

Improving learning processes at schools by integrating new technologies

Case: Grib Oy

Abstract

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Title of publication Improving learning processes at schools by integrating new technologies Case: Grib Oy		
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Abstract <p>This thesis was launched with the purpose of evaluating the market potential for a Helsinki based start-up Grib. Grib was established in 2014 in the open environment of Aalto University and was recognized as an innovative project. The main goal of Grib is to provide simple 3D modeling in augmented reality for users without software skills.</p> <p>The theoretical framework of the study discusses a business-to-business model, as Grib's final users are companies and enterprises. In addition, it explores product management and the overall state of augmented reality and 3D modeling industries in Europe. As for the empirical part, the thesis is focused on 3D modeling usage at schools in Sweden and Norway. The main objective of the research is to understand whether 3D modeling is a commonly used practice and how Nordic schools use its capabilities to create better experiences among pupils. The latter data has been obtained by conducting interviews with teachers among various secondary leveled educational establishments.</p> <p>To conclude, having analyzed both primary and secondary information sources, the researcher suggests what opportunities Nordic market is able to offer to Grib.</p>		
Keywords 3D Modeling, Augmented Reality, Product Management, Business-to-Business, Nordic Countries		

GLOSSARY

AR: Augmented reality

B2B: Business-to-business

B2C: Business-to-customer

VR: Virtual reality

R&D: Research & Development

ROI: Return on investment

3D modeling: Three-dimensional modeling

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1 INTRODUCTION

This chapter is written with the purpose of introducing the following thesis to its readers. In order to fulfill this goal, it starts with explaining the reason for conducting this research. After that, the chapter states the purpose statement and sets the research questions and limitations. It continues with a theoretical framework, research methodology and data collection methods. Finally, the readers get acquainted with the detailed thesis structure.

1.1 Background

"Augmented reality (AR) is a variation of a virtual environment (VE), or virtual reality (VR)" (Kipper & Rampolla 2012, 1). It serves as a middleman between fully natural and fully synthetic worlds. Augmented reality combines digitally generated content, such as images, sounds, smells, etc., with a physical environment. Thus, its users experience the real world with some virtual objects placed nearby. (Kipper & Rampolla 2012, 1.)

One of the most common examples of AR is heads-up display for fighter pilots. It is presented in Figure 1. The typical heads-up display uses AR solution to provide pilots with the relevant piece of data such as the horizon, altitude, speed, etc. This information is digitally generated and reflected on cockpit windows. Since AR is a combination of virtual and real environments, cockpit windows represent the real environment and, thus, are real physical objects. (Kipper & Rampolla 2012, 1.)



FIGURE 1. Fighter Jet Heads-up Display (Kipper & Rampolla 2012, 2).

AR is a rapidly developing field. Figure 2 shows that in 2017 the market value is around 13,9 billion dollars. However, by 2020 the market might have reached the share of 143.3

billion dollars. (Statista 2017.) In other words, in the future, the industry could have grown by 10 times in comparison to today.

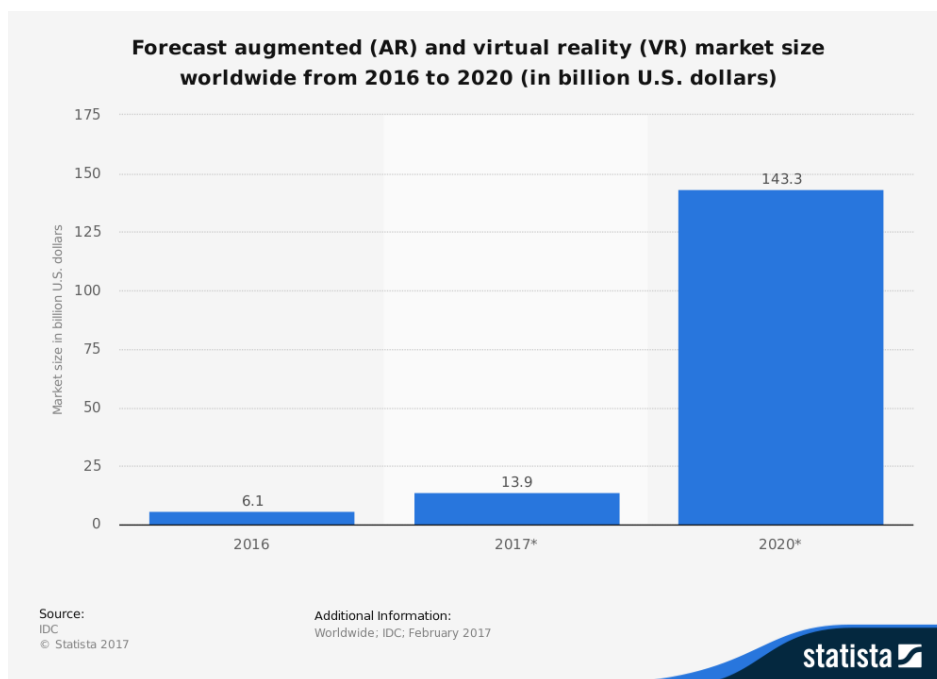


FIGURE 2. Forecast augmented (AR) and virtual reality (VR) market size worldwide from 2016 to 2020 (in billion U.S. dollars) (Statista 2017).

Such a tremendous growth of AR could be easily explained by the opportunities the technology is bringing to various businesses. The implementation of AR solutions will start a revolution in healthcare services, logistics, manufacturing, military, design/ architecture, etc. For instance, in medicine, the necessity of surgical interventions would be decreased since AR will allow examining a patient without opening him/her up. Another example is ensuring more smooth and efficient warehousing operations. The technology will guide workers around the warehouse in a quick and safe manner and possibly delete picked up goods from inventory. (Mainelli 2016.)

The introduction was launched with the description of AR since the following thesis deals with AR. The main purpose of this thesis is to discover potential business-to-business (B2B) customers for *Grib*. *Grib* is “a cloud-based software” that enables simple “3D modeling in augmented reality” (Gribbing Oy 2018). The uniqueness of this product is achieved by three characteristics:

- **Being intuitive:** *Grib* offers a new experience to its customers by enabling them to work instinctively in augmented reality.

- **Being accessible:** Grib's users are just required to have a pen, paper, and a mobile device. The platform works in offline mode and is equipped with sharing, exporting and printing possibilities.
- **Being seamless:** Grib's developers claim that the product is easy to understand and use. And more importantly, the speed of proceeding with complex objects exceeds other current solutions by ten times. (Gribbing 2016-2018.)

At this stage, Grib is still being developed and its founders have decided to customize it to the needs of schools. The app has already been tested on Finnish pupils and turned out to be successful. Grib's founders have received rather positive feedback regarding their product, its features and value for both children and teachers.

The start-up has very optimistic plans to gain international buyers. This is the key reason for launching this thesis. The researcher has been asked to find some qualitative data that will allow the company to evaluate potential markets, to be precise Nordic countries. The findings presented in this thesis will be used by Grib's founders in building growth strategies and setting down long-term and short-term goals.

1.2 Purpose statement, research questions and limitations

The purpose statement is a declaration which specifies the direction of the entire research. It is generally expressed in one or more briefly shaped sentences. The correct purpose statement explains the reason why the study has been initiated. (Ayiro 2012, 151.)

The following purpose statement has been developed for this study:

To analyze the target market in terms of the state of 3D modeling and augmented reality and to examine Grib's overall characteristics in order to adequately forecast the start-up's opportunities

Another crucial step in the research process is to define research questions. Research questions are described as objects which shrink the purpose statement to particular questions answered during the study. In comparison to the purpose statement, they are not commonly presented as a single declaration. Researchers identify a set of questions in order to fulfill the study comprehensively. (Ayiro 2012, 157.)

In this study, the research question is:

What opportunities can European B2B customers bring to Grib?

To answer the research question, the following sub-questions are set:

- *What is a B2B model and how does it work?*
- *What makes a product? What is the new product management and why do innovations fail?*
- *What is the state of 3D modeling and augmented reality industries in Europe?*

The latter research questions have been answered in the theoretical part. As the researcher has been working in close connection to the case company and because this thesis has been launched to help the start-up build a proper growth strategy, the company's interests have always been the cornerstone during the entire research process. Thus, since Grib has made a decision to target schools, the researcher has designed two extra research questions discussed in the empirical part. These are:

- *How are school systems organized in Nordic countries?*
- *How do schools and teachers in Nordic countries use 3D and augmented reality tools to improve the teaching process?*

In order to conduct a trustworthy thesis research, it is crucial to consider some limitations. Firstly, a geographical limitation exists. The theoretical part of the research concerns Europe and European market whereas the empirical part shrinks it even more to Sweden and Norway. All statistics provided in the case study represent schooling systems while the interviews have been conducted with schools and teachers who are based in the mainly capital region, in other words, Stockholm and Oslo. Finland, as a target market, is excluded as the start-up has already initiated some collaboration with local schools and is familiar with the market.

Secondly, it seems rather relevant to mention that a limited number of teachers and schools have participated in the research. This factor could have affected the nature of retrieved data as the market itself is relatively large and complex.

Finally, the last limitation is the shortage of theory on 3D modeling as it is a rather new field and lack of statistics on schooling. The researcher, in particular, has faced lots of difficulties finding the proper data on the Swedish school system. In addition, all statistics, retrieved from trustworthy information sources, are usually published a couple of years later after the research has been carried out.

1.3 Theoretical framework

The sub-chapter starts with the introduction of the term. According to Oxford English dictionary (2018), a theoretical framework is a “basic conceptual structure underlying a system, a study, etc.” while Business dictionary (2018) explains the term as “a group of related ideas that provides guidance to a research project or business endeavor”. Thus, this part briefly discusses the key research areas of this thesis.

The theoretical framework is launched with the topic of business-to-business (B2B) markets. The researcher pays particular attention to this subject because the case company is a B2B operator. Later, in the empirical part, the research is narrowed down to schools in Nordic countries as a key target market for the company. The theoretical framework continues with the topic of new product management. The researcher considers it a highly relevant issue because Grib is an innovation. Thus, the third chapter introduces five product levels and product lifecycle models. It also proves that new product development is a necessity and suggests a six phases program on how to successfully present innovations to the market. The theoretical part ends with the description of the state of augmented reality and 3D modeling industries in Europe because Grib operates in these fields. Last part of the theoretical background serves as a cornerstone for empirical research since the thesis researcher examines the presence and usage of AR and 3D modeling among schools in Nordic countries.

1.4 Research methodology and data collection

This sub-chapter presents the research methodology and data collection methods. The description explains commonly accepted concepts of deductive and inductive reasoning, qualitative, quantitative and mixed research methods and primary and secondary data collection methods. Gradually moving from general to specific, the overview illustrates the techniques that are utilized by the researcher in the following thesis.

