

Virtual- and Augmented Reality in Tourism Marketing



Bachelor's thesis

Valkeakoski, Bachelor of Business in International Business

Fall of 2020

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Title	Virtuaalinen ja lisätty todellisuus turismin markkinoinnissa.	
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TIIVISTELMÄ

Opinnäytetyön tavoitteena on esitellä lisätyn- ja virtuaalisen todellisuuden teoriaa ja käyttötarkoituksia. Teknologioiden kattavan teoreettisen esittelyn jälkeen opinnäytetyössä kuvataan lisätyn- ja virtuaalisen todellisuuden nykyisiä käyttötarkoituksia, sekä esitellään myös mahdollisia potentiaalisia käyttötarkoituksia tulevaisuudessa. Tämä opinnäytetyö keskittyy matkailualaan ja siksi näiden teknologioiden soveltamismenettelyt liittyvät kyseiseen alaan. Opinnäytetyön tavoitteena on tarjota esimerkkejä näiden tekniikoiden nykyisistä käyttötarkoituksista matkailualalla, sekä tarjota mahdollisia käyttötapauksia ja toteutustapoja heille, jotka eivät ole vielä ottaneet niitä käyttöön toiminnassaan ja palveluissaan.

Opinnäytetyön yhteistyöyrittäjä on HAMK Smart. Tässä raportissa tehty tutkimus koskee kyseisen organisaation kehittämää matkailuun keskittyvää VIKKE-älypuhelinsovellusta. Tutkimuksen tavoitteena oli kerätä opinnäytetyön tekijän valitsemilta testilentäjiltä palautetta, jota sitten tarjotaan parannusdatana yhteistyöyrittäjälle. Tämän tutkimuksen hypoteesi todettiin myöhemmin opinnäytetyössä; VIKKE:llä on pätevä idea ja visio sovelluksesta, mutta sovelluksen nykyinen muoto ja tila vaativat hiomista.

Opinnäytetyön oletetut päätelmät esitellään myöhemmin johdannossa. Lisätty- ja virtuaalitodellisuus ovat nopeasti kasvavia teknologioita, jotka tarjoavat suuria potentiaalisia liiketoiminnan parannuksia matkailuyrityksille ja -järjestöille, sekä palveluissa että markkinoinnissa. Näiden teknologioiden käyttöönotto ja tarjoaminen hyödyttää sekä palveluntarjoajaa että asiakkaita.

Opinnäytetyön loppuehdotus on, että matkailualan yritysten ja organisaatioiden tulisi sisällyttää lisätty ja virtuaalitodellisuus toimintaansa ja palveluihinsa.

Avainsanat Virtuaalitodellisuus, Lisätty Todellisuus, Turismi-markkinointi

Sivut 43 sivua, joista liitteitä 01 sivua

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ABSTRACT

The aim of this thesis is to introduce the theory and applications of augmented- and virtual reality. After a comprehensive theoretical understanding of the technologies, the thesis describes the current use-cases of augmented- and virtual reality and also introduces potential future use-cases for them. This thesis focuses on the travel- and tourism industry, and therefore the application methods of these technologies will revolve around this industry. The thesis aims to provide examples of current use-cases of these technologies within the industry, as well as to offer potential use-cases and implementation methods for those whom have not implemented them in their operations and services yet.

The commissioning company of the thesis is HAMK Smart. The conducted research in this report is on a tourism smartphone application called “VIKKE”, developed by the commissioning company. The aim of the research was to gather feedback from selected test pilots by the thesis author, which then will be offered as improvement data for the commissioning company. The outcome of this research was as hypothesized later in the thesis; VIKKE has a competent core idea and vision of the app, but the current form and state of the app is in need of some polishing.

The outcome of the thesis is as hypothesized later in the introduction. Augmented- and virtual reality are rapidly growing industries which offer great potential business operations improvements for tourism companies and organisations in both services and marketing. Implementing and offering these technologies will benefit both the provider and the customers.

The thesis concludes on the suggestion that companies and organisations within the travel- and tourism industry should incorporate augmented- and virtual reality in their operations and services.

Keywords Virtual Reality, Augmented Reality, Tourism Marketing

Pages 43 pages including appendices 01 pages

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LIST OF ABBREVIATIONS

App(s)	Application (<i>referring to mobile- and/or computer software</i>)
AR	Augmented Reality
BCI	Brain-Computer Interface
CAGR	Compound Annual Growth Rate
CAVE	Cave Automatic Virtual Environment
CPU	Central Processing Unit
GDP	Gross-Domestic-Product
GPS	Global Positioning System
GPU	Graphics Processing Unit
HMD	Head-Mounted Display
LED	Light-Emitting Diode
SME	Small and Medium-Sized Enterprises
UI	User Interface
UX	User Experience
VR	Virtual Reality
WTTC	World Travel and Tourism Council

1 INTRODUCTION

Exploring the world and longing for new adventures is a feature that is ingrained in the human nature. The excitement of experiencing and witnessing new environments are some of the greatest joys in life. As a result of this natural instinct and appeal towards exploration, it is no surprise that the tourism- and travel industries are some of the largest industries in the world. Travel has seen a rapid rate of growth as a result of globalization, and the growth is most likely going to continue. Other factors have been the rise of many countries from poverty, technological advancements, and the democratization of global travel through declining costs. The demand has also grown with the industry, and as well is not likely to die down.

A by-product of the digitalization of societies, and rapid technological advancements, has been a fundamental disruption of many industries. The travel and tourism industry are no exception. Examples of intriguing experience-focused technologies, that have seen rapid improvement and adoption in the recent years are Virtual Reality (VR) and Augmented Reality (AR). These technologies are not necessarily new-borns, but have experienced rapid development, and growing adoption recently. They are in the centre of the growing market of providing virtual experiences to people.

Virtual Reality (VR) is a digital medium as its name suggests. VR is often a combination of a head-mounted-display (HMD), headphones, and joysticks. This enables a complete visual and audial immersion for the user, and the joysticks act as movement controllers. VR hosts a multitude of different mediums and applications, but these areas and the further definitions of VR will be returned to in chapter 2.

Augmented Reality (AR) is a bit different from VR. Whereas VR attempts to immerse the individual in a virtual environment as much as possible, AR attempts to enhance the natural environment with digital inputs. The most common use case of AR is through a variety of mobile applications, acting as utility tools, information add-ons, or entertainment. AR often utilizes the smartphone camera and uses optical tracking to add digital input onto the surrounding natural environment and then displaying this on the smartphone screen. AR as well will be further defined, and its use cases explored in chapter 2.

It is essential to remember the abbreviations VR for virtual reality, and AR for augmented reality, as they will be often referred to as in these forms throughout this thesis.

The focus of this thesis is on how these two technologies can offer alternative experiences in the travel-industry, and how both individual agents and organisations within the tourism- and travel industry can benefit from them. There are existing services and experiences for consumers utilizing VR and AR, but nonetheless, it is an emerging sector

with large growth ahead. This thesis is going to introduce some of the current services offered within this market, as well as hypothesize the future potential services.

The timeframe of writing this thesis ranges from the Spring of 2020 to the Fall of 2020. During this period, the Covid-19 pandemic (also referred to as the Coronavirus) has more or less disrupted and halted the entire world. Businesses, schools, people, and entire countries entered lockdowns, which since have slowly expired the strictest regulations, leading to slow normalization again.

As a result of the pandemic, one of the hardest hit industries has been the tourism- and travel industry. As virtually every country initiated strict travel restrictions, as well as introducing restricting measures to the in- and outflow of people.

All of the airline companies drastically limited their flights, e.g. the Finnish airline *Finnair* reducing their flights as much as up to 90% during the strictest time-periods in spring of 2020. International travel came to an almost complete halt, not accounting to even a fraction of the regular volume of travel (Näveri, 2020).

This presents new difficulties and challenges to the participants in the respective field, but it also presents opportunities for accelerated and more extensive incorporations of innovative new technologies. These technologies can offer alternatives to the conventional techniques assumed to be the norms in the tourism- and travel industry. Some compelling examples of these technologies involve the formerly mentioned virtual- and augmented reality, which also are the point of interest of this thesis.

Commercial and non-commercial business has been disrupted in multiple ways, with one of the primary points of focus being on business travel, as well as being physically present at work versus work-from-home. Businesses have become increasingly aware of the at-times unnecessary business travel trips, as they have been able to complete these under the current unconventional situation utilizing digital channels, e.g. the online videoconferencing-tool Zoom.

In relation to this derives the question, whether there could be a digital alternative to the conventional experience-driven travel and tourism. Of course, staring at other peoples' journeys through the world from your conventional screens (e.g. TVs and monitors), are never the same as experiencing those journeys by one's self. Perhaps there is a middle ground, an intermediary between these two drastically different experiences. This is where virtual- and augmented reality come forward. They offer first-hand and personalized digital experiences, which lie somewhere in between these two conventional ends of experiences. This thesis is dedicated to exploring this ground in the middle, and what these technologies can offer for the marketers and participants in the travel- and tourism industry.

The thesis starts with relevant literature review and theoretical explanations of the subjects of this thesis. This will be followed with an overview of the tourism industry in Finland in general, and Tavastia Proper in more detail. A practical research and survey were conducted regarding a tourism app in-development called VIKKE. VIKKE is an interactive smartphone application developed by HAMK Smart, that acts as an entertaining utility tool to be applied when learning about the Tavastia Proper region and its history. The app will be given improvement ideas based on the research and analysis. Further application propositions regarding AR and VR are discussed, which will attempt to benefit potential marketers in the travel- and tourism industry in general.

The aim of the thesis is to focus on the following research questions and to find appropriate answers for them.

1. How can marketers operating in travel and tourism utilize the technologies offered by virtual- and augmented reality?
2. How could individuals and organisations in Finland and Tavastia Proper adopt them and benefit from VR and AR?
3. What service opportunities do VR and AR offer to the tourism- and travel industry?
4. What are the main focal points in need of improvement for the VIKKE-app?

The hypothesis for this thesis is that virtual- and augmented reality are costly technologies that are difficult to apply for low-budget firms with non-tech-savvy employees. These technologies offer further customer intrigue and create a more alluring and modern view of the company. As regarding the VIKKE-app, the feedback is likely to revolve around the unpolished interface of the app, as well as the early-stage feel of the app. The creative idea behind the app is likely to gather some positive input. The participants assumably have previous experience with AR and interactive apps, as well as tourism apps.

