect Toward Use</b> <b>(A-ATU)</b>	<ol style="list-style-type: none"> <li>1. I believe AR is appropriate to use in online retail.</li> <li>2. I believe VR is appropriate to use in online retail.</li> <li>3. I believe AR is appropriate to use in physical retail.</li> <li>4. I believe VR is appropriate to use in physical retail.</li> </ol>
<b>Affect</b> <b>(A-A)</b>	<ol style="list-style-type: none"> <li>1. I would like to see more AR in online retail.</li> <li>2. I would like to see more VR in online retail.</li> <li>3. I would like to see more AR in physical retail.</li> <li>4. I would like to see more VR in physical retail.</li> <li>5. I would choose a retail distributor with AR/VR over the one without AR/VR experience.</li> </ol>

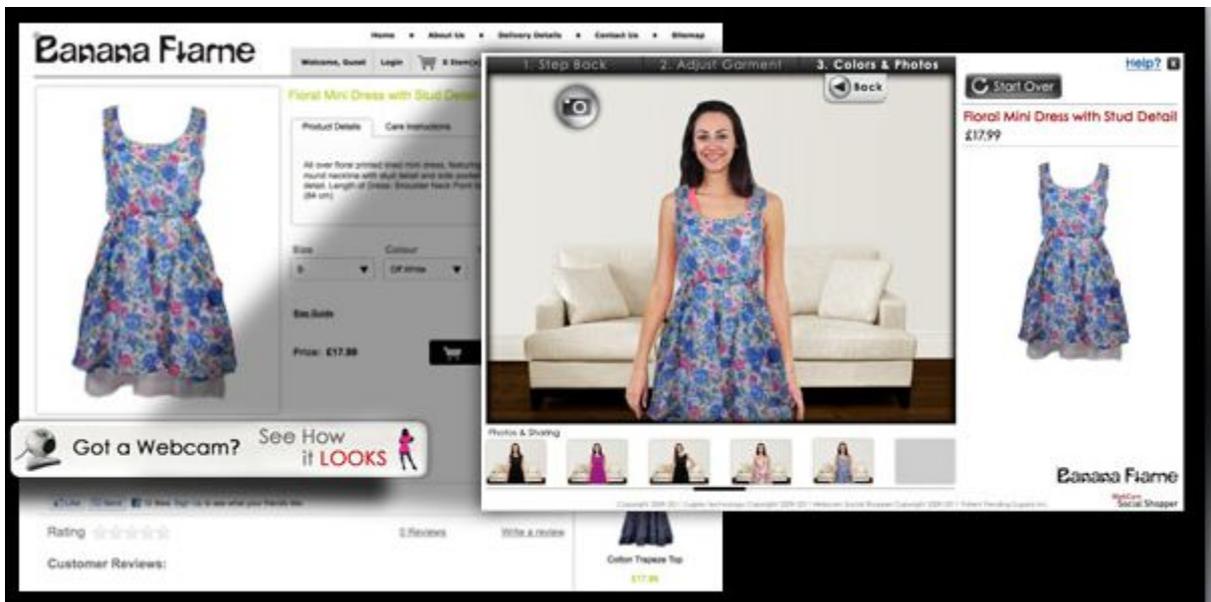
Facilitating conditions (FC)

<b>Compatibility</b> <b>(FC-C)</b>	<ol style="list-style-type: none"> <li>1. I believe AR will fit in my shopping routine.</li> <li>2. I believe VR will fit in my shopping routine.</li> </ol>
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## Appendix 2. Visual examples in data set



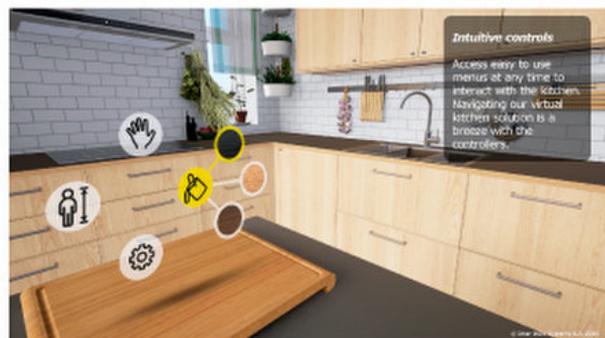
*BMW AG AR application allows to test out and customise all the colour, seat and storage options in real-time.*