The sub-chapter opens with the topic of reasoning. The reasoning is commonly divided into inductive and deductive. The concept of inductive reasoning means moving from observing to building theories. In other words, initially researchers overwatch some occurrence/ phenomenon, proceed with identifying some general principles and, finally, create a theory. Comparing with inductive reasoning, a deductive approach is carried out the other way around. The researchers use some commonly-accepted theory, as a starting point, test it by launching the research and, finally, validate or reject it, according to the research results. (Tracy 2013.)

The next step in the research is to choose research methods. Research methods can be either qualitative or quantitative. A qualitative approach is commonly applied to a limited group of participants because the results are time-consuming and costly to analyze. The findings are quite individualistic but they discuss a certain question inside out. In comparison to the qualitative approach, a quantitative method seeks to involve a larger number of respondents in order to generalize the outcome and identify particular patterns and trends. (Ben-Eliyahu 2014.)

Another difference between these two approaches is that the quantitative research method concentrates on quantity or amount. Thus, the findings are traditionally expressed in numerical value. Besides, according to Krishnawami and Satyaprasad, it is typical for quantitative research to utilize some statistical tools such as median, standard deviation percentage, etc. Comparing with the quantitative approach, the qualitative one deals with behavioral patterns, opinions, and attitudes. In order to collect information researchers conduct interviews, group discussions, etc. (Krishnaswami & Satyaprasad 2010, 6-7.)

Reasoning and research methods are discussed yet nothing has been said about data collection. Data are generally collected from sources of data. Sources of data are defined as “places, where from information is obtained in order to answer a problem” (Mligo 2016, 94). These sources can be either primary or secondary. Primary data is information which has been collected by the researcher himself/ herself and has not been used in any other publication or work. For instance, surveys, interviews and meeting minutes serve as primary data sources. (Mligo 2016, 94.)

In comparison to primary data, secondary data is regarded as any materials that have been used at least once before and have been collected by some other researchers. Secondary data can be obtained from books, journals, newspapers, etc. (Mligo 2016, 95.)

In this research the primary data sources are interviews. The researcher organized a series of them to complete the empirical part. The first interviewee has been Pouria Kay who is the CEO of Grib. He has provided the researcher with a deeper understanding of the product and numerous company's policies associated with pricing, customer support and after-sales services. The rest of the interviews have been launched in order to adequately measure how developed Nordic schools are in terms of 3D and AR implementation.

The secondary data in this thesis has been mainly collected from electronic sources and books. Its usage has been quite relevant for the researcher because it helps to open the concepts of B2B model and product management. In addition, secondary data has been

vastly utilized in the first chapter in order to introduce the thesis's background and structure.

1.5 Thesis structure

This part presents the structure of the thesis. The thesis is built by three major blocks. These are the theoretical part, the empirical part, and the results. The readers can get acquainted with the detailed thesis structure by taking a look at Figure 3.

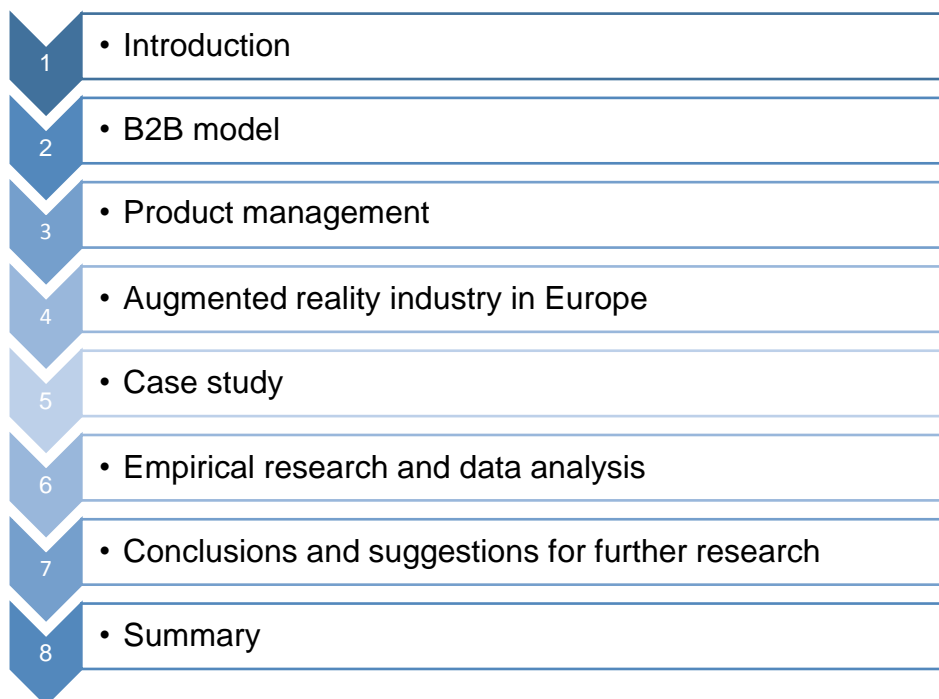


FIGURE 3. Thesis structure.

Chapter 1 is launched with the description of the thesis background, purpose statement, research questions, and limitations. It additionally covers the theoretical framework, the research methodology, and the thesis structure.

Chapter 2 discusses the concept of B2B business model. It covers the area of B2B market research and emphasizes its special features. The chapter also deals with B2B marketing, specifies the role of trust in B2B purchasing and offers a solution on how to strengthen it. The part ends with the topic of B2B integration, its benefits and drawback, and probable costs.

Chapter 3 is named product management. The chapter is launched with the introduction

of two analyses such as five levels of a product and product life cycles. It also states the need for new products and explains why they fail on the market. Considering the high rate on new product failures, the chapter provides a methodical approach on how to launch and introduce innovations to the market and finishes with the consumer adoption process.

Chapter 4 is dedicated to the state of augmented reality industry in Europe. It describes trends that have an impact on industry development. The chapter also provides an overview of augmented reality centers in Europe and most applicable areas for AR services. The part also briefly discusses AR service providers in terms of size and product maturity. It ends with the introduction of legal and non-legal requirements the companies have to comply with if they operate on the territory of the European Union.

Chapter 5 is launched with a brief introduction of the Nordic region. It continues with providing some quantitative data on school systems of Nordic countries. For instance, it includes some statistics on the amount of the school-age population, number of schools and pupils, education costs for the government, etc.

In Chapter 6 the researcher presents information regarding empirical research and data analysis. Chapter 6 covers the timeline of the research, explains how interviews have been designed and data acquired. It also presents the findings retrieved by carrying out interviews and suggestions for further research.

Chapter 7 is a summary of the thesis's key points. It also discusses the following thesis in terms of reliability and validity and provides suggestions for further research.

2 B2B MODEL

2.1 B2B market research

The *“Without data you are just another person with an opinion”*

W. Edwards Deming

It is a well-known fact that customers play a significant role in the success of any business. If the company does not value and care enough about the customers' needs and preferences, it is most likely to fail. Customer needs can be easily identified with the help of market research.

Market research is “the systematic and objective collection and interpretation of data to help reduce risks in marketing decisions” (Hague 2018, 6). The first nationwide market research was carried out in 1879 in the USA by N W Ayer&Son. Later in the 1930s an audit firm of Nielsen and Attwood designed some techniques measuring sales via retailers. Its subscribers were able to assess market size and market shares. Thus, it is commonly believed that the science of market research was born in the first half of the twentieth century and the demand for it dramatically grew in its last years. (Hague 2018, 5-6.)

Market research is a structured and purposeful activity. Its key goals include finding new opportunities, boosting the development of new products and services, assessing market potentials and its weaknesses and strengths. Gathering data is not the final goal of a well-conducted market research. Data serves as a middleman which allows managers to draw conclusions and improve the company's operations. (Hague 2018, 8.)

Nowadays market research is usually carried out by two methods: qualitative and quantitative methods. Qualitative method is implemented when the company needs to explore customers' feelings, thoughts and experiences about the product or service. The technique is also applied if the business has to analyze small segments of the population. With the implementation of this method organizations can solve several tasks such as identifying particular behavioral patterns, product/ market/ consumer evaluation, analyzing certain problems and finding solutions, etc. (Hague 2018, 75-76.)

Quantitative research is carried out when the company requires measuring. By implementing the latter method the business is able to assess three classifications of numbers: market measures, customer profiles, and attitudinal data. Market measures provide quantified data regarding the market. For instance, market size, purchase frequency, market shares, etc. Customer profiling allows managers to classify data

according to age, income and educational level, buying frequency, attitude to certain products and brands, etc. Finally, attitudinal data is used to measure awareness and perceptions in customers' mindset. (Hague 2018, 95-97.)

The topic of market research, in general, has been covered in the previous paragraphs. However, experts identify some specific features related to B2B market research. To begin with, on B2B markets qualitative methods are more frequently used than quantitative ones. The basic reason is the fact that quantitative research requires large sample sizes which are challenging to obtain due to the limited target audience and their unwillingness to share information. (Movahhed 2016.)

Many experts claim that B2B market research is a complicated task to do. Firstly, each business is a single unique organism with its own structure, company size, an industry of operation, location, etc. That is why combining them into various groups, based on similar characteristics, can be a wrong decision. Secondly, in B2B markets purchasing decisions are made by a group of people rather than a single individual. In practice, it means that the company has to survey employees from numerous departments what makes the whole process longer and more challenging. Finally, the target audience, which needs to be interviewed, is usually quite unwilling to share detailed information or might be simply overloaded with other related work duties. Providing meaningful answers to surveys always requires time and effort. Considering the information above, many people may start to wonder how to conduct a proper B2B research. The next paragraph will contain a possible answer to this question.

One strategy is to hire an expert who is capable of identifying the right people and the right questions to be asked. A business can outsource this duty to a B2B market research organization that is familiar with the industry of operation. As a result, the data will be more reliable and the entire process will flow faster and more smoothly. Another useful hint is to offer some gift card or some benefit the respondents are granted after participating in the interview.

The second effective approach is to implement some tools such as Google Analytics's keyword tool. This solution will allow the business to identify the keywords the target audience is using in search engines. (Movahhed 2016.)

2.2 B2B marketing and building a brand

2.2.1 Decision-making committee

In comparison to B2C, in B2B model purchasing decisions are commonly carried out by a group of people. This group normally consists of six to seven people who are called a decision-making committee. This decision-making committee includes both people who are familiar with a product and those who will never interact with it. Their opinions are equally valuable though in some cases nonusers' viewpoint is considered as more appropriate.