2 VIRTUAL- AND AUGMENTED REALITY

The following section is dedicated to exploring and analysing virtual- and augmented reality, and their application purposes and potential. This will be conducted by reviewing already existing research on these technologies.

So far, the discussion has introduced the potentials of these technologies and especially their future role in the tourism- and travel industry. The objective of this chapter is the thorough explanation of these technologies, what they are, how they work, and what they are used for. After understanding the fundamentals and the core essence of these technologies, planning business models for these technologies will be much easier.

2.1 Virtual Reality

Virtual Reality (VR) is a term and technology associated with the recent years and within the 21st century in general. However, VR already started around 50 years ago. The primitive stages of the technology would be recognizable to us still today, as the basic premise of the technology was similar. Although, the hardware was obviously very different (Slater, Sanchez-Vives, 2016).

The definition of VR varies depending on whether the focus of the individual specifier being on the hardware side of things or the experiences. For example, Immersive VR refers to building and structuring a digital environment in which they feel as if they're part of the virtual world. The hardware of VR varies. The first and most popular set includes portable head-mounted glasses with screens in front of one's eyes. These glasses with screens fully immerse the user's visual senses, blocking out all the external and natural world. These glasses are most often combined with joysticks and headsets for full immersion and interaction within the digital environment. There are, as well, entire rooms filled with a multitude of large screens filling the complete room or area. Plenty of head-mounted displays (HMD) have been developed throughout the years, and most of the mainstream options now have features such as a wide field of vision, tracking systems, stereoscopic displays, accelerometers, and gyroscopes. These features enable qualities such as the ability for the VR-set to recognise user's positions and movements, therefore being able to set the scene according to the user's position and movements. These are the most commonly adapted forms of the technology and are more familiarly referred to as "VR-headsets". The formerly mentioned rooms that act as a virtual environment in their entirety are referred to as fixed device systems, or VR-screen based systems. These fixed systems are used and developed in a multitude of areas of knowledge. The CAVE (Cave Automatic Virtual Environment) is a completely immersive VR system, that takes place in a cubic or square room, in which the subject is surrounded by walls with stereoscopically projected images, except on one wall. The subject uses stereoscopic glasses, which provide the subject with an illusion of a real world/environment (Loureiro, Guerreiro, Eloy, Langaro, Panchapakesan, 2018).

The popularity of VR is in a prosperous bloom. The technology represents new, innovative, and intriguing new customer experiences. The complete market size for virtual realities (VR and AR in particular) is expected to grow from approximately 27 billion USD in 2018 to 209.20 USD in 2022. This represents an exponential growth projection for the market size of these technologies and an explosion in demand (Loureiro et al., 2018).

However, a survey conducted by ContextWorld in 2016, settled on the conclusion that about a quarter of the population still had not heard about VR, and only approximately 10% of consumers have heard extensively about it. The survey reveals that only 1% of the participants owned a VR

device, and 10% of the participants had actual usage experience with VR (Herz, Rauschnabel, 2019, p. 229).

The outlook for VR is positive. There are a multitude of different growth projections for the technology, but one prominent one is from the banking giant Goldman Sachs. They've predicted the combined market for both VR and AR to reach \$80 billion by the year 2025. This would be comparable to the present PC market. The well-known Forbes Agency Council's market predictions from 2017 are also in line with Goldman's views (Herz, et al., 2019).

When studying the growth projections of VR, as well as its current adoption rates, it can be viewed still as a niche market instead of being a widely adopted technology. This may well change in the future as large companies such as Facebook, Samsung, and Google are constantly developing VR-hardware. As the technology evolves and becomes more appealing to the consumer base, wide adoption could take place in the future.

2.2 Augmented Reality

The definition of Augmented Reality (AR) has seen a variety of definitions throughout the years and a common simple definition has not surfaced yet. This is mostly due to the common understanding that AR is a developing technology and has not yet reached its full potential or final form. This has resulted in AR having a multitude of definitions depending on the context or method of applying the technology. However, there are some universal attributes and criteria that are regarded as necessary in order to classify the technology on hand as AR. The needed attributes include such as the connection between the virtual and real environment, the ability for the virtual environment to interact with the surrounding natural environment and be able to register and conjoin the artificial and natural environment and the objects within them. Essentially, AR is the integration of digital information through live video on the immediate natural surrounding environment (Jung, Dieck, 2017, p. 4).

The digital information in AR includes such as 3D models, text, video, and haptic feedback. AR also enables access to immediate information in the natural environment that was not accessible before, e.g. measurement apps using AR. The basic logic behind AR is to conjure computational information with the natural environment in order to shift the conventional desktop interface to real world-centred interface. Essentially using our natural world as the basis interface. In the recent years, the development and evolvment of smartphones has enabled new opportunities for the use of AR. As the hardware has improved, it has opened new possibilities for businesses to take advantage of AR. Many industries have already exploited this, and there will surely be more following (Evangelista, Ardito, Boccaccio, Fiorentino, Petruzzelli, Uva, 2020, p. 2).

2.3 Virtual Reality Applications

VR is objectively applied in a more varied variety than AR as of this moment. VR is very hardware focused and utilises a broader spectrum of software and hardware, than AR. VR is used in creative ways in different industries, software, and games. AR has a greater focus on smartphone apps as of this time. Therefore, AR often times seems quite similar between different apps, even-though the apps offer different use-cases and services.

As of today, VR has seen the creation of a variety of applications for different purposes. Some examples of these include 360-degree video apps, education apps, games, and applications for tourism (Herz et al., 2019).

One field that is projected to benefit from VR is education. Some studies suggest that students are able to receive and retain larger amounts of information and apply the learned information better, after engaging in VR activities. The potential enhancement in learning and educational purposes has understandably gained attention and interest within researchers, educational institutions, teachers, and other organisations. The VR applications and utilization methods in education vary from desktop use to HMDs (Radianti, Majchrzak, Fromm, Wohlgenannt, 2020, p. 2).

VR, like AR, is making a major impact, perhaps even a revolution, in the travel and tourism industry. This affects both industry related products and services. However, despite the obvious potential of these technologies in the industry, there is very little research literature focused on the current state of the subject (Loureiro, Guerreiro, Ali, 2020, p. 1).

2.4 Augmented Reality Applications

As smartphones have become a fundamental part of the every-day life, augmented reality (AR) -applications (apps) may become coincidentally essential to the daily life through consumption, utility, and marketing. The natural reality we operate in will be steadily supplemented with virtual/digital content. Developers and marketers will have to learn to exploit this beforehand of the wider acceptance of the technology in order to gain competitive advantage and innovative lead (Rauschnabel, Felix, Hinsch, 2019, p. 43).

AR is an innovative platform, which can be already been taken advantage of. The engaging format of enhancing the users' surrounding real world with virtual information is commonly referred to as AR. Some examples of the use of AR include; Pokémon Go, a smartphone app that combines the users' natural world and the digital world. Users can walk around with their smartphone with Pokémon appearing in different locations. The users can interact with these Pokémon through their smartphones and see them placed within their real world through the smartphone camera. The users can then attempt to capture these Pokémon, as well as battle with other users. Some other applications have also used AR, enabling the users to

try on different clothes using a virtual mirror, as well as trying out different furniture by placing them in their rooms with the AR apps. The AR-app field is expected to grow immensely in the future. An example of such a forecast is from Technavio (2017), which predicts an annual compounding growth rate of 31% for the AR market until 2021 (Rauschnabel et al., 2019).

The most prevalent use case of AR in this point in time is in Instagram and Snapchat, in which users can enhance their pictures with filters and additional objects, which are inserted using AR. This is a fairly simple use case of the technology and serves as a good introduction for more complex technologies in the future. Another widely used AR feature is with the Pokémon Go – app, which was discussed above. The amount of AR apps and features are likely to increase in this new dawning decade, as the consumer hardware gets better and enables more advanced AR features.

2.5 VR Hardware

The latest VR head-mounted displays (HMDs), for example HTC Vive and Oculus Rift, enable the users to have an experience involving deep immersion, that leads the users to be submerged in the virtual environment. Adding a pair of headsets to these displays enables such immersion, that the users may temporarily forget about the natural environment and be almost completely immersed in the virtual environment. The visuals, sounds, and touch interfaces (controllers) create involving stimuli, that allow the perception of the individual actually being there in the digital world (Radianti et al., 2020).

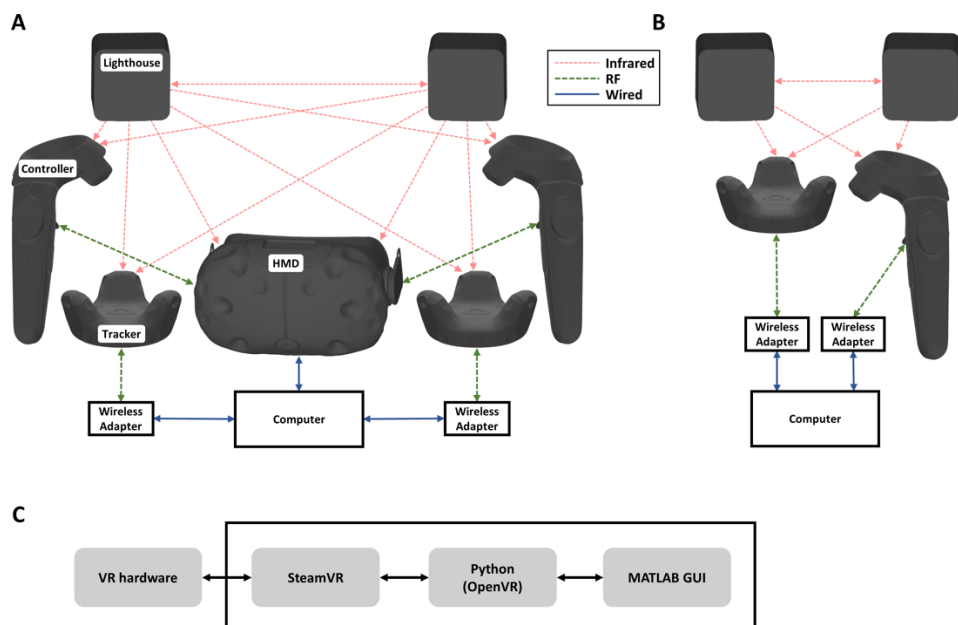


Figure 1:
VR HMD-set; HTC Vive (Cline, Coogan, He, 2018).