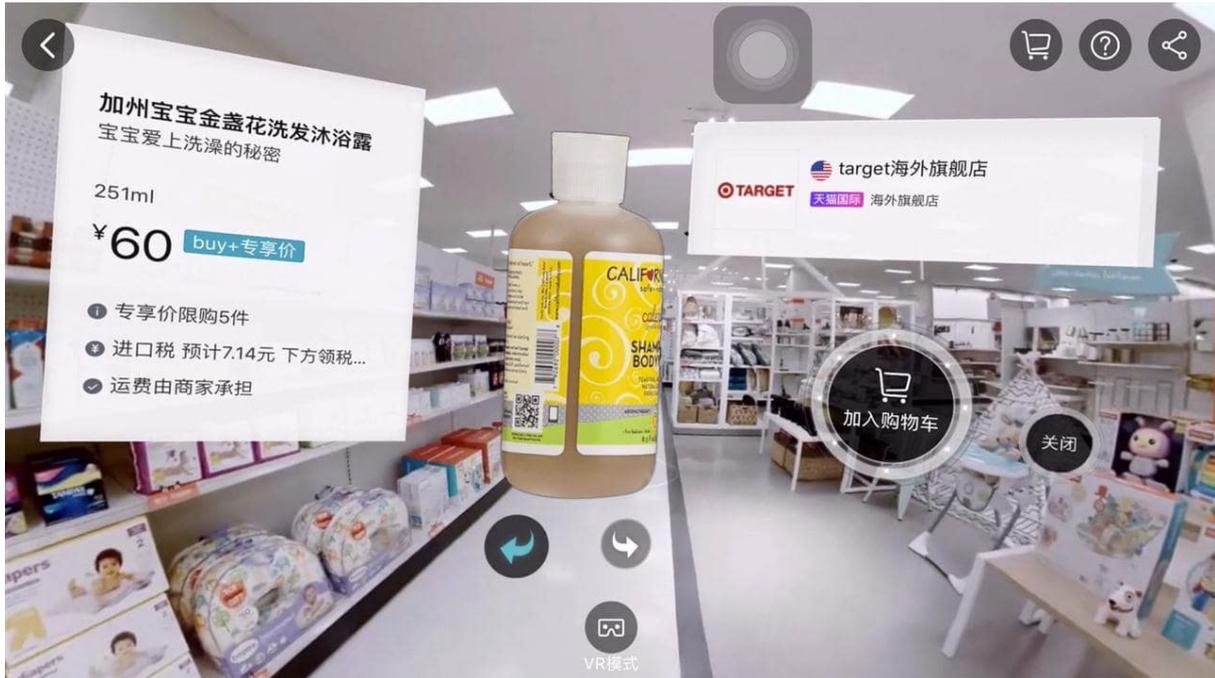
*AR mirror. With the help of AR technology customers are able to try on clothes in real time (via webcam at home or AR mirrors in stores).*



*IKEA Place AR phone application allows customers to fit digital furniture at their home.*



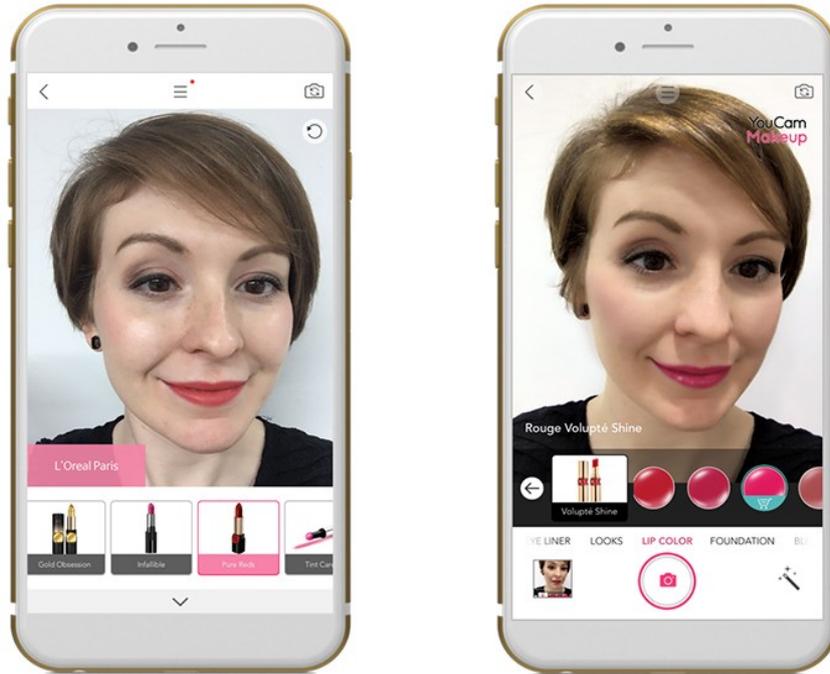
*IKEA VR Experience application allows to immerse into virtual room and try out IKEA furniture. The application can be used both at IKEA VR stations in physical stores, or downloaded online for personal use.*