Taking into account the various experience of committee members with the product, it is crucial to create multiple messages. Each of these messages should be persuasive and relevant so that committee members start to believe that this product responds to their needs best of all. The more persuaded they feel the higher chances the brand has. (Leake, Vaccarello & Ginty 2012, 6-8.)

Decision-making committee members also need to trust the company they are planning to buy from. Without trust business is impossible. The committee commonly starts to research the company online in order to ensure its credibility. The company's reputation can suffer if, for instance, it managed to appear in the first pages due to paid campaigns (not organically) or first pages bring some negative results like customer complaints. On the other hand, brand credibility online can be supported by social media, public relations, and blogs.

Decision-making process is also affected by the inner culture of buying inside the company. In other words, it is crucial to understand if the committee members operate as a single team or more like individuals. Getting the right answer will help to choose an appropriate marketing approach and save from fatal mistakes. (Leake, Vaccarello & Ginty 2012, 6-8.)

The correct determination of the key influencers in the buying company is a key to success. Key influencers are people who (1) sign the checks, (2) use the product (3) and deal with the sales team at the last stage. In order to succeed, the business should categorize these three groups by their job title, segment, industry, and role in the company. Understanding their backgrounds will help to set a strategy on how to influence these decision makers.

When the key decision makers are identified, the company has to examine its product or service from their angle. The business has to identify what challenges these people are

facing and how the product will solve them as well as to predict the risks associated with acquiring and using the product that will force the company to look for other options. As soon as this basic information is obtained, the company can start to develop a marketing strategy that is more accurate and reliable. (Leake, Vaccarello & Ginty 2012, 25.)

2.2.2 Building a brand

Building a strong brand is a priority for many companies. A strong brand means a trust for customers and B2B sales are all about trust. Building a brand is a comprehensive and time-consuming process though it always gives a wide range of benefits for the business. For example, in B2B markets companies tend to collaborate more with strong brands because they view them as a possibility to mitigate risks, to receive extra value and get more efficient and trustworthy information.

All B2B markets share a range of characteristics mentioned below. Firstly, B2B markets are relatively small. They are significantly smaller than business-to-customer (B2C) markets and, consequently, the number of potential buyers is also smaller. In order to succeed on the B2B market, it is crucial to understand the target audience, its needs and how to satisfy these needs. As soon as the analysis is carried out, the business should clearly communicate to its potential customers about its product, emphasizing its low risk and high reward. (Leake, Vaccarello & Ginty 2012, 18-20.)

Secondly, compared with B2C, the average lifetime of a B2B customer is significantly longer. On B2C markets the average consumer lifecycle lasts for a year what is regarded as quite a long time. On B2B markets the length of customer lifecycle is more than one year. In some industries, even three years do not belong to "long" category. However, longer lifecycles require the company to invest more in branding, create stronger and more sustainable brands and stay technologically up-to-date.

Thirdly, on advertising side, B2B operators frequently spend less than B2C. The average advertising budget for B2B companies is followed with one to two percent of sales whereas B2C companies invest around ten percent. Although on financial side B2B businesses save a lot more, the amount of time, talent and dedication invested is approximately the same regardless of the market of operation. (Leake, Vaccarello & Ginty 2012, 18-20.)

2.2.3 The role of trust and how to build it

As has already been mentioned before, B2B purchasing is all about trust. Decision-making committee should trust the company they are planning to buy from and

believe that this is the best option. Committee members are always making purchasing decisions under pressure because wrong choices can damage the company's reputation, their own credibility and cause other serious consequences.

One option to strengthen the brand is to use online advertising. Online advertisement means that the company has sufficient financial resources and that it is relatively stable. In addition, statistics claim that on average advertising promotes brand awareness by 62%, stimulates purchasing intention by 21% and improves brand favorability by 19%.

Another well-known strategy is to maintain the leadership in social media. Social media content should present tools which will help the company to solve its core weaknesses. Another way to use social media is to build strong relationships with brand advocates. Brand advocates are individuals or companies who are very passionate about the product or service. For instance, loyal customers or suppliers. These groups can communicate about the positive experiences they have already had with the brand what will also strengthen the company's reputation. (Leake, Vaccarello & Ginty 2012, 20-21.)

2.2.4 Understanding target audience

B2B buying is never impulsive. It is always a well-planned procedure because B2B purchases are costly and have long-term consequences on the company's operations.

In B2B markets, decision-making committees are regarded as a target audience. It can also be segmented. Decision-making committees are divided into four categories: the executive sponsors, the check signers, the influencers and the change agents. The change agents are called "the main point of contact" because their main function is to evaluate suppliers and spread the project within the organization. The executive sponsors are the people who have the ultimate veto power. If they do not approve of the business idea, the company will never follow it. The check signers' duty is to ensure that the price corresponds to the value the organization is getting out of this purchase. Finally, the influencers, who do not have the real power, but whose opinions can spoil the deal if their interests are not met. (Leake, Vaccarello & Ginty 2012, 29-31.)

As soon as the segmentation is carried out, the company has to come up with the target messages for each customer group. The change agents need trust and they need the product to succeed since incorrect choice can ruin their careers. The executive sponsors also need trust that is why they frequently prefer to work with strong and reliable brands. Newly established companies are regarded as a source of threats and risks. In order to get approval from the executive sponsors, the business preferably should have had some business operations with their peer companies. The influencers need information. They

need to believe that the product will solve current issues and bring improvements to the organization. Thus, the message has to be more product-focused. Finally, check signers who are very suspicious about risks need to trust the company as well. They want to ensure that the business is relatively stable and that supplier company will still function after the check being cashed. The check signers are always looking for long-term benefits and are extremely concerned about the price. If the company has to pay extra, the check signers are always making sure that the product lives up to its value. (Leake, Vaccarello & Ginty 2012, 29-31.)

3 PRODUCT MANAGEMENT

This chapter focuses on product understanding. The part starts with the concept of **five levels of a product** and the **product life cycles** model. When these two analyses are presented, the researcher continues with new product development. This part includes the need for new product development, the reasons for their failures and suggests a methodical approach for introducing innovations to the market. The chapter ends with the description of the consumer adoption process. In other words, the process of accepting new products by customers. The researcher also provides the factors, having an impact on customer mindset regarding innovations.

3.1 Five levels of a product

Nowadays it seems that many people have a wrong perception of a product. They view it as a single tangible item though in the modern world a product is a more broad and complex thing. The book Marketing Management defines products as “anything that can be offered to a market to satisfy a want or need and consists of a set of attributes...” (Kotler, Keller, Brady, Goodman & Hansen 2009, 506). Under attributes, marketers mean physical goods, services, experiences, events, ideas, etc.

Today it is highly inefficient to offer just a physical product because of higher competition rates and increased customer demand. Thus, enterprises have to add extra tangible and intangible attributes to their core product. As a result, they achieve a desirable customer offering.

When planning a desirable customer offering, companies have to identify five levels of a product. Each level creates more value and significantly contributes to higher customer satisfaction. In this thesis, **five product levels** model is represented in Figure 4.

The first level is the **core benefit** that is the cornerstone of the product. The core benefit is the main reason for customers to purchase the item. For instance, when booking a hotel, the guests are initially buying “rest and sleep”. When offering the products, marketers have always to perceive themselves as benefit providers.

The second level is called **the basic product**. Referring to the aforementioned hotel example, each hotel room has a bed, a bathroom, a wardrobe, etc.

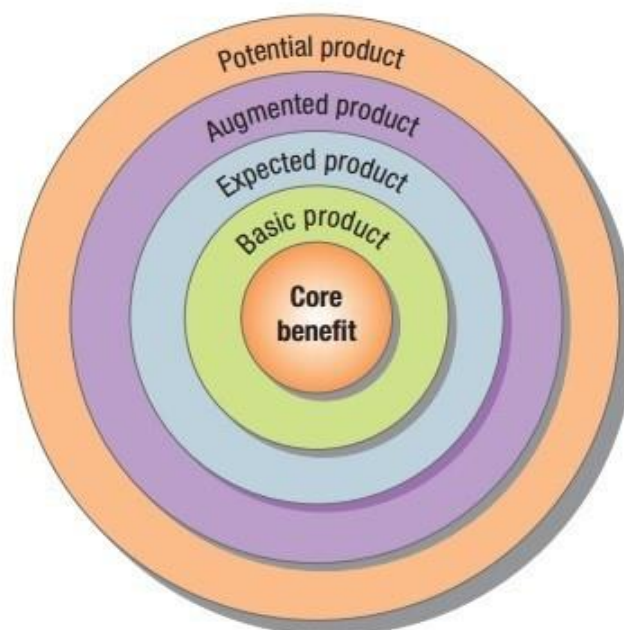


FIGURE 4. Five Product Levels (Kotler, Keller, Brady, Goodman & Hansen 2009, 506).

The third level is named as an **expected product**. It can be described as a set of expectations the customers are having when making a purchasing decision. For instance, when arriving in the hotel room the guests expect it to be clean and relatively quiet, to have fresh towels and beddings.

The next level is defined as an **augmented product**. When marketers describe it, they usually specify it as some extra going beyond customer expectation. In the hotel room, this added value could be a wi-fi connection or a flat-screen TV. (Kotler, Keller, Brady, Goodman & Hansen 2009, 506-507.)

The last fifth level is the **potential product**. The potential product includes all augmentations and transformations. Through this fifth level companies are looking for new approaches to impress and satisfy customers and distinguish their market offer. For example, the hotel staff can provide a free fruit bowl for its guests.

The toughest competition and differentiation happen at the last two levels. Each augmentation and potential benefit leads to an increase in supplier's costs and, consequently, a higher final price. Nowadays customers are willing to pay more in order to obtain superior experience and a higher than ever level of service. However, aside from "willing to pay a fortune" customers, there are always people who get satisfied with a lot more modest market offering. As a result, alongside the high demand for five-star hotels, there is still a need for modest hotels and motels in many locations. (Kotler, Keller, Brady, Goodman & Hansen 2009, 506-507.)

3.2 Product life cycles

Nowadays business people understand and accept the fact that each product has its own life cycle. When speaking about life cycles, it is crucial to assume four basic ideas:

- Products are subjects to limited life
- Sales process passes through various stages, each of which brings difficulties, opportunities, and issues to the seller
- Revenues dramatically vary at every stage of the product lifecycle (Kotler, Keller, Brady, Goodman & Hansen 2009, 490-491.)

Typically all product lifecycles represent four basic stages such as introduction, growth, maturity, and decline. The model is presented in Figure 5.