There are also lower-budget HMDs available, for example Google Cardboard and Samsung Gear VR, which enable a greater audience to have these virtual experiences (Radianti et al., 2020).



Figure 2:
Budget VR set; Google Cardboard (Johannsen, 2016).

These VR headsets are the typical approach, but another budget-friendly approach takes advantage of the consumers' existing hardware, e.g. smartphones, and mounts these in front of the viewers' face (Herz et al., 2019).

VR is already much utilized in the tourism industry, but it is still far from its future potential and wide usage. VR has been used for preparing tourists for attractions they will want to witness on their trips, as a mean to help them plan their upcoming adventures. But perhaps more importantly, it has helped consumers experience sights and attractions they would've not been able to witness in the real-world. As an example, a project in Google Earth called "Rome Reborn" enables people to explore and experience Rome in the shape it was centuries ago. These services offer much deeper immersions and experiences than would be possible via more traditional screens and media projectors (Loureiro et al., 2020).

Modern VR HMDs have positioning systems built into them, decreasing the need for external positioning and mapping gear. Samsung's GearVR is an example of an Inertial Unit. An inertial unit system indicates, that it is made of internal accelerometers, gyroscopes, and magnetometers. These devices yield fairly reliable and rapid rotational information. These three formerly mentioned sensors enable this rapid and reliable information when located correctly, via using high-performance fusion algorithms (Arnaldi, Guitton, Moreau, 2018, p. 120).



Figure 3:
Samsung GearVR (Samsung, n.d.).

Another hardware method is a combination of the inertial unit system and an optical system. The Oculus Rift is an example of this hardware engineering. This VR headset's inertial unit system operates similarly to the system mentioned above, but in addition, there are one or more infrared LEDs (Light-Emitting Diodes) in the headset, which calculate the orientation and position of the headset in relation to its surrounding environment (Arnaldi et al., 2018).



Figure 4:
Oculus Rift (Oculus, n.d.).

2.6 AR Hardware

AR requires both software and hardware in order to operate and function. Essentially, the software determines what needs to be done, and the

hardware executes the task. AR hardware consists of three basic components; sensors, processors, and displays. These combined into a single functioning unit of technology enable the use of AR, e.g. smartphones. Sensors are used for tracking. They measure and provide information of the real world. This information is processed by the engine of the unit, hence the term processor. The processed information is then displayed to the user on the display on the device, from which the user can view the AR enhanced world and interact with it (Craig, 2013).

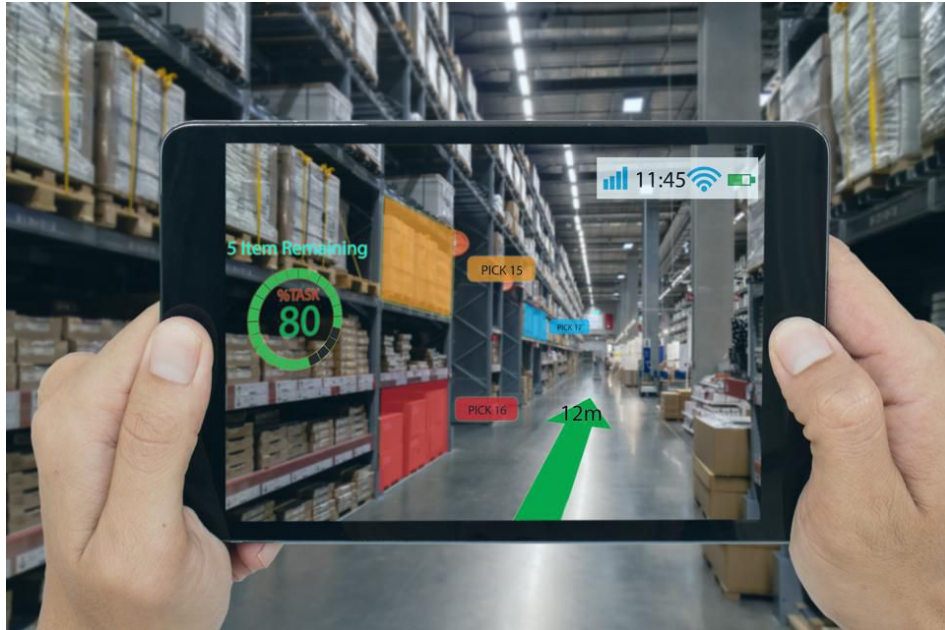


Figure 5:
AR on a display; AR in Business (Fade, 2019).

The most commonly used tracking method is optical tracking. It mainly utilizes the device's camera as an input method of information, that is analysed and processed by the device. GPS (Global Positioning System) is used most often as well, especially in outdoor settings. It provides additional information about the surrounding environment via compass, geographical location, and weather. The camera is the most commonly used and the most important part for tracking for AR.

Usually, the hardware used in processing the AR information consists of a single or multiple CPUs (Central Processing Unit) and GPUs (Graphics Processing Unit). GPUs are especially designed for processing complex three-dimensional graphics computation and information. However, the most common AR devices (smartphones) usually only include a single processing unit (CPU) that has integrated graphics (GPU) within it. Major advancements in technology have enabled such small devices to enable graphics processing of this multitude.

The display is the component that enables us humans to process the information displayed to us. The physical display is the most obvious and the most important part of the human decoding experience because our sight plays the biggest role in AR, but it is not the only sensory display provided to us. Often times there are also audio displays (hearing), haptic displays (feedback you feel physically), and some other niche sensory displays. The visual and audio displays provide the most important

information on AR, but the haptic feedback increases the stimuli and involvement with the digital reality. The most common experience of AR for people is via the visual information provided via the screen/monitor of our smartphones (Craig, 2013).

Recent technological advancements and developments on brain-computer interfaces (BCI) and nanotechnology are going to enable applications utilizing AR to flourish onto new frontiers. A multitude of large- and small-cap companies and researchers are working on developing wearable devices that take advantage of AR. Some current visions of the evolution of these technologies include these devices being as small as glasses or even contact lenses. This would enable intuitive AR interaction with the real world. It would lead to much more natural feeling technological interaction and enhance the connection people have with technology (Loureiro et al., 2020).



Figure 6:
Mojo AR Contact Lens (Sullivan, 2020).

Glass Enterprise Edition 2 is a wearable AR device in the form of glasses. These glasses developed by Google help industry professionals make their hands-on work more efficient through glanceable informative assistance, that is activated and controlled via voice (Google Glass, n.d.).



Figure 7:
Google's AR glasses; Glass Enterprise Edition 2 (Google, n.d.).

2.7 Companies and suppliers involved in AR & VR

Throughout the years as the technological advancements in AR and VR have taken great leaps, many companies have either entered the space, acquired start-ups in the space, or individuals have created their own start-ups in the industry. The adoption and interest in these technologies is growing rapidly, which explains the widespread corporate interest.

The total global AR/VR start-up valuations equate to 45\$ billion. When including start-ups that are not exclusively AR/VR, the valuation reaches 67\$ billion. This is excluding all the big names in the space, e.g. Facebook, Google, and Samsung. These valuations represent a hot start-up market, which is only going to grow (Merel, 2019).

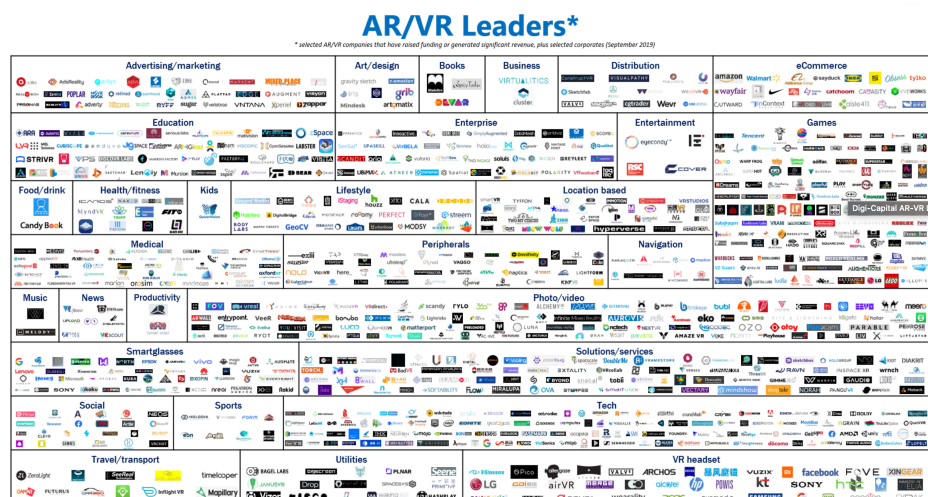


Figure 8:
An illustration of the amount of leading companies in the AR/VR industry. According to: (Merel, 2019), modified from: (Digi-Capital, 2019).

Table 2: Global Providers of Virtual Reality Software and Hardware*

Company	Headquarters	Year Founded	Number of Employees
Oculus	Menlo Park, CA	2012	--
Google	Mountain View, CA	1998	85,000
Samsung	Suwon, South Korea	1938	321,000
WorldViz, LLC	Santa Barbara, CA	2002	35
Bricks & Goggles	Breda, The Netherlands	2015	--
Marxent Labs	Kettering, OH	2011	30
Unity Technologies	San Francisco, CA	2003	2,000
Snap, Inc.	Santa Monica, CA	2011	3,100
Firsthand Technology	Seattle, WA	1995	8
Retinad Analytics	San Francisco, CA	2014	--

*Rankings from Datamation (<https://www.datamation.com/mobile-wireless/virtual-reality-companies-top-20-vr-companies-to-watch-1.html>)

Figure 9:

Global Providers of VR Software and Hardware. According to: (Thomasnet, n.d.), modified from: (Datamation, 2017)

2.8 VR/AR Growth Projection

As previously discussed, the expected growth rates for the adaptation and increase in usage for both virtual- and augmented reality are exponential. The explosive growth projections are good news for both the providers- and adapters of the technology. These technologies are expected to penetrate many existing and new industries. They are likely to increase customer satisfaction, -engagement, and -expectations. Below is a figure to help visualize the projected growth.