*Alibaba Buy+ VR retail simulator implies an idea of a virtual mall, where customers are able to walk across “the shop”, examine products and make instant purchases within the simulation.*



*UNIQLO AR mirror. Example of in-store AR system.*



*Loreal AR mirror app. Example of online AR system.*



*IKEA VR. Example of in-store VR system zone.*

### Appendix 3. Axial coding: laggard example

<p><b>PE comments</b></p>	<p>“I would certainly try <b>AR online</b> because I can use it at home on my own and nobody would hurry me up, and I would not be <b>shy to figure the technology out.</b>”</p> <p>“I would probably <b>not try VR in-store</b> because VR helmet <b>does not look comfortable</b> at all. Moreover, it can destroy my hairstyle or makeup. I also <b>don’t know how I would feel</b> myself in a closed, dark space. Maybe I could try it at home, on my own, in some online store.”</p> <p>“AR, in general, is <b>more convenient</b> so that you just put your phone or tablet on a product, or stand in front of a mirror, and there is no need to put anything on, as in case of VR.”</p> <p>“I am sure that VR potentially can help me in retail, but the biggest problem and <b>stopping point is the helmet.</b> I don’t want to put it on, the idea of it seems inconvenient for me.”</p> <p>COMMENT ON AR AND LOW INVOLVEMENT PURCHASES: “How it can potentially help me with low involvement purchases? Maybe to show some kind of information about food products via AR when you put your phone on it, or what dishes to cook with this product. It can help, but <b>I would not use it on a daily basis</b>”</p> <p>COMMENT ON VR AND LOW INVOLVEMENT PURCHASES: “Can not imagine any scenario where I would use VR on a daily basis like for food or cosmetics.”</p>	<p>BI1 (positive)</p> <p>SI-SF2 (negative)</p> <p>BI4 (negative)</p> <p>EE-C2 = f (negative)</p> <p>EE-C2 = f (negative)</p> <p>BI1, BI3 (positive)</p> <p>EE-C2 = f (negative)</p> <p>PU9 (negative)</p>
<p><b>PE participant observation</b></p>	<p>The respondent is <b>not fully aware</b> of how much the technology is developed, so she was ensured that AR/VR as a concept itself will help in many retail scenarios.</p>	<p>EE-C2 = a (positive)</p>
<p><b>EE comments</b></p>	<p>“<b>Effort is not a problem.</b> It is not like learning a new language. But I would rather dedicate my time to learn more about AR, but not VR.”</p> <p>EASE OF USE: “I have never used AR or VR before, therefore probably <b>at first, I would not understand</b> how to use it. If no assistance or description is given and I would need my own phone or tablet to use, it is <b>unlikely that I understand</b> what and how to use on my own.</p>	<p>EE-C1 (positive)</p> <p>EE-C2 = a (negative)</p> <p>EE-C2 = a (negative)</p>
	<p>As I said I have never used it before so it would be <b>confusing</b> for me.”</p>	<p>EE-PEOU (negative)</p>

<b>Outcome Expectations (PE-OE)</b>	<p>“I would like AR/VR to make me <u>spend less money</u> for trying different things, like to eliminate a need to buy various options to see if I like it or not, and to <u>invest less time</u> to try different options. For example, no need to go to a store, or continuously put clothes on and off. In my case, it will also give me <u>less mental stress</u> because when trying clothes on I become very anxious when I can not find the right piece for a long time.”</p>	<p>PE-OE: save money PE-OE: save time PE-OE: decrease stress</p>
<b>SI comments</b>	<p>“I would not use VR <u>if there are many people</u> around this system.”</p>	<p>SI-SF2 (negative)</p>
<b>FC comments</b>	<p>“I <u>would for sure try AR/VR</u> if friends or family suggest(s), but only in case if I need a product/service itself. If assistant suggests to try AR/VR and I am already in store and interested in a product, but if they randomly come to me and ask to try something that I don't need, then no.”</p>	<p>SI-SN1 (positive)</p>