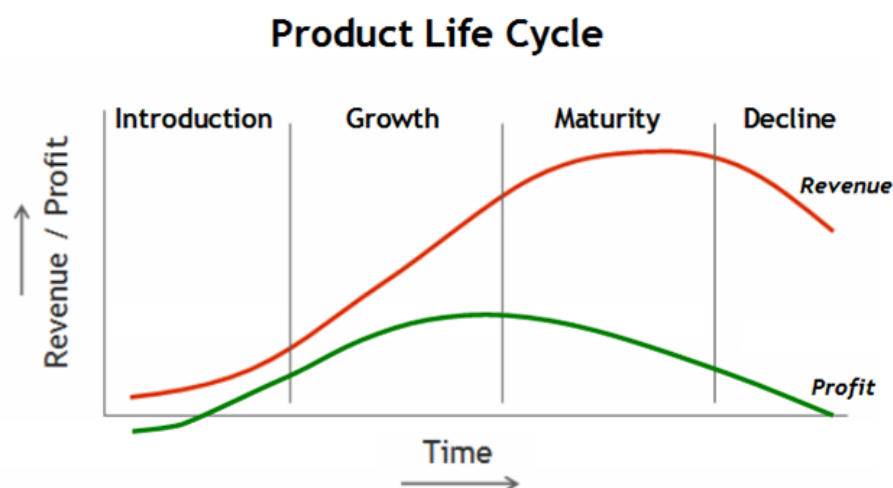


FIGURE 5. Long Range Product Market Expansions Strategy (Kotler, Keller, Brady, Goodman & Hansen 2009, 490).

At **Introduction** stage, sales grow quite slowly because the product is new to the market. At this stage, the company does not enjoy any profit or very low profit due to high costs associated with the product launch.

Launching a new product is a costly activity because the company needs to inform its potential clientele about the market offering, convince them to try it out and secure distribution in retail outlets. The enterprise has primarily to focus on customers who are willing pay since prices are high due to high initial costs. (Kotler, Keller, Brady, Goodman & Hansen 2009, 490-491.)

At **Growth** stage, the market accepts the item what leads to major profit improvement. Sales grow because new customers have a favourable attitude towards the market

offering. New competitors enter the market because they get attracted by the opportunities. They offer new augmentation and potential product benefits and expand distribution.

Prices remain the same or slightly decline. Companies continue with promotional activities and invest a lot in them to meet competition and keep the customers educated. However, due to fast sales incline, promotional expenditure does not seriously hurt the company's budget. One of the key challenges at this stage is to identify when the accelerating growth trend turns into decelerating one and prepare new solutions. (Kotler, Keller, Brady, Goodman & Hansen 2009, 490 495-496.)

At **Maturity** stage, sales slow down since the market offering has already been accepted by the majority of its target audience. As a result, profits stabilize or decrease due to high competition. The maturity stage usually lasts longer than the previous stages and causes huge difficulties for marketers.

The maturity stage consists of three phases: growth, stable and decaying maturity. At the first phase, sales start to drop, new distribution channels do not appear but competition arises. At the second stage, the majority of potential customers have already tried out the market offering and future sales can derive from population growth and replacement demand. At the last stage, the absolute level of sales decreases and consumers switch to other alternative solutions. The third stage is the most challenging since the company's competitors heavily invest in advertising and promotion, R&D activities in order to gain a market share and contribute to the creation of strong industry. (Kotler, Keller, Brady, Goodman & Hansen 2009, 490, 497-498.)

At final **Decline** stage, sales significantly decrease and profits erode. Experts identify numerous reasons for sales decline such as technological development, changes in consumer preferences and increased foreign and domestic competition. The speed of sales drop varies a lot. It can be either slow, for instance in sewing machines industry, or fast as in case of floppy disks. As long as sales and profits have dramatically declined, the companies could completely withdraw the product from the market, cut down the number of units supplied to these markets, reduce promotion expenditure and decrease prices. Unfortunately, in the modern world, the majority of enterprises has not developed yet the appropriate strategy for aging products. (Kotler, Keller, Brady, Goodman & Hansen 2009, 490, 501.)

The product lifecycles model is relatively easy to comprehend and seems to be logical though not all market offering share the same principle. For instance, such product

categories as small kitchen appliances, drugs, and fashionable items have various life cycle patterns.

3.3 New product development

This sub-chapter tackles the issue of new product development. The topic is launched with the introduction of the term “new product”. A product can be described as either a physical object or a combination of benefits that customers are expecting from it. When a certain product is positioned as a new, it is quite relevant to consider the angle. In other words, the question under examination is whether the product is regarded as new by the company itself or by the market. From the company’s perspective, the product can be defined as new if some changes or additions have been applied to it. However, from the angle of the market, the product can be called new if customers are experiencing a set of new perceptions regarding it.

The need for a new product development was already stated in the 1960s by Theodore Levitt. He suggested two key reasons that encourage product innovation. These are the **increasing instability of consumer preferences** and the **growing competition**. Apart from changing consumer behavior, experts name another powerful external force, such as **technological development**. Constant technological accomplishments also play a significant role and are capable of changing market sizes and market characteristics. (Levitt 1960, as cited in Proctor 2000, 508.)

Companies choose new product development for two reasons as well. Firstly, product innovation is carried out to replace existing offerings on current markets of operations. Secondly, product development is regarded as the most appropriate strategy for a new market penetration. However, conquering new markets can also be achieved by adopting new pricing, promotion and distribution techniques applied to existing offerings. (Proctor 2000, 507-510.)

The need for new product development has been proved above. However, innovations can still pose some difficulties and threats for the company. The section below explains why new products can be a subject to failure.

3.3.1 New product failures

Innovation is the cornerstone of success, though not all innovations are successful. When the organization makes a conscious decision to launch a new product, it must remember that the likelihood of failure is rather high.

The most common approach to measure, whether the product is a success or failure, is to calculate the return on investment. According to Investopedia, the return of investment (ROI) is a tool to measure the efficiency of an investment. It is calculated as mentioned in Figure 6:

$$\text{ROI} = \frac{(\text{Gain from Investment} - \text{Cost of Investment})}{\text{Cost of Investment}}$$

FIGURE 6. The Return on Investment Formula (Investopedia 2018).

The formula for ROI is the same though its result cannot be satisfactory for every organization. Companies differ in size, a field of operation, expectations, etc. Each of these factors influences the return on investment.

Forecasting product sales, profits, and costs is always a challenging and unpredictable task. Despite all invested efforts, the results can still be quite inaccurate. To minimize the risks, experts suggest carrying out R&D activities that are rather costly. Statistics claim that every decade these R&D activities require more and more financial investment than before. Thus, in 1980s pre launching activities accounted for 10% of total costs whereas in 1990s the share rose to almost 20%. (Proctor 2000, 510-513).

Rather high R&D costs may not be the only factor repelling companies from product launch. Despite highly-rewarding ideas, large organizations may escape from developing them due to a relatively small market. In this case, these companies can resell their business ideas and plans to smaller companies and even provide them with financial and other support if needed.

The key part of this sub-chapter is to suggest why new products fail on markets. Experts name numerous reasons, for instance, the product is not meaningful enough and unique. Other reasons include poor marketing, poor planning, lack of support from the top management, market unreadiness for the product, high product costs, etc. Discussing the issue of product failure, Proctor also states that a shortage of common sense in decision making and inadequate treatment of marketing result in major product failures.

Considering the information above, the next section aims at building a systematic approach towards new products that will allow businesses to mitigate risks. (Proctor 2000, 510-513).

3.3.2 Methodical approach

Experts have developed a six stages model that allows organizations to evaluate a new product idea. The earlier the company realizes, that the idea is poor, the better it is since

costs arise when the business moves from one stage to another. The model is represented in Figure 7.

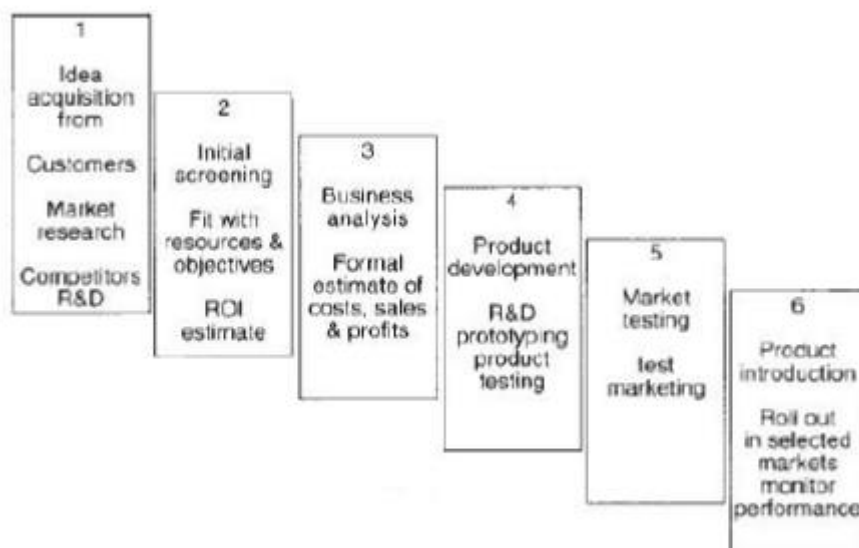


FIGURE 7. Six Phases of the New Product Development Programme (Proctor 2000, 514).

The first stage is called **Idea Acquisition** stage. At this phase, the company is supposed to analyze its resources and major problems. It also should take into consideration external growth opportunities such as expanding markets, new technologies, and rising profit margins. All these aforementioned operations will report to the organization about key strategic interests.

New product ideas can be generated from customer feedback, R&D activities, market research and monitoring competitors' product development. One technique to gain new ideas is based on problem solving. The business should identify particular unmet needs and desires via customer complaints, sales call reports, service department records, etc. and use them as an opportunity to launch new products. Another solution could be to interpret a product as an entity with various dimensions. For instance, all commodities differ in sizes and shapes, are produced of various materials and belong to various target markets. The combination of various dimensions may result in the birth of the new product idea. (Proctor 2000, 514-522.)

When the idea is generated, the second stage **Screening** comes. Experts claim that new ideas do not necessarily appear simultaneously. They are usually born one at a time and cannot be compared to many other alternative solutions.

At screening stage, the company makes rough estimates which will be more accurately calculated in the next phases. However, the new product idea should already positively respond to several questions/ challenges. For example, the company should clearly understand if the new product is able to fulfill the missing need in the market, if the product is going to attract enough target audience, if the product's promotion is easy to arrange and if the new product can be efficiently delivered via present distribution channels, etc. The following checklist can undoubtedly be extended or cut down to size. However, all successful new products share two basic characteristics: ***they correspond to the company's inner functional strengths and meet the market need.*** (Proctor 2000, 522-524.)