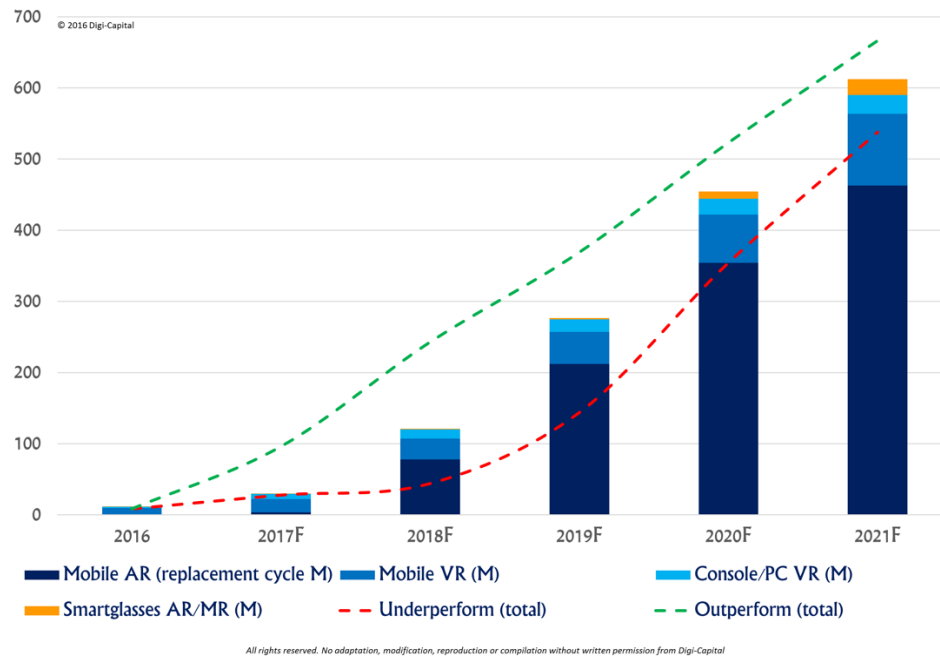


Figure 10:
VR/AR Installed Base. According to: (Merel, 2017), modified from: (Digi Capital, 2016).

3 BACKGROUND AND CONTEXT

3.1 The Current State of the Tourism Industry

The current year is 2020. As of writing this, the world has gone through various levels of lockdowns as an attempt to combat the spread of the Covid-19 virus. Better known as the Coronavirus, the virus originated in Wuhan, China, from where it took the world by storm as a result of its high contraction rate. The Chinese government has been heavily criticised for their seeming concealment of the virus in the early stages. This led to unawareness, upon on which the virus could grow into a pandemic.

The virus is an alarming health-risk, especially for the risk-groups. But, perhaps, the biggest impact the virus will ultimately have is economic, not medical. The coronavirus has completely obliterated economies worldwide and has turned GDP - (Gross-Domestic-Product) rates into a negative growth rate. This economic downfall has resulted from a multitude of variables, e.g. the closing of all non-essential businesses (excluding hospitals, grocery stores etc.), a distressing and extreme spike in unemployment, and the downfall of the customer-led economies through companies falling and consumers losing their jobs. This has led to a major decrease in spending and the monetary flow within the economy.

Most industries have seen unprecedented losses, while some have seen some of their strongest growth so far. The streaming giant Netflix has seen enormous growth as people have spent more times indoors because of the

pandemic. Another benefactor of the period has been the online-retail giant Amazon (BBC, 2020).

However, most companies and industries have fallen on their backs. Perhaps one of the worst affected industry is the travel- and tourism industry. Countless airlines, hotels, restaurants, and cruise lines have filed for bankruptcy, and the industry as a whole is going through a nightmare scenario.

As the worldwide travel and adventure came to a halt, it raised a need for alternative means of exploring the world. Nature documents are adored, and travel-series are seemingly popular. However, staring at someone else going through these experiences on a traditional screen is not the same as being there yourself. VR and AR could potentially be the factors that bridge this gap between in-person and tv. VR, especially, could potentially offer digital in-person experiences within the travel-realm, that could give a truthful glimpse of experiencing it physically yourself. This could be well utilized in marketing these experiences and locations, as well as be an alternative experience to the traditional physical presence in a location.

With the growing concern over the impacts of air-travel on the environment, and over the threat of new pandemic-spreads, these technologies can attempt to offer a digital alternative to some planned conventional in-person trips.

3.2 General Overview of Tourism in Finland

Tourism's part in Finland's economy has increased during the years and it's become an ever more important focal point to focus on. Finland's collective revenue from tourism has been around 14 billion Euros for several consecutive years. The 15 billion mark was reached in 2017, and an approximate of 4,6 billion was spent by foreign tourists. As of 2018, the tourism sector also employs an estimated 140,200 people in Finland. The portion of tourism in the Finnish economy in terms of GDP (Gross Domestic Product) has been around 2,6% during 2011-2017. As of 2017, overnight visits consisted of 15.2 million domestic tourists, and 6,7 million foreign tourists. Russia is the biggest source of foreign tourists at this moment, and the biggest growth was seen from the Chinese (+35,8%) (Ministry of Economic Affairs and Employment of Finland, n.d.).

As of 2018, the number of non-resident over-night visits reached 6,8 million, representing an increase of 1,3% from the previous year. The top five nationalities of foreign visitors are as the following (from first to last); Russia, Germany, UK, Sweden, and China. The fast growth of the travel industry highlights Finland's potential to become the most attractive travel destination within the Nordic countries (Business Finland, 2019).

The four major tourism regions of Finland are; Lapland, the Finnish lake district, the Helsinki region, and the coastal region and the archipelago. These regions offer diversity in landscapes and experiences. These regions create the foundational attractions for Finland, upon to which more sub-

regions can be marketed and offered. With national cooperation Finland can achieve great growth with foreign tourists and increase its visibility on the international stage (Business Finland, 2019).

Tourism in Finland has also taken use of the virtual possibilities offered by new technology. These will show their importance in times like these, when travel has drastically decreased, and tourism has come to a temporary halt. One of the leading tourism organisations in Finland is VisitFinland. VisitFinland has professional and high-quality social media presence and digital content. VisitFinland offers several virtual experiences of Finland on their website, including; a virtual tour of Helsinki, a 360-degree photography experience of Suomenlinna, a wide variety of photography from around Finland, culture videos e.g. Finnish Opera and Ballet, and informative descriptions of several historical sites in Finland and museums. There is also a sub-website of VisitFinland titled “Visit-Häme”, which focuses on both virtual- and in-person tours and experiences of the historic Tavastia Proper region (VisitFinland, 2020).

3.3 Tourism in Tavastia Proper, Finland

Tavastia Proper (Kanta-Häme in Finnish) is the region in-between four major cities; Helsinki, Tampere, Turku, and Lahti. Hämeenlinna is the biggest city in the region, as well as its heart, located strategically in-between Helsinki and Tampere, an approximate 100 km (kilometres) from both.

Tavastia Proper has an approximate of 10,000 ha (hectares) of parks and nature reserves, 785 lakes, historical sights, and lots of other services. Tavastia hosts multiple small-to-medium sized cities with their own characteristics. Hämeenlinna is a historical city with lots of traces to the medieval ages, such as the Hämeenlinna Castle, which has its first recorded mention in the year 1308. Some other cities in the Tavastia region include Riihimäki, Janakkala, and Forssa, which have lively nature and handcraft industries, and -traditions. Some popular attractions include medieval history, a multitude of museums, and national landscapes. Hämeenlinna, in addition to the castle, also hosts popular military museums, nature sceneries, and historical sites dedicated to the legendary composer Jean Sibelius, whom was from Hämeenlinna. It is said that Aulanko’s nature-scenery inspired Sibelius’ Finlandia (Visit Häme, n.d.).

3.4 Virtual Reality During the COVID-19 Pandemic and in Tourism

As the world has mostly moved to remote work, travel has decreased to marginal levels, and the basic social interactions have been limited, people are turning to technology for help. The demand for digital tools to enable increased productivity, entertainment, and social interaction has increased dramatically from the normal. VR is a form of technology that is more stimulating and involving than the more conventional use cases of technology we’re used to. It narrows down the gap between the real world and the virtual one. This will potentially lead to greater consumer/user

satisfaction as the experience feels more significant than the regular digital channels consumers are used to.

As the ongoing COVID-19 pandemic still has the world in an unpredictable situation, healthcare is one of the industries that could benefit from VR. VR could be used for the further education and training of the medical staff. This could potentially lead to increased efficiency and accuracy of the provided healthcare services throughout and after the pandemic. This simulation-based teaching – and learning method makes VR a more feasible tactic as it is almost translatable to the real-world situation. Some of the major concerns the pandemic has emerged within the health care industry include; more thorough medical training, patient treatment, more effective medical marketing, and spreading disease awareness wider. The educational approach utilizing VR provides the staff an edge to take the epidemic head-on, by the enhanced skills, confidence and attitude boost, and increased performance, all offered through better education as a result of VR. This method of educating the staff results in improvements not only in learning, but also in case handling strategies. There are plenty of advantages proposed to be gained from the utilization of VR within the medical staff. Some of these can be seen in the following figure (Singh, Javaid, Kataria, Tyagi, Haleem, Suman, 2020).

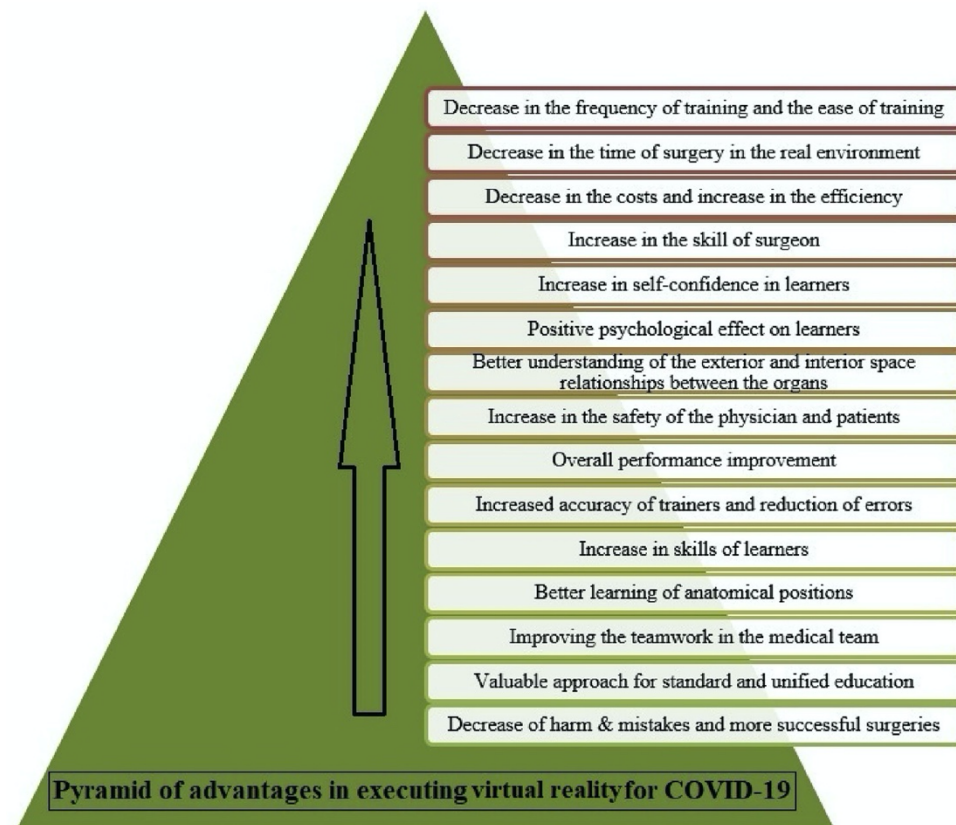


Figure 11:

Proposed advantages of VR during Covid-19 (Singh et al., 2020).

As formerly discussed, the travel- and tourism industry is one of the worst affected industries as a result of the outbreak. The World Travel and Tourism Council (WTTC) has given alarming warnings stating that the industry could potentially see job losses reaching 50 million worldwide.

Different measures have been taken in order to protect the industry, and governments have had to step in in order to save the industry from drowning. There have been calls for temporary state aid for the sector, e.g. multiple airline bailouts, governments purchasing more ownership in the airlines, simplification and ease on visa-rules, and increased budgets in promoting and marketing the travel destinations. This latter proposition is where VR comes in (Rogers, 2020).

VR can serve as a preparing medium that provides potential leads with virtual tourism experiences, that are much more immersive and engaging than regular tourism ads and videos. The ability to make the users feel like they are at the destination without being physically present there is a unique new medium enabled by the technological advancements in VR. This pre-experience may potentially lead to increased desire to experience the destination in real life after the pandemic. This could lead to increased demand once the situation has eased up (Rogers, 2020).

A company named Travel World VR provides travel companies, -agencies, and -organizations with technologies that can be utilized into making truly immersive 360-degree videos and pictures of any destination. These 360-degree cinematic productions can take customers through major destinations and sights, resorts, cruise lines, or even places that are not accessible in real life. This innovative approach in attracting customers will create a new kind of buzz that will lead to increased sales for the promoting actors. VR has been even brought to planes and lounges for better customer experiences by Skylights, the first company to bring VR to passengers. For example, customers are able to experience forward-facing 360-degree movies in an immersive movie theatre experience, while travelling (Rogers, 2020).

However, the simplest and perhaps one of the best ways to experience virtual travel is via Google's Google Earth VR. An individual can travel to relatively anywhere in the world, if they own or have access to a VR-hardware. It's considered an essential for VR users, and even though it is one of the best tools out there, it is completely free. Travelling around the world, immersed in a digital world, could be a great escape for people stuck in their quarters during the pandemic (Rogers, 2020).

VR-tourism experiences are actually quite similar to the traditional tourism experiences. Despite the fact that the other happens virtually, both of them are traditionally carefully curated. The customers are shepherded to the handpicked famous landmarks and sights, which only hold a limited part and representation of the locations cultural and environmental background and history. This same mentality has therefore naturally been implemented into the VR tourism space as well. Despite the fact that VR enables tourism experiences that would be unavailable for most of the people, a large focus is put on the traditional tourist attractions. However, this brings some positive side-effects. For example, the environment could greatly benefit from this shift in tourism. As many of these famous locations are under heavy strain from an influx of continuing tourism, a

virtual alternative could provide a great option for the growingly environmentally conscious population (Chandler, 2020).

The VR experiences, that are conventionally seen as unattainable in the real world, introduce some extremely intriguing experiences. For example, a French start-up FlyView operates and provides a VR experience, that makes the user see Paris from the view of someone jetpacking over and around it. As there won't be people jetpacking around Paris, at least in the near-term, this is just another example of an exciting experience provided by the technology. Another example would be a "virtual reality wellness experience" introduced by a Four Seasons Resort at Ko Olina. In their project, the users are able to take on relaxing journeys through the deep space, -ocean, and -caves, all of which are mostly unattainable to humans at this point in time. These exotic experiences create an expansive contrast for the technology, along with their more mundane or traditional virtual tourism experiences (Chandler, 2020).

However, despite all of the growth projections on the segment, one should not expect VR-tourism to take over traditional tourism anytime soon. People will still want to physically travel and explore, but VR could work as a great add-on and substitute for some trips. VR could play a great hybrid role with traditional travelling, resulting in lowered strain on the environment and enabling people to have exponentially greater sums of adventurous and explorative experiences throughout the world (and beyond) (Chandler, 2020).

How authentic VR feels as either a substitute or an add-on in tourism, depends majorly on the users' own acceptance and attitudes towards the technology. Naturally, if one evaluates these experiences objectively, they are inauthentic. However, when the subject approaches the VR substitute with an open mind and is open for positive influences of the capabilities of the technology, their conceptualization of the authenticity may result in a more positive and constructive outlook of the technology working as a substitute to conventional travelling and tourism. Authenticity can be argued to be a socially constructed concept, that is a subjective and negotiable concept. Accepting VR tourism as a different kind of an alternative to conventional travel, may enable one to approach and utilize this technology in a more open format and mindset (Guttentag, 2010).

3.5 Augmented Reality During the COVID-19 Pandemic and in Tourism

AR may not be as immersive as VR, but it is still more engaging than many of the more conventional content consumption channels. AR is a rapidly emerging field, which has possibly gained even faster and greater traction due to the slowed-down and digitalized state of the world currently. AR provides potential utilization methods for many different industries to innovate new services and media interactions to their target audiences. Whereas VR works as a sort of alternative medium for the real world, and attempts to isolate the two, AR strives to integrate these two and mediate a hybrid version of reality. In a sense that it provides

additional data and information infused to our real world surrounding through seamless and effortless ways.

The emergence of disruptive technologies, e.g. AR in this case, have always forced industries to adapt and innovate. It has changed the tourists' behaviour in information search, decision making, as well as in product and service purchasing. Studies have shown that smartphone use has become an essential part during the tourists' travel experiences. As everyone is so dependent on their smartphones on every front of their lives, and even increasingly so when travelling, an opening is presented for wider adaption of AR. AR encourages tourists to explore unfamiliar environments while providing the users with intriguing and extensive knowledge to increase their experience satisfaction. Museums for one are positioned to greatly benefit from this technology and modernise their offerings and operations. This could lead to more immersive experiences to the visitors and increased demand and interest. The more interactive nature of AR could provide much more engaging and informative experiences to the visitors. Additionally, to the educational and interactive benefits, AR has been found to provide and enhanced experience especially in the cultural heritage sector. It additionally creates business benefits and secures additional revenue-sources and decreases the seasonal nature of the operations (Cranmer, Dieck, Fountoulaki, 2020, p.2).

Even as AR is seen to greatly enhance the tourism experiences in the moment, AR is seen to offer potential in the pre-booking and information gathering stage. AR creates a more emotional reaction in the potential leads due to its instant interaction between the company and customers. This is a more effective booking process than the traditional brochures and videos usually utilized in the industry. An example would be the hotel giant Marriott, which developed an AR application to showcase their more exclusive resorts, which enabled the potential customers to explore and interact with these locations they would have not previously even considered or been interested in seeing. In an overall resolution, AR adoption results in better tourist experiences, improved customer-satisfaction, -attitudes, and -behaviour. As for the businesses, adopting AR is a crucial technology to take use of in order to ensure profitability, competitiveness, innovativeness, and improvement of offered products and services. Those whom are not adaptable with the emerging technologies, will be eventually left behind. However, despite the studies and evidence provided of the benefits of AR, focus on AR in terms of tourism suppliers is still scarce. This, however, is most probably going to change in future (Cranmer et al., 2020).

The future of AR seems promising in terms of how fast the sector is expected to grow. The global market for AR is expected to grow with a 65% CAGR (Compound Annual Growth Rate) from 2019 to 2024. The major drivers driving this growth include the high penetration of smartphones and their enormous market size and consumer base, and additionally the rapidly evolving and innovating AR industry that's penetrating new markets and expanding in already existing ones, e.g. e-commerce and tourism (Business Wire, 2020).

4 METHODOLOGY

4.1 Scope

The main purpose for this thesis has been to explore the technologies of VR and AR. The discussion has led through the basics of the technology, to the application purposes, and narrowed down to applying them in the tourism industry specifically. Despite the AR and VR industry still being an emerging industry and still being in its rather early adoption phase in the travel- and tourism industry, the purpose of this thesis is to research and contemplate the current landscape and to reflect on the future potential and outlook of these technologies and the industry.

The study conducted for this thesis is an unbiased user-focused evaluative feedback on a virtual tourism experience. This experience is built on a smartphone-app, which offers a virtual tour of the Tavastia Proper region. The sample size of the study consists of six participants, whom were first-time-users of the app. The participants were not anyhow connected to the app nor its developer base. The test-drive of the app was conducted in two separate groups and in two separate times. Both taking place in Hämeenlinna. After testing the app, the participants were asked to fill an evaluation survey based on their experiences. This feedback was gathered for the purpose of analysing it for the improvement of the app and general thoughts on virtual tourism experiences. The combined time for the test and evaluation was an approximate of one hour for both groups.

4.2 Limitations

The sample size and demography for the study would be of greater variety in optimal situations. The majority of the participants were originally from Tavastia Proper, and the rather condense sample size consisted of only males. However, taking the infancy stage of the app and it's userbase into consideration, the sample size and demography was not too limited.