The next stage is **Business Analysis** stage. At this phase, the organization estimates profits and costs, associated with the product launch. Experts suggest that the more approaches the company uses the more precise the estimates are. These approaches are:

- Examining sales histories of similar products
- Surveying market opinion
- Using expert opinions
- Statistical models

In spite of the chosen method, the business has to predict the minimum and maximum sales to adequately measure the risks. Another crucial point to consider in profit calculation is whether the new product is a one-time purchase, infrequently purchased or a frequently purchased product. If the item belongs to infrequently purchased category, the company has to analyze the first-time sales and replacement sales. If the item is a frequently purchased product, the company should pay attention to first-time buyers and repeat purchases.

Speaking about the costs, the organization should beware of rising costs on supplied parts or raw materials which will incline the final price on products and services.

From the financial viewpoint, all new product ideas have to be tested from the angle of after-tax return on investment, payback period and the best/ worst scenario of return on investment and payback period to forecast the risks.

When the financial side is clear, the company could use the aforementioned survey of market opinion. This technique provides businesses with a deeper understanding of the selling item, its benefits and customer perceptions regarding it. By using this method, the company will figure out if the benefits of using the product are clear to a customer, if the

product gives satisfaction and the product price corresponds to the value customer obtain from utilizing it. (Proctor 2000, 524-528.)

When all appropriate estimates are carried out, the new stage **Product Development** is launched. During this phase, new product ideas are transferred to physical entities and are introduced to the market. Product development stage varies in the timeline because some items are more complex and time-consuming to be produced than others.

It is also a stage when heavy costs arise. Usually, the production process starts with prototyping. Prototypes are physical versions of the product that meet customer needs, can be safely utilized under normal use and conditions and require limited manufacturing costs. When the prototype is created, it is a subject to numerous customer tests to ensure that it is effective and safe enough. Testing can be arranged in several ways. For instance, sometimes users are invited into laboratories to try the sample out or it can also be delivered to their houses for home usage. (Proctor 2000, 529-530.)

After the Product Development phase, the **Test Marketing** stage starts. In case the launch costs are relatively high, it is common to test the new product before supplying it in large quantities to the market. Test marketing might be regarded as a risky practice from the security viewpoint because it can lead to the leakage of confidential information to company's competitors though at the same time it can significantly reduce expenditure and save company's budget.

Marketers identify a wide range of testing techniques nowadays, however, the test marketing of industrial and consumer goods differs a lot. When choosing a proper approach, it is crucial to consider **speed** as a key decision factor. Nowadays companies have to introduce new products to the market extremely quickly in order to be ahead of the competition. To win in this speedy world the organization has to do the right job the first time, do not delay decision making, motivate its team, ensure that its products are easy to test, utilize wide-spread components, encourage immediate market awareness, etc. (Proctor 2000, 531-533.)

If the tests have been carried out successfully, the company can enter the market or, in other words, the **Product Introduction** stage comes. At this stage, the organization has to choose the right entry strategy which heavily depends on how familiar the firm is with its potential market.

Familiarity can be described by three levels: **base, new/ familiar and new/ unfamiliar**. Base familiarity means that the firm is already selling its products in this market. A new/ familiar category means that the company has conducted an extensive research, has

experienced staff and links with this market as a customer. Finally, a new/ unfamiliar category is applied when there is a shortage of knowledge and/ or experience.

The degree of familiarity with the market is discussed, however, nothing has been said about the familiarity with the technologies. Experts also name three levels: base, new/ familiar and new/ unfamiliar. The base means that the technology is already implemented in the company's products and services. New/ familiar refers to the situation when the organization is familiar with the technology via extensive research or experience with similar technologies. Finally, new/ unfamiliar means that knowledge and/ or experience regarding the technology is missing. (Proctor 2000, 540-541.)

Based on the two aforementioned factors, Proctor suggests the following entry strategies, summarized in Figure 8.

EXHIBIT 12.10 ENTRY STRATEGIES				
Technology or service embodied in the product				
		<i>Base</i>	<i>New familiar</i>	<i>New unfamiliar</i>
Market factors	<i>New unfamiliar</i>	joint ventures	venture capital or educational acquisitions	venture capital or educational acquisitions
	<i>New familiar</i>	internal market developments or acquisitions (or joint ventures)	internal ventures or acquisitions or licensing	venture capital or educational acquisitions
	<i>Base</i>	internal base developments (or acquisitions)	internal product developments or acquisitions or licensing	joint ventures

FIGURE 8. Entry Strategies. (Proctor 2000, 542).

The following part briefly discusses the entry strategies mentioned above. To begin with, the part starts with the concept of joint ventures. According to Scott Allen, a **joint venture** is “a strategic alliance where 2 or more parties, usually businesses, form a partnership to share markets, intellectual property, assets, knowledge and profits” (Allen 2017). The joint venture is usually represented as a separate business entity and is operated under the agreement. In other words, the initial companies retain their freedom and are responsible only for liabilities, mentioned in this agreement. (Murray 2017.)

The main purpose of setting a joint venture is the intention to enter the market without heavy financial investment. Secondly, some organizations consider joint ventures because of local regulations and legislation systems. Thirdly, joint ventures also happen between large and small enterprises because in some cases large companies through such collaboration can get access to technologies or resources challenging to obtain.

The reasons and the advantages are obvious yet nothing has been said about the risks of launching a joint venture. Scott Allen claims that the official statistics on joint venture failure is hard to find because little research has been conducted in this field. However, according to recent findings, 60% of all joint ventures fail within five years. The key reason for this is the human factor. For instance, the partners set various goals to be achieved via this collaboration or have various perceptions of deadlines and time or are just incapable of organizing proper communication. Moreover, quite many joint ventures fail due to a lack of trust between partners. The joint venture is able to succeed only when all partners are willing to work and move forward together. (Allen 2017.)

The second possible entry strategy is an **acquisition**. An acquisition is a situation “when one company takes a controlling interest in another” (Financial Times 2017). When the acquisition is carried out, the second company, called an acquiree, can either still remain as a separate entity or completely shut down its operations and transfer the assets to an acquirer (Financial Times 2017).

McKinsey&Company suggests that six types of successful acquisitions exist. The organization also claims that the acquisition succeeds only when there is a “specific and well-articulated value creation idea” (Goedhart, Koller & Wessels, 2017). One favorable scenario is when one company acquires another entity with the purpose of improving the performance. By carrying out this activity, the company is able to cut down costs, improve margins and cash flow and even encourage revenue growth. Another reason for choosing acquisition is to remove excess capacity from the industry. Companies are usually extremely unwilling to cease their existing facilities, though they might be quite unprofitable. In return, the organizations tend more to arrange an acquisition and shut down means of production across larger combined entity. McKinsey&Company also mentions other plausible reasons such as improving market access, obtaining skills and technologies that are challenging or more costly to be built, etc. (Goedhart, Koller & Wessels, 2017.)

Speaking about the advantages of this market entry strategy, it seems essential to mention that acquisition is the quickest growth strategy, allowing companies to reach larger market share, build stronger market presence and diminish the power of

competitors. In addition, experts emphasize the role of reduced entry barriers and new resources, and competences to obtain.

On the other hand, critics claim that acquisitions pose certain risks to the companies. For example, the acquisition may turn out to be financially unprofitable and, moreover, can lead to the loss of key customers, personnel and fewer synergies. More than that, the integration process can cause difficulties due to various organizational cultures or diverse product lines. Another obstacle to overcome is finding a reliable well-established partner otherwise the acquisition is likely to damage the organization itself. (Nead 2014.)

Licensing is another entry strategy mentioned by Proctor. Licensing, as a cooperation form, involves a licensor and a licensee. These parties make an agreement and the licensee gets access to licensor's invention, product or trademark and has to pay back the royalties on any profit. (Dwilson 2018.)

Experts name some advantages in favor of this entry strategy. From the licensor's viewpoint, the owner of a product/ intellectual property has a passive income deriving as a percentage of licensee's sales without losing ownership rights. In other words, he/ she is generating profit without making any efforts. From the licensee's angle, it is also regarded as a rewarding and efficient form of cooperation since the licensee is able to get a greater return. For instance, by operating under well-known and reputational trademark he/ she can charge higher prices. Another example is the situation when the licensee has bought an access to some invention and by upgrading it he/ she is most likely to enjoy some extra revenue.

The benefits are clear still this form of cooperation poses certain risks and threats for both parties. Licensors can become victims of piracy and technology being stolen especially when they lack strong legal representation. Special attention should be paid to software because it relates to "extra risky" product categories. The software is extremely easy to get stolen since licensee has an opportunity to make millions of copies and distribute it illegally. The risks of licensors are obvious however licensees can also face certain challenges such as high dependency on its partners. As soon as the licensor realizes that another party is heavily dependent on him and his business, he/ she can incline the price or set stricter terms of condition when renewing the agreement. Another threat to bear in mind is the fact that the licensee probably does not have an exclusive license what means that he/ she is going to operate in the competitive environment and enjoy lower profitability rates than expected. (Dwilson 2018.)

Apart from these three well-known approaches, Figure ten has also mentioned venture capitals. Venture capital is the funding, provided for building new start-ups with high

growth and high risks potentials from other businesses and firms. The main reason for this finding is the fact that new companies are not able to borrow money for growth and development from traditional institutions like banks. However, they are capable of obtaining financial support from venture capitalists who are willing to invest in return for ownership shares. By making an investment venture capitalists gain an opportunity to participate in decision making in the future. (Brooks 2013.) The entry strategies are discussed and the next sub-chapter is about consumer adoption process and how customers relate to innovations.

3.4 Consumer adoption process

The last sub-chapter of Product Management chapter is dedicated to consumers and their adoption process. Kotler defines adoption as “an individual’s decision to become a regular user of a product” (Kotler, Keller, Brady, Goodman & Hansen 2009, 567).

The consumer adoption process includes a couple of steps individuals have to pass through from hearing about a new product for the first time to its final adoption. Experts identify five stages and these are:

- **Awareness:** the consumer learns about the product’s existence but lacks knowledge about it
- **Interest:** the consumer is willing to look for information about the innovation
- **Evaluation:** the consumer evaluates, if the innovation is worth trying or not
- **Trial:** the consumer is testing the new product in order to improve his or her estimate of its value
- **Adoption:** the consumer makes a conscious decision to become a regular user of the product (Kotler, Keller, Brady, Goodman & Hansen 2009, 567.)

Marketers have to make the adoption process as smooth as possible. In order to achieve this goal, they should consider offering a trial-use with an option to buy to potential users. After testing the product, customers are more secure about the product, its benefit, and quality what is extremely necessary when the item is relatively expensive.