The target of the research introduced some limitations as well, in regards of the wider scope of this entire thesis. Despite of offering an interactive virtual tourism experience, the app does not apply neither AR nor VR. However, the app provides some interactive nature through location services. To compensate for this, the study asks about other AR-experiences of the participants, as they are most often also in the form of a smartphone-app.

The early stage/age of the app as well does not offer as thorough experience to the participants, as a more developed and matured app would. This does, however, present the app development with valuable feedback upon to which improve.

The time that the participants had for this was not perhaps as optimal as it could be. As some apps often have time-consuming, thorough, and deep evaluations from test users.

Also, as most of the test pilots were either from the Tavastia Proper, or were already familiar with it, the content of the app was approached with familiarity. Having for example foreign tourists not familiar with the region could've added valuable diversity of feedback.

4.3 Commissioning Company

The commissioning company for this thesis is HAMK Smart. HAMK Smart is HAMK's research unit, which supports commerce, industry, and the broader society in service development and digitalization. Some of the objectives and tasks of the unit include; creating and executing R&D activities for both the Tavastia Proper region in general and the enterprises that reside within it. These are executed in co-operation networks. The unit especially specializes in the utilization of digital tools and - technologies, and business development, which they mentor, and which can be implemented to a variety of industries and sectors of business (HAMK, 2020).

4.4 The Target of the Study

The target of the study and evaluation is a mobile application called VIKKE. VIKKE is an app published and still currently developed and improved by HAMK Smart. It offers a virtual tourism experience of the Tavastia Proper region.

VIKKE brings interactive information about the Tavastia Proper region to both visitors and locals. The information is displayed in a playful story-manner, and the different locations of which the story is told are marked on map locations in the app. VIKKE is essentially a virtual culture-trip in Tavastia Proper. The app is still a work-in-progress, meaning it is still in its development- and evolving stage.

5 RESULTS AND FINDINGS

5.1 Research Implementation

The following figures represent the quantitative research performed via the application Google Forms. The purpose of the questionnaire is to work as a productive feedback outlet for the VIKKE-app. Six test pilots were recruited for the testing of the app, and after testing the app together in two separate sections, the participants were asked to fill out the questionnaire in their truthful and intuition based experience. The objective was to gather overall feelings of the app, and additionally singular ideas and criticisms in order to improve the app based on user feedback. Each question and answer are marked by the acronyms "Q+#" and "A+#" and are placed right above each one of them. There are 15

questions and answers in total. The questionnaire was created by the author, and the answers were collected and analysed by the author as well.

5.2 Research –Questions, and -Answers

Q1:

What is your age bracket?
6 responses

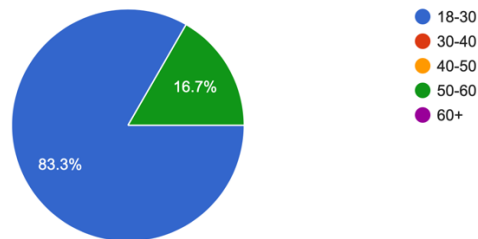


Figure 12:

A1:

All of the six test pilots were in their 20s, excluding one who was 60.

Q2:

Which gender are you?
6 responses

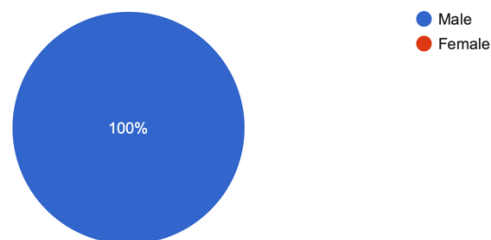


Figure 13:

A2:

All of the test pilots were male.

Q3:

Are you originally from Tavastia Proper (Kanta-Häme)?
6 responses

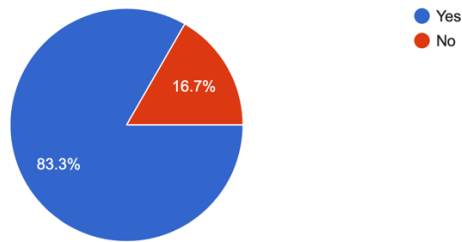


Figure 14:

A3:

All of the respondents in their 20s grew up in Tavastia Proper, excluding the one older respondent who was from Pirkanmaa.

Q4:

Have you had any previous experience with Augmented Reality?
6 responses

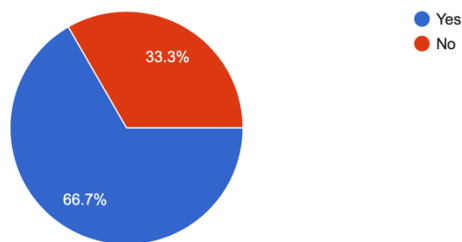


Figure 15:

A4:

Four (three in reality, explained in the next paragraph) out of the six test pilots had first-hand experience of augmented reality in some form.

Q5:

⋮
If yes, with what hardware and software (e.g. apps)?

Long answer text

Figure 16:

A5:

Four responses in total. Three of them had experience from the global AR hit Pokémon Go. One of the respondents had experience also in IKEA's Place AR-app and another respondent had experience in Hämeenlinna's Hämeenlinna AR-app. The fourth respondent's previous question had glitched which led to an accidental "yes" -answer even though he did not have experience from AR.

Q6:

How were your first impressions of VIKKE? *

Long answer text

Figure 17:

A6:

Six responses;

“The user interface was perhaps a bit clunky and not aesthetically pleasing. However, I did like the basic idea of the app.”

” It looked simple. Maybe a bit unfinished.”

“Idea is solid, but I feel it lacks something. Maybe more pictures, or statistics of the locations to get people more intrigued.”

“It looked simple to use and have nice theme on it.”

“The app wasn't the most inviting one looks wise.”

“Interesting as an idea and execution. I’m missing a fact-section next to each of the story-parts. The story alone is not interesting enough and leaves a bit of an amateurish-feel. Additionally, in some parts the text ends in the middle of a phrase. These kinds of errors should be carefully looked for and checked before publishing.”

Q7:

What were your thoughts on the user interface? Would you change something?

Long answer text

Figure 18:

A7:

Six responses;

“It was not well optimized for iPhones without a home button, and the overall aesthetics could use a overhaul. The UI elements could be improved with smaller fonts, better colours, more intuitive UX design, and better use of the space on smartphone screens.”

“Not a huge fan of the medieval theme, but I understand the point fits the storytelling aspect and the area.”

“Text was too large and there was a small amount of stuttering when scrolling through the text. Overall look felt good though.”

“Texts were a little bit clumsy sometimes.”

“I would change the design almost entirely.”

“Every section should be balanced in a way, that would add a fact-section next to the story-section.”

Q8:

Did you prefer the storytelling approach taken on the app? Rather than a more traditional "fact package".
6 responses

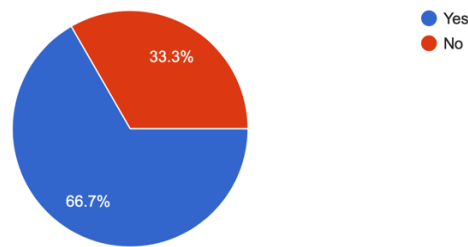


Figure 19:

A8:

Four out of the six respondents preferred the storytelling – approach to the more traditional “fact-packages”.

Q9:

Did you enjoy the interactive nature of the app with the different locations?
6 responses

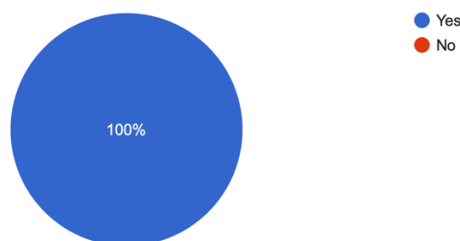


Figure 20:

A9:

All of the respondents appreciated the interactive nature of the app that utilized different locations and guidance around Tavastia Proper.

Q10:

Are there some specific locations that you would've liked to see in the app, but were missing?

Long answer text

Figure 21:

A10:

Four responses;

“Maybe a bit more history about the castle itself, as well as about the early history of Tavastia.”

“Nothing comes to mind.”

“Janakkala region. A bunch of interesting civil war history, with ancient ritual sites etc.”

“I think there were plenty enough of locations.”

Q11:

Would optical tracking via your smartphone's camera increase your engagement with the app?

6 responses

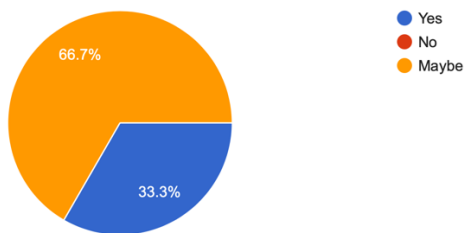


Figure 22:

A11:

None of the six respondents thought optical tracking through their cameras would have not increased their engagement with the app. Two thought it would definitely increase their engagement with the app, and four thought that perhaps it could increase their engagement.

Q12:

Do you have any improvement ideas for the app, in order to improve the overall user experience?

Long answer text

Figure 23:

A12:

Four responses;

“Revamp the overall user interface, and to my taste there could be a bit more of those traditional and “boring” historical facts additionally to the story telling aspect.”

“The application could look more professional.”

“Making the app a bit sleeker would maybe increase its attractiveness.

Also, in addition to the texts, some video- and audio-clips could maybe enhance the overall experience as well.”

“Nothing additional to the previously mentioned.”

Q13:

How likely would you recommend this app for a friend interested in learning about Tavastia Proper?

6 responses

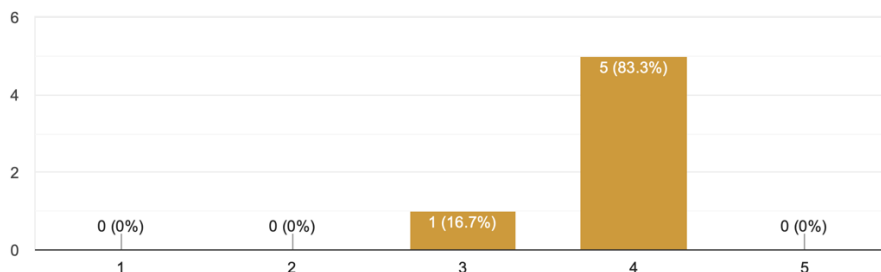


Figure 24:

A13:

Five of the respondents would recommend the app to their friends, and one of the respondents was neutral in this. The scale went from 1 (would never recommend) – to 5 (would highly recommend).

Q14:

Have you had any other experiences with any other tourist or location guides via apps? If so, where and how was it?

Long answer text

Figure 25:

A14:

Five responses;

“I’ve used Google’s AR features on their apps a bit when travelling, but that’s about it.”

“I’ve actually tried "Hämeenlinna AR" in Hämeenlinna. That app was quite good, and I enjoyed the added "AR" side of it that used your smartphone's camera.”

“No”

“TripAdvisor, almost always useful when planning my trips beforehand.”

“Yes. Vanha Rauma (Old Rauma), and in a few different locations in the U.S.”

Q15:

Any other optional feedback:

Short answer text

Figure 26:

A15:

Three responses;

“A fun way of providing visitors (or locals) information of the Tavastia region.”

“Decent idea, maybe just needs a software overhaul.”

“A nice idea. With some improvements and sharpening this app can become very decent. I had not heard of VIKKE beforehand, so some additional “info-packages” could bring it forward to a larger potential userbase.”

(Peltonen, 2020)

6 ANALYSIS AND DISCUSSION

6.1 Research Implications – User Testing

As formerly stated, the test pilots/participants of the research were all male with everyone being in their 20s with an exclusion of one individual in his

60s. All of the participants were originally from Tavastia Proper, in which they also grew up in. Again, with the exclusion of the one older individual.

Half of the participants had prior experience with augmented reality. However, the question regarding optical tracking indicates that despite the lack of experience, all of the participants were interested in trying AR and believed to various extents, that applying AR through optical tracking via smartphone cameras would've made their experience more engaging. When judging through this marginal test group, it would be a great idea to add optical tracking to VIKKE. This additional feature would potentially make the app more engaging and immersive to its users. For example, providing real time data in the various locations via AR would result in a more profound experience. Also, as stated in the former chapters, studies have shown AR to greatly improve user immersion and satisfaction. When users feel like the provided technology is more advanced than the competition, and when it provides higher and extended user satisfaction and -experience, they are more likely to use the app and interact with it more and longer.

The app itself was criticized for its overall looks and navigating experience, but complimented for the core idea of the app. When reflecting on the gathered data and feedback, the suggestion arises towards the redesigning of the overall user interface (UI) design of the app, as well as the user experience (UX). A more intuitive and minimalistic approach to the design of the app would make it more inviting. Having some space in the app as a way to let it "breathe", would result in a less cluttered and amateurish feel. Additionally, incorporating more factual information with the story-based approach would satisfy knowledge-hungry users and a generally wider userbase. Adding video- and audio-content to the app would result in an extensive and content-rich experience. Having only one content- or media-medium may give off a lacking and empty feeling for the app.

The interaction between the physical locations and the information in the app is a great start for an engaging app. This approach was appreciated. However, furthering the depth of interaction between the user and the app through technologies such as optical tracking, would give an entirely different impression of the app, in regards of its technological advancement and user satisfaction and -intrigue. In addition, reconfiguring the text placement and fonts, and making sure they are well optimised for different devices, would vastly improve the app towards a more professional feeling software.

To conclude the gathered data and impressions from the test pilots, improving on the core idea and implementing add-on features and technologies would further increase the user engagement. Most importantly, the overall design and user interface of the app is in due of an update. Learning from other already existing apps helps in redesigning the app and reconfiguring the interactive elements in the app. The app has potential but is naturally in need of some improvements.

6.2 UX Design - Heuristic Evaluation

This following heuristic evaluation has not been conducted by an external usability expert. It was conducted by the author of this thesis, based on his own experiences and evaluations of the app.

In a heuristic evaluation the objected software or website is evaluated by usability experts. The interface of the target is evaluated and compared to, based on universally followed and accepted usability principles. The objective of the study is to find errors or issues in the overall usability and experience of the software or website. The process is usually outsourced to multiple external experts in order to get unbiased and different contrasting feedback (Usability.gov, 2013).

Heuristic evaluation in UX design can be divided into ten separate segments which to evaluate. These include; the overall visibility of the system, cohesion between the software and the real world, granted control and freedom of the user, consistency within the app and following the standards, preventative measures of errors and glitches, intuitive recognition of tools for the user without the need for memorizing and recalling, easy and flexible use of the software, pleasing design, easy recovery from errors, and access to help and other potential documentation (Schlecht, 2019).

The visibility within the app is decent. There aren't overlapping elements and the overall features in the app are simple, so the user is aware of what they're performing at all times. The infusion between the app and the real world is cohesive. The user will be able to correlate between the information and locational data provided in the app with the surrounding correct environment. The app is simple to follow as it gives you the information of the precise location for each of the stories. As stated before, the app is very simple in terms of features and design, so the app will not feel limited in terms of user freedom, as there aren't many features to be free with to begin with. The app maintains good consistence in terms of the theme and operations. The actions to open and close different stories and locations are just a matter of a couple clicks. However, the design is not without errors, as the text disappears mid-sentence in some cases, and the app layout and text placement are not optimised for all devices. Navigating in the app is simple and marked out with button placements, acting to the users' benefit as they are not required to learn or remember any specific navigating performances. In terms of usability, the app is simple and efficient to use. This is good in an operational viewpoint, but as the app in its core design is so simple, this should not be taken as a position of strength. User interface (UI) wise the app is not well designed. It lacks the minimalist design elements and colours, and the overall aesthetics of the app are not pleasing nor up-to-par with the expected UI-standards in today's app competition. There were no encountered errors or glitches, and neither error-messages when conducting the evaluation and trial of the app. This was a good sign of the apps overall functioning and running capability. The app is lacking help-sections, but it does have

informational documentation and feedback accessible straight through the app, which is a good implementation.

When considering the experience from UX, and UI standpoint, the biggest flaws and shortcoming of the app are in terms of overall design and features. The design is in need of an overhaul in terms of aesthetics and operating layout. The feature set that incorporates the interactive location data is a good start, but adding other mediums, e.g. video, audio, and optical tracking, would create a deeper and more extensive user experience. By improving on these two essential elements of the app, and building on the core idea, VIKKE could evolve into an exemplary AR cultural experience.

7 RECOMMENDATIONS AND BUSINESS IMPLEMENTATION

7.1 Reasons for Utilizing AR and VR

As formerly discussed, a more engaging app, be it app design and/or features, results in greater interaction with the app from the users' part. An app that is not engaging, is not beneficial for a company to develop. A simple app can be engaging even only through great UI-design, as well as a feature-rich app with bad UI-design can be very unengaging. But combining an innovative core idea with great features, and with great UI-design and app layout, one can create an impeccable app that will generate loads of interaction.

A feature that has seen rapid growth and adoption in the recent years has been AR. When dealing in smartphone apps, AR can drastically increase user engagement. Some apps have centred around AR using 3D-modelling as a utility tool in different apps, and some major apps, such as; Facebook, Instagram, and Snapchat, have used AR for simpler entertainment purposes, e.g. facial filters.

However, the most engaging virtual experience consumers can experience as of now, is VR. Smartphones as of yet do not offer great VR-experiences, but in the future, we could see improvements hardware-, and software-wise on this front. VR is mostly centred on desktop applications and websites, running on traditional computers while using external HMDs. Adding VR-experiences and services to your product selection is a seal of technological novelty for a company. Whether these services are offered for free or are additional purchasable resources and products, running in their own dedicated applications or on the web, the main benefit remains in proving your technological evolvment and range of services. VR is a great way to offer deeper virtual experiences to customers and further enhance their engagement with a company's services and increase their positive outlook of a company.

As these technologies are still very slightly utilized on a larger scale, adapting them in one's services will offer a technological-, and image-

advantage. AR and VR are still in their rapid adaption and evolvement phase, and their role in the hardware and software spectrum is most likely to only rapidly increase, if the growth-projections prove correct.

7.2 Customer Segment

The targeted customers can be a diverse group of both domestic and international leads. These virtual services will automatically be distributed internationally, so the potential userbase is diverse. Creating traffic from a variety of geographical and demographic sources is a challenge though.

However, the targeted customer segment could and should be narrowed down for operational planning purposes. As we are dealing with growing, and relatively recently widely adopted technologies (VR & AR), the targeted user segment should be towards tech-savvy individuals. The age demographic should be targeted towards Millennials (born 1981-1996) and Gen-Z (born 1996-2010), as this age group is most likely to adopt and utilize these technologies, as well as be open to virtual experiences instead of the conventional ones. The primary geographic target should be domestic (Finnish) individuals, secondarily individuals from the other Nordic countries, and then Europe. With the international reach, some leads could be reached e.g. from North America and Asia.

7.3 Channels

Apps for smartphones are the easiest way of reaching customers. Creating an engaging virtual tourism app using AR is a tool that is universally adoptable. These apps should be distributed through Apple's App Store, and Google's Play Store, after having developed a finished high-quality product. However, VR offers greater engagement and an enhanced experience. It is a project worth going after, but keeping the access to VR hardware in mind, the potential customer base is still very narrow.

Creating a professional and engaging mobile app using AR is the recommended first stage of product development. After this picks up users, introducing a cohesive and extensive VR experience through for example a website, is a great lead-up. After experiencing a pleasing mobile experience, the users with VR hardware are more likely to try out additional VR experiences.

7.4 Expected Costs

The development and maintenance of these apps do not come for free. A software development team is needed for this, as well as a product design/development team for the user experience and -interface aspects of the products.

The development cost of an app ranges from a simple app (\$25,000), to a medium app (\$40,000), to a complex app (\$70,000). This is calculated using an average hourly rate of \$50. The app development can be done

inhouse, or outsourced to external software developers (Nataliya Kh., Evgeniy A., 2020).