Experts name a couple of factors influencing the adoption process. These are differences in individual readiness to try new products, the effect of personal influence, differences in the organization’s readiness to try new products, etc.

To begin with, the discussion starts with an **individual’s readiness to try a new product**. In each industry, there are people who are more tolerant and open-minded to new ideas than other members of their social system. They are called pioneers and early adopters.

Figure 9 describes users, considering the time of the adoption of innovations. They are categorized as innovators, early adopters, early majority, late majority, and laggards.

Innovators are technology enthusiasts who are willing to test new products and communicate about its weaknesses in response to low prices. (Kotler, Keller, Brady, Goodman & Hansen 2009, 567-569).

Early adopters are opinion leaders who get attracted by new technologies and carefully look for them. They are less dependent on prices and are eager to trial innovations if they are provided with personalized solutions and good service support.

Early majority are mainstream users. They switch to new technologies when their advantages are proven and obvious and the degree of adoption is relatively high.

Late majority are skeptics who are very price sensitive, technologically shy and reluctant to take risks.

Laggards are people who are not willing to adopt new technologies until their status quo is no longer defensible.

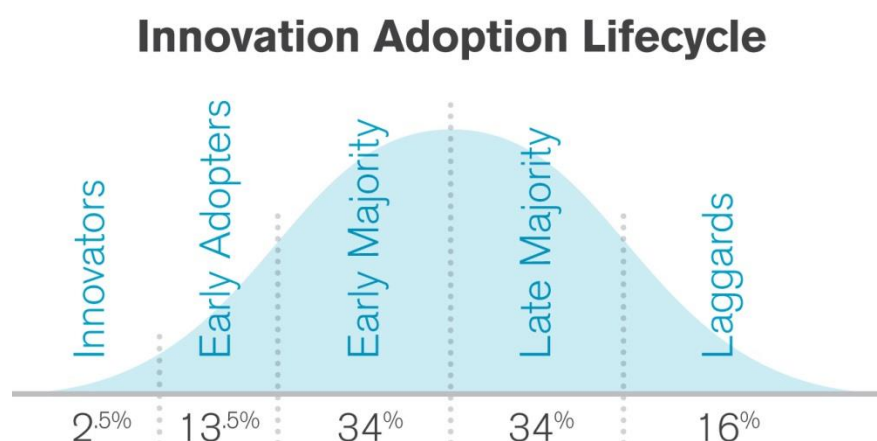


FIGURE 9. Adopter Categorization on the Basis of Relative Time of Adoption of Innovations (Kotler, Keller, Brady, Goodman & Hansen 2009, 568).

Secondly, **personal influence** also plays a key role in consumer purchasing decisions. In other words, the impact one person has on another. Marketers believe that personal influence plays a greater role in the purchasing decisions of late adopters rather than early adopters.

Finally, the last factor to be discussed is the **organization's readiness to adopt innovations**. In the majority of cases, innovators are willing to supply their new products to innovative enterprises and establishments. The level of innovation tolerance depends

on the organization, its size, and profits. It is also relevant to consider the age and the educational level of top management. Finally, the level of adoption depends on the company's operational environment including community progressiveness and income. (Kotler, Keller, Brady, Goodman & Hansen 2009, 567-569).

To conclude, consumer adoption is a process that educates customers about new products, allows testing them. As a result, consumers either accept or reject innovations. This process is a subject to many influential factors such as consumers' and organizations' willingness to try out new market offerings, personal influence, etc.

4 AUGMENTED REALITY INDUSTRY IN EUROPE

This chapter provides an overview of the state of the augmented reality industry in Europe. The topic is relatively new and little research has been conducted yet. The researcher uses the **CBI report** as one of the key sources of information. CBI is the Centre for the Promotion of Imports from developing countries. It was founded in 1971 and nowadays is supported by the Netherlands Ministry of Foreign Affairs. (About CBI, 2017.) The researcher has also used some main ideas and statistics gained from **Virtual Reality and Its Potential for Europe research** carried out by Ecorys. “Ecorys is an economic and strategy consulting firm with a global reach, serving clients in over 100 countries” (Bezegová, Ledgard, Molemaker, Oberc & Vigkos 2017, 2). These two resources have served as a cornerstone for this chapter.

4.1 AR industry in Europe

The aforementioned CBI report suggests a couple of statements that reflect the content of this chapter. All these ideas are listed here and will be more deeply discussed in the next sub-chapters. According to the CBI report:

- The AR and VR market is dramatically growing worldwide and is likely to be accounted for €150 billion by the year 2020
- The market is shifting from the VR field to the AR field
- Europe is going to represent one fifth of the global AR and VR market
- The most likely and promising customers for VR and AR services are gaming and healthcare industries
- Both B2B and B2C markets can bring new opportunities for VR and AR industry. (Virtual Reality and Augmented Reality in Europe 2017.)

4.2 Key trends on the European market offering opportunities for VR and AR industry

This sub-chapter provides certain trends, occurring on the European market, which can bring new opportunities for enterprises, operating in VR and AR field. CBI report names such trends as technological developments, mobile applications, 4G and 5G internet, and skills shortage.

To begin with, the researcher starts with the **technological developments** trend. It is an open secret that VR and AR, as emerging technologies, are developing at super high speed. New technologies, appearing on daily basis, give both B2B and B2C customers an

easier access to VR and AR applications. Such new technologies as less bulky and expensive hardware, well-developed graphics, VR sensors in mobile devices and new software platforms encourage the development of AR and VR applications. In the upcoming year, they are still going to play a significant role in AR and VR industry development and act as key boosters. (Virtual Reality and Augmented Reality in Europe 2017.)

Secondly, **mobile applications** are regarded as the second main trend on the European market. Mobile VR and AR applications are also going to act as a primary source of opportunities for enterprises, specializing in this field. Statistics claim that 23% of developers have already shifted to VR and AR mobile application development. They believe that this trend is going to grow into the consumer-first market.

The third key trend is **4G and 5G mobile internet**. Growing and rapidly developing technologies require a certain level of bandwidth. 4G internet is accessible almost everywhere in Europe and its quality is improving on a daily basis. However, despite impressive average characteristics, the availability and speed vary a lot within European countries. Thus, Hungary, the Netherlands, Lithuania, and Denmark are evaluated as countries with good 4G coverage ranging from 71 to 85 percent availability and from 28 to 41 Mbps speed. However, statistics show that, for instance, in Ireland and France the availability rate is less than 50% and the average speed is around 20-24 Mbps, what means that these countries belong to limited coverage category. (Virtual Reality and Augmented Reality in Europe 2017.)

In comparison to 4G internet, that is already a mainstream, 5G internet is still on its way to Europe. Experts promise that 5G internet's speed will equal to the speed of fiber optics. It means that its introduction to VR and AR industry will bring a new level of customer experience and customer satisfaction. European Union is actively supporting the spread of 5G internet and has already created the 5G for Europe Action Plan. According to this plan, by 2020 5G is going to serve as a cornerstone for all commercial services and by 2025 it will be common for all urban areas and the majority of transport paths.

Finally, the last but not the least trend is a **skills shortage**. Due to the fact that European VR and AR market is constantly developing, the need for specialized developers is rapidly increasing. However, the key issue is that the European Union is lacking experienced professionals with relevant IT competencies and certification. With reference to the European Commission, the shortage of skilled IT specialists may reach the edge of 825K by 2020. (Virtual Reality and Augmented Reality in Europe 2017.)

4.3 The potential of the European market for VR and AR service providers

Nowadays Europe has already become one of the most attractive markets for VR and AR service providers in line with Asia and North America. It is estimated that in the near future Europe will represent one fifth of the AR and VR global market. Apart from this, the CBI report also specifies that the greatest potential will be deriving from western European countries.

Figure 10 below shows the pace of growing industry in Western Europe. (Virtual Reality and Augmented Reality in Europe 2017.) For instance, its share in 2017 was followed with 2,5 million whereas, according to forecasts, in 2020 the market value would be accounted for 25,7 billion. In other words, the market would have grown by 10 times.

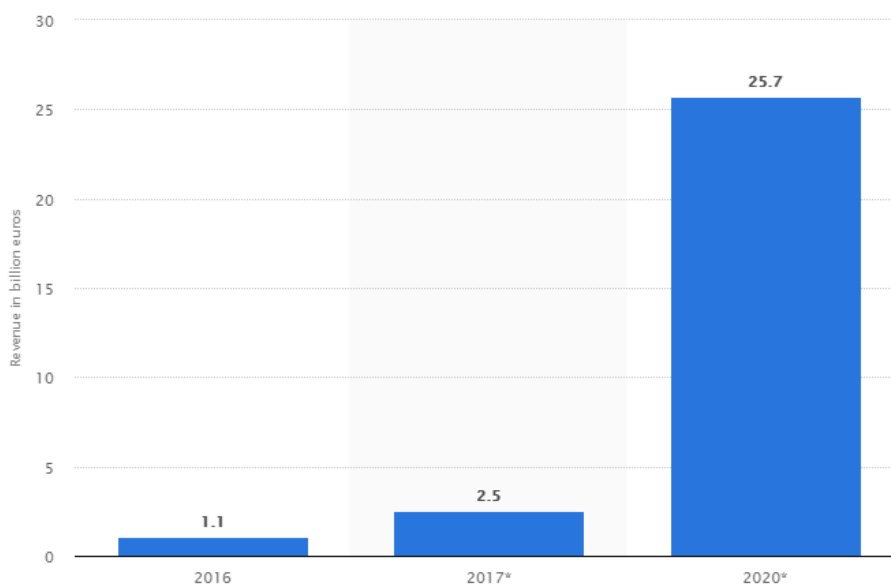


FIGURE 10. Revenue for Augmented Reality and Virtual Reality in Western Europe from 2016 to 2020 (in billion euros) (Statista 2017).

These estimates are supported by the research conducted by Ecorys. Ecorys is an economic and strategy consulting firm with a global research, serving clients in over 100 countries (Bezegová, Ledgard, Molemaker, Oberc & Vigkos 2017, 2). The firm suggests two key ideas: by 2020 the production value of VR and AR industry will grow between €15 and €34 billion and, secondly, the industry will open from 225K to 480K both direct and indirect new working positions. (Bezegová, Ledgard, Molemaker, Oberc & Vigkos 2017, 5.)

Figures 11 and 12 demonstrate these estimates via bar charts. Figure 11 describes the growth driven by content while Figure 12 illustrates increased employment rates. Both

graphs provide minimal and maximal probable outcomes expressed as optimistic (blue) and baseline (light blue).

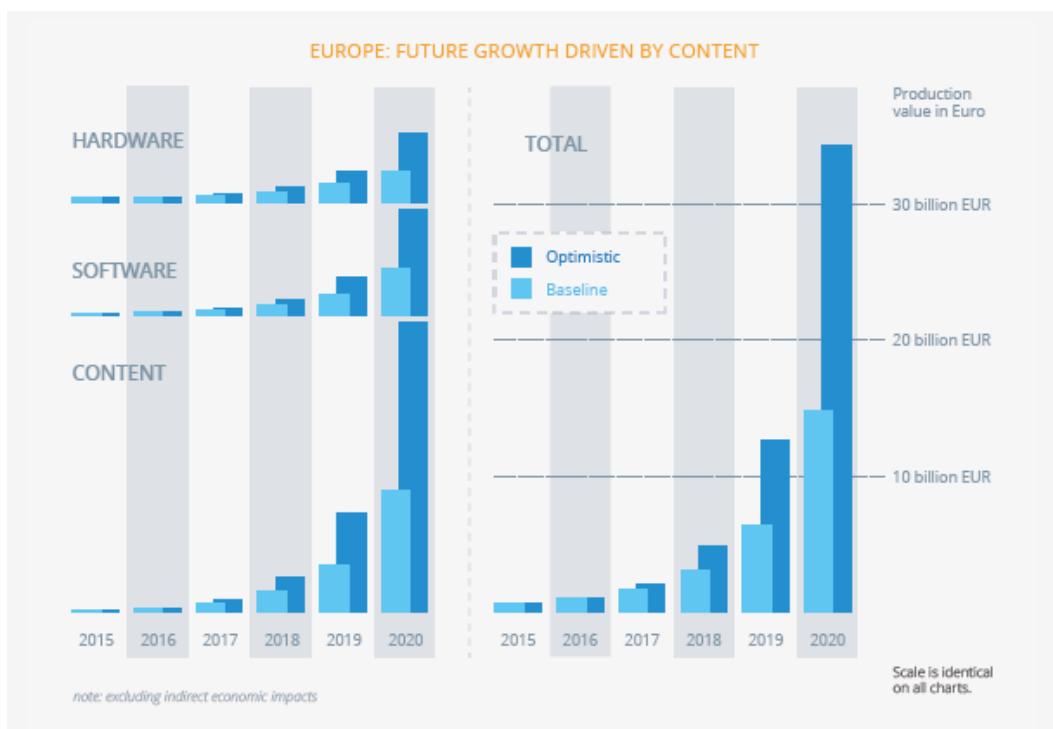


FIGURE 11. Europe: Future Growth Driven by Content (Bezegovaa, Ledgard, Molemaker, Oberc & Vigkos 2017, 15).

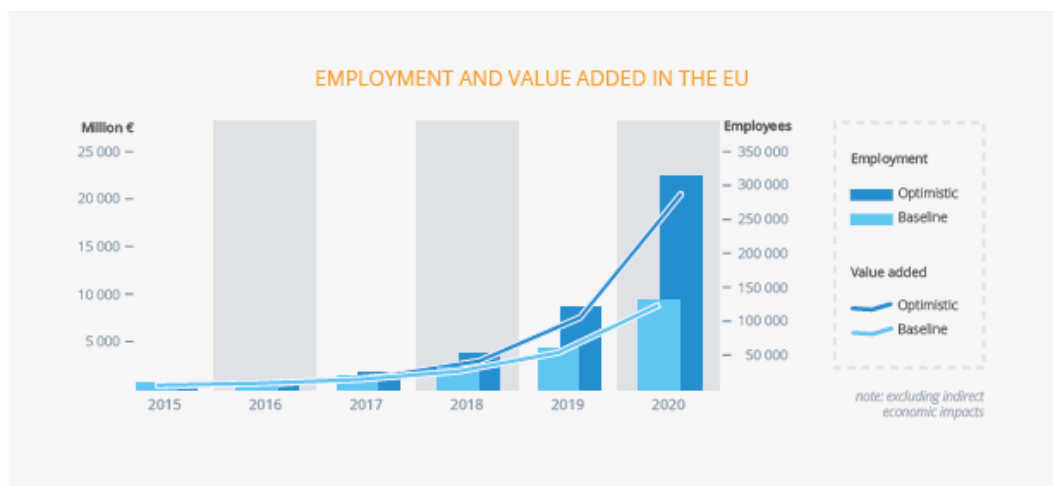


FIGURE 12. Employment and Value Added in the EU (Bezegovaa, Ledgard, Molemaker, Oberc & Vigkos 2017, 15).

4.4 European VR and AR companies

According to the study, conducted by Bezegovaa, Ledgard, Molemaker, Oberc and Vigkos, European VR & AR operators are represented by small or medium-sized companies.

More than 30% of companies employ between one to ten workers, what allows experts to relate them to “micro” category. Around 29% of VR and AR service providers serve as a workplace for 11-50 employees. However, it is worth mentioning that some very large companies, employing more than 1000 workers, provide 20% of total VR & AR jobs in Europe. In the wide majority of cases, these very large enterprises operate in the manufacturing field and implement VR & AR solutions for engineering. (Bezegová, Ledgard, Molemaker, Oberc & Vigkos 2017, 21.) All the aforementioned findings are summarized in Figure 13.

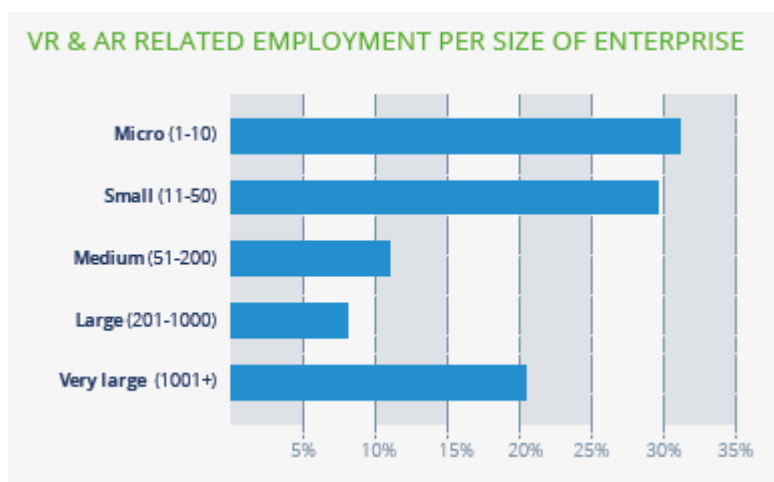


FIGURE 13. VR & AR Related Employment per Size of Enterprise (Bezegová, Ledgard, Molemaker, Oberc & Vigkos 2017, 20).

Speaking about the product, the research suggests that only 28% of all VR & AR products are well-established at the market and generate profits for their creators. The rest are still under development stage or have just been introduced to the market. Besides, 6% of VR & AR services stay within companies as they have been created for inner purposes. All statistics, concerning product maturity, are reflected in a more detailed way in Figure 14.

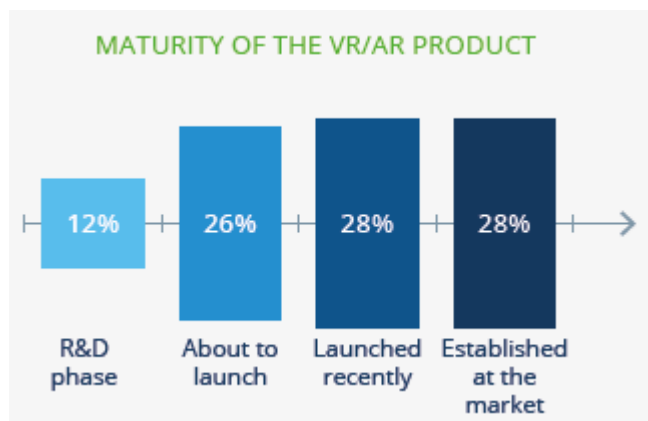


FIGURE 14. Maturity of the VR/ AR Product (Bezegová, Ledgard, Molemáker, Oberc & Vigkos 2017, 20).

When the topic deals with companies, it is quite relevant to discuss financing. European VR & AR start-ups are financed mainly through companies, “as a side activity of the company” or are self-funded or through venture capital (Bezegová, Ledgard, Molemáker, Oberc & Vigkos 2017, 20). Very rarely, to be precise in 4% of cases, start-ups get financial support from EU public funding, national or local public funding (9%) or from outside Europe. Statistics are illustrated in Figure 15.

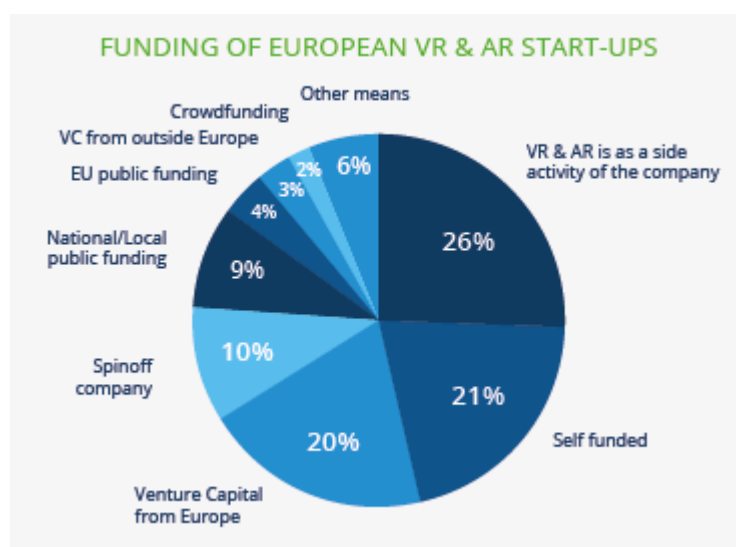


FIGURE 15. Funding of European VR & AR Start-Ups (Bezegová, Ledgard, Molemáker, Oberc & Vigkos 2017, 20).

Figure 16 shows the presence of VR & AR service providers within European countries. According to the research, such countries as France, Germany, The United Kingdom, and the Netherlands are the frontrunners in this field. However, the industry is also rapidly growing in Nordic countries, like Finland and Sweden, Switzerland, Spain and Italy. Eastern European countries are characterized by limited VR & AR activity.