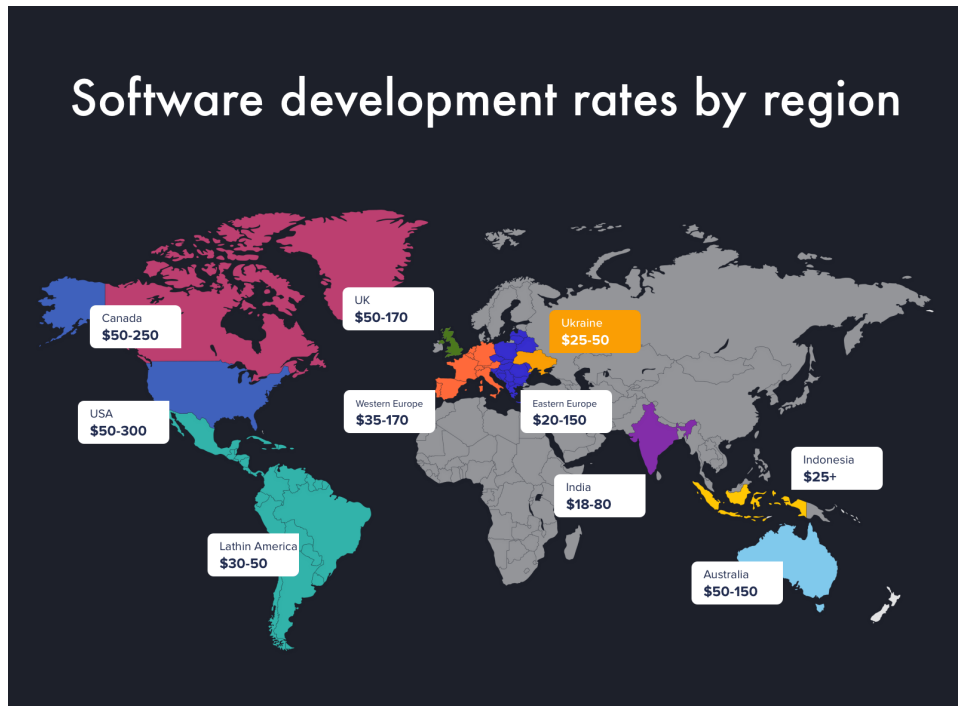


Figure 27:

Cleveroad: Software Development Rates by Region (Hourly \$), (Nataliya Kh. et al., 2020).

The figure above does not show hourly rates for Finland, or the other Nordic countries, but it can be used as reference if thinking of outsourcing app development internationally.

Alle poimin esimerkkejä yleisimmistä elementeistä/toiminnallisuuksista, mitä mobiilisovelluksesta löytyy käyttöliittymän osalta (http: henkilötyöpäivä – 7,5h):

Navigaatio (tabinavigaatio ja stack navigaatio) 1 – 3 htp

Kuvallinen artikkelilistaus (pull-to-refresh, infinite scroll) 2 – 5 htp

Kirjautuminen 1 – 4 htp

Push-notifikaatioiden vastaanottaminen 2 – 5 htp

Hakutoiminnallisuus suodatuksilla (hakukenttä, checkbox valitsimet) 2 – 8 htp

Asetukset (push-notifikaatiot, kirjaudu ulos, yhteydenottolomake, tietoa sovelluksesta) 3 – 8 htp

Suosikit (listaus suosikeiksi tallennetuista artikkeleista) 1 – 4 htp

Ylläpito vuodessa (sovelluskirjastojen päivitysten tekeminen jne. – esim. tuki uusille puhelinmalleille ja käyttöjärjestelmäversioille) 10 htp

Teknisen kehityksen osalta 1 henkilötyöpäivän suuntaa antava hinta on 675€ + alv 24, mutta kaikki lopulliset toteutushinnat arvioidaan kuitenkin aina tapauskohtaisesti.

Figure 28:

An example of the cost of developing an app in Finland (Geniem, 2020).

The figure above displays a common costs structure of developing a smartphone app in Finland. The structure is laid out in a common one-person workday (7,5h), and includes the most common features developed for apps; navigation, picture infused article listing, log-in(s), push-notifications, internal search-engine, app-settings, and annual app-updating. The approximate cost for a day of one person developing the formerly mentioned features is 675€ + VAT (24%). This equals to 837€ per day – per developer. The approximate total working days expected for the development of these features by one developer is anywhere from 22-days to 47-days. Therefore, the expected cost for developing an app with these basic features can vary anywhere from 18,414€ to 39,339€. However, this is just a generic example and the costs associated with app development always depend on each app individually (Geniem, 2020).

Adding 3D-modelled AR, along with other interactive features to the app, we can see the cost of development rise. It is not possible to give any accurate approximates for the total cost of development beforehand without consulting the developers of the entirety of the project, and still after this the final cost may vary from the originally projected cost. However, one should be prepared to make a significant investment if they are after a professional and well-developed application utilizing high-end features such as AR.

7.5 Revenue Models and Return on Investment

Developing and distributing a non-free-to-download app through app store would not be the optimal approach, when talking about a niche market such as Tavastia tourism. Therefore, the potential monetization of the app would happen through partnerships and/or in-app purchases.

Sponsored partnerships could be the most viable way to monetize the app. Working together with tourism organizations and the city-officials would open beneficial operations for both parties involved in the transaction. Essentially the partners financing and paying for in-app features for their services and locations. The app could be further developed to incorporate e.g. AR features, information, and interactive features in the city's different sights and locations. The same could be utilized in the tourism organizations'/companies' operations, locations, and services. This way the app developers would get a return for their investment on the app, and the tourism providers could improve and modernise their services, as well as enhance their customers' interaction at their sites and tours.

In-app purchases are also a common way to monetize apps. Apple and Google take a 30% stake from the purchases at their respectable app-stores, but nonetheless, if the developers are able to find a creative and attractive premium in-app subscription or other purchasable features or micro-transactions, it would potentially open up lucrative revenue inflow for the developers.

7.6 Initiation Process

Evaluating the potential market, possibilities, and viable consumer base at the outlined location, should be the first steps in the initiation process of adopting AR and VR operations. As the development cost of the software and application features for these technologies is steep for SMEs (Small and Medium-Sized Enterprises), the benefits, monetization, and adaptation of the features should be well-thought-out before initiating on the development process.

If the initial evaluation process results in favour of adopting AR and/or VR, the next step is software planning. The use-case, features, and usability should be planned-out in detail. After the software/app is planned and evaluated, the developers should find partners in the tourism sector. Of course, preparing a completely independent app-, software, or web-service utilizing these technologies is also a viable approach. However, using Tavastia Proper as an example, it would be beneficial for the app developers to partner up with the city itself, as well as the tourism organisations working in the region. This could lead to wide in-person adaptation of the app within the region. A single app that would be utilized in a multitude of different sights and attractions would be optimal, as consumers are typically not keen on downloading a plethora of apps. Through this model, for example the AR-features provided by the app could be utilized by a multitude of museums, sights, organisations, etc. The service providers would be able to provide a much more interactive

and interesting experience to their visitors and customers, and the developers would be able to monetize their developed software and acquire a return on their investment.

Acquiring feedback, data, and improvement ideas are crucial in order to create a great service. This applies to the software as well. The data should be collected from both the service providers, as well as their customers. Also, studying the inactive segment is important, in order to find what is needed in order to spark their interest in using the technology and the developed software. It is essential for the developers to update and improve the features and user-experience of their app or software. Constant improvement of the software results in retaining the current users, as well as improving the chances of acquiring new users.

8 CONCLUSIONS

The objective of this thesis has been to persuade why AR and VR should be applied by tourism organisations and -companies. These rapidly growing and evolving technologies offer great monetizable opportunities for companies' products and services. The positive future outlooks that this thesis has discussed, speaks in favour of the adaptation of these technologies.

Virtual- and Augmented Reality are technologies that have been present in one way or another for quite some time in one form or another. But despite of this, they are still regarded to be in their early adoption phase and as seen from their current growth rates. These are emerging technologies with exponential future growth projections. AR and VR are likely to become very prevalent within this decade, so understanding the core technology offered in this thesis gives an important base knowledge for either adopting or consuming these technologies.

As the travel- and tourism industry is facing one of its worst periods in recent history, it is important for the companies in this space to be open minded for alternative services and to think outside of the norms. Implementing AR and VR can offer some financial relief in these trying times and offer customers services and experiences even though the conventional travel is limited as of this moment.

The research conducted on HAMK Smart's VIKKE-app, shows that the belief in the core idea of the app is strong, but the app is in need of work feature- and design wise. The interactive approach on the app is the right choice as it is a tourism focused app, but app development is a demanding effort as the users' expected requirements are constantly increasing as apps become a larger part of the modern society. By taking the feedback provided in this thesis, the developers could significantly improve the overall user experience.

Software- and app development in general are costly endeavours but they are worthwhile investments when the app, use case, and user segment are well planned out. Of course, the app also has to be professional and a joy to use in order to attract users and to get a good return on investment. Developing software and services utilizing AR and VR will not come cheap, so it is important for the adaptors to weight the benefits beforehand. However, if these technologies offer potential lucrative opportunities, being on the forefront of technological development while offering great products and services to the customer base, implementing AR and VR in business operations is a great idea.

These user-engaging technologies will potentially play a big part in both casual- and professional use in the future. The objective of this thesis has been to introduce a more comprehensive knowledge of these technologies and of their potentials, before they have reached market maturity and wide adoption. The intellectual framework gathered from this thesis attempts to benefit the reader significantly on the emerging technologies of AR and VR, as their relevance is projected to grow into the upcoming years. Another objective of the thesis is to offer a comprehensive understanding of these technologies for agents, organisations, and companies within the tourism- and travel industry, so they could potentially either implement these technologies in their future business operations, or to improve their existing ones with the information gathered from this thesis.

Augmented- and virtual reality are here to stay and are most likely to become impactfully ingrained in our daily lives in the future. They will most likely evolve in directions unimaginable as of right now, but what is certain is that they are here to stay. As humanity becomes more and more dependent on technology and digital information, it is expected that AR and VR will play ever increasing part in our lives. As the digital and/or virtual information provided by these channels are objectively superior when compared to the most conventional display and text methods we are currently used to. This being a result of their more user- and world involving nature. As they can both be better merged with our natural world, as well as also be separated more distinctly from our surrounding natural world. This offers better digital integration in our natural existence and also offers a potential complete virtual environment in which the user can be almost completely immersed.

For the reasons mentioned above it is recommended and important for businesses to understand these technologies as they can offer great operations improvements for them. Even if the current operational landscape would not be asking for them, it is beneficial to have an understanding of them for future reference and potential implementation. As people are currently stuck at their homes and close proximity, the travel- and tourism industry should take a serious look at AR and VR in order to offer their existing and potential customers alternative experiences, as they are longing for adventures from their homes.

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APPENDIX HEADING