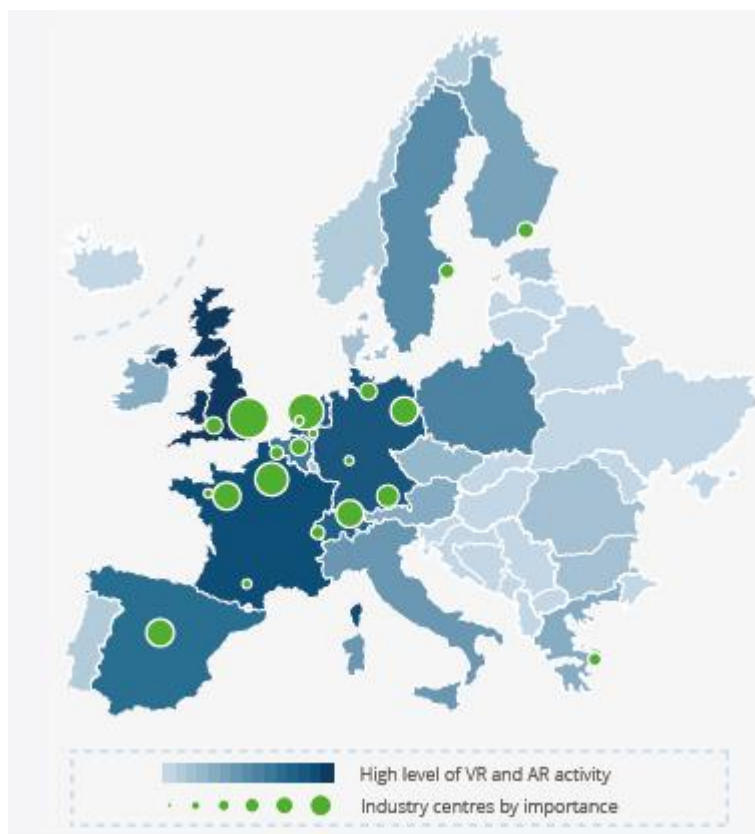


FIGURE 16. VR & AR Companies in Europe (Bezegová, Ledgard, Molemaker, Oberc & Vigkos 2017, 26).

London, Amsterdam, Paris, Laval, Berlin, Munich, Stockholm, Zurich, and Madrid are regarded as hot spots for VR and AR field. Among these cities, London and Amsterdam play an even greater role. These cities are named as spots with the most favorable atmosphere for new VR and AR start-ups because of their “innovative culture” and “vibrant business environment”. (Bezegová, Ledgard, Molemaker, Oberc & Vigkos 2017, 26).

Speaking about the industries, entertainment, gaming, healthcare, real estate, architecture, training for professional are going to be the most applicable areas for the VR & AR activity (Bezegová, Ledgard, Molemaker, Oberc & Vigkos 2017, 26). Figures 17 and 18 show what areas and what kind of products are mostly developed and produced in frontrunner and runner-up countries.

EUROPE'S VR AND AR FRONTRUNNERS		
COUNTRY	TOP APPLICATION AREAS	TOP TYPE OF PRODUCT
UK	Cinematic entertainment, Gaming	Content - video, 3D modeling
FR	Manufacture & engineering, Cinematic entertainment	Software and content
NL	Entertainment, Advertising	Content - video, 3D modeling
DE	Manufacture & engineering, Entertainment	Software and content

FIGURE 17. Europe's VR and AR Frontrunners (Bezegová, Ledgard, Molemaker, Oberc & Vigkos 2017, 26).

VR AND AR RUNNER-UP COUNTRIES		
COUNTRY	TOP APPLICATION AREAS	TOP TYPE OF PRODUCT
SE	Entertainment, Gaming	Software and content
ES	Gaming, Entertainment	Software and content
CH	Healthcare, Gaming	Software and content
PL	Entertainment, Gaming	Content - video, 3D modeling

FIGURE 18. VR and AR Runner-up countries (Bezegová, Ledgard, Molemaker, Oberc & Vigkos 2017, 26).

4.5 The requirements towards VR and AR service providers

European Union sets a wide range of requirements, both legal and non-legal, the companies and businesses have to comply with, if they would like to operate on its territory (Virtual Reality and Augmented Reality in Europe 2017).

First of all, it has come up with data protection legislation, known as the **Data Protection Directive (95/46/EC)**, in order to enable the privacy of its citizens. The main purpose of

this directive is to find a balance between a high level of privacy protection of individuals and a free movement of personal data.

For instance, it sets that personal data must be processed in a fair and lawful way and collected for specified and legitimate purposes. In other words, personal data must be accurate and up to date, must be used only for the purposes it was collected for and not be stored longer than needed. The law also states that it is prohibited to track personal data related to ethnic origin, political beliefs, health and sex life, etc. If personal data processing is not organized in a fair and lawful way, what damages someone's reputation or personal life, this someone is allowed to demand a compensation for damage suffered.

Concerning free movement of personal data, the Data Protection Directive says that personal data must be transferred to third countries with the relevant degree of protection. (Protection of Personal Data 1995.)

Another key regulation, to be taken into account, is the **Directive on the legal protection of computer programs**, issued on 23 April 2009. This document declares that the European union's member states should protect computer programs by copyright. A computer program can be protected only if it is the author's intellectual property. According to this law, computer programs' right owners are allowed to reproduce the product in part or in whole, translate, adapt or distribute it to the public. Any distribution of computing program copies by parties, other than right holders, is forbidden. A person, who is suspected of distributing copies for commercial purposes, is a subject to remedy, according to national legislation systems. (Directive 2009/24/EC of the European Parliament and of the Council of 23 April 2009 on the Legal Protection of Computer Programs, 2009.)

In addition, buyers often prefer businesses to comply with data security **ISO standards**. It concerns both data protection and security systems. For example, ISO 27001 standard provides "requirements for establishing, implementing, maintaining and continuously improving an Information Security Management Systems (ISMS)" (An Introduction to ISO 27001 (ISO27001), 2013).

The compliance with requirements is discussed. The next sub-chapter is dedicated to the topic of competition. The researcher will explain what challenges VR and AR service providers are going to face on the European market and introduce the concepts of outsourcing and nearshoring.

4.6 Outsourcing and nearshoring

The sub-chapter starts with the analysis on why European companies prefer to outsource IT services. Experts name 2 main reasons like **cost reduction** and **lack of in-house expertise and specialization**.

64% of European operators claim that the key purpose of IT services outsourcing is cost reduction. Developing countries offer cheaper labor and more competitive pricing. The first reason is relatively obvious, yet the second one seems to attract more interest. The Europeans companies enjoy outsourcing AR and VR solutions because they require in-house expertise. These services demand a certain level of knowledge and skills which the European operators do not have at their disposal. Lack of specialization among businesses gives opportunities to players, operating and originating outside the European Union. The topic of outsourcing ends with some statistics: research has shown that 41% of European companies intend to incline IT outsourcing, 37% have made a decision to keep it at the same level whereas only 9% of enterprises believe that they will decline outsourcing activities. Thus, the aforementioned data proves that Europe based businesses will have to compete with both European and non-european VR and AR service providers and have to find some competitive advantages, outweighing the benefits of lower costs. (Virtual Reality and Augmented Reality in Europe 2017.)

In addition, European enterprises tend to either outsource services within the same countries, the practice known as onshoring, or choose nearshore locations. By nearshoring the companies can enjoy language and cultural similarities, proximity and little or no time differences. Eastern European countries, like Poland, Bulgaria, and Romania, have always been the most preferred outsourcing destinations, though, in times of prices rising, they are gradually losing their attractiveness. Due to this situation, European operators are forced to outsource their operations further. Experts say that such countries as India, China, Malaysia, Brazil, and Indonesia are regarded as destinations with the most potential. (Virtual Reality and Augmented Reality in Europe 2017.)

4.7 3D modeling

This sub-chapter is about three-dimensional modeling (3D modeling) since Grib, the case company, creates 3D models in Augmented Reality. The sub-chapter starts with the definition of this term.

According to ArchiCGI, the company that deals with 3D architectural rendering services, 3D modeling is “the process of creating a three-dimensional model of an object” (What is

a 3D Modeling? Things You Have Got to Know Nowadays 2016). This technology enables users to capture the size, shape or texture of a real physical or artificial entity.

The history of 3D modeling started in the 1960s. At those times the technology was available only to computer engineers or automation specialists who worked with mathematical models and data analysis. Ivan Sutherland, the creator of Sketchpad, is called as a pioneer of 3D graphics. With his co-worker David Evans he has established the first 3D graphics company in 1969 under the name “Evans & Sutherland”. At the beginning, 3D modeling and graphics were used mainly in advertising purposes or on television though nowadays experts have already found a lot more areas of its implementation. What is a 3D Modeling? Things You Have Got to Know Nowadays 2016.)

3D modeling has already impacted a wide majority of industries. However, it is commonly believed that technology has had the strongest influence on gaming, entertainment, architecture, manufacturing, publishing, advertising and marketing, geology and science and healthcare. For instance, nowadays publishers are using 3D solutions to create illustrations of places with challenging access or rare flora and fauna. They also claim that the technology is rather beneficial when they need fantastical illustrations showing future or pre-historic events. Besides, scientists take the advantage of 3D modeling to create artificial earthquakes and landforms and study the effects of these stresses. (Conversion 2018.)

5 CASE STUDY

The chapter is written with the purpose of introducing schooling in Nordic countries. It deals with a range of quantitative data and focuses on the number of schools and pupils in these countries. This quantitative data is withdrawn from reliable local information sources and is provided per country.

The chapter starts with the overview of a Nordic Region. The information provided is supported by **State of the Nordic Region** report. Starting from 1981, the following report is being published once in two years. The researcher has used the latest report, published in 2018, that contains the findings of 2016.

To begin with, the Nordic Region includes Denmark, Norway, Sweden, Finland and Iceland, as well as the Faroe Islands, Greenland and Åland (Grunfelder, Norlen & Rispling 2018, 12). The region is positioned as the seventh largest area in the world with the total territory of 3425804 km². Its population is around 27 million people and its economy is 12th largest in the world. Despite the impact of the economic crisis and the fact that half of its area is covered with glaciers and ice caps, the region is performing well exceeding average EU indicators. (Haagensen et al. 2017, as cited in Grunfelder, Norlen & Rispling 2018, 17.)

Worldwide Nordic countries are recognized as highly innovative region offering a wide variety of knowledge-intensive jobs and positions even in peripheral areas. Another extremely developed field in this region is green solutions. Nordic countries are a very attractive destination for Foreign Direct Investment (FDI) inflows that are followed with seven percent while the population share in comparison to the entire EU is around four percent. (Grunfelder, Norlen & Rispling 2018, 23).

Since the empirical part is devoted to schooling, the case study also briefly discusses the education systems of Nordic countries. The researcher has decided to target Sweden and Norway as these two countries are very close to Finland. Finland is excluded from the research process because Grib's CEO Pouria Kay has already launched some business activity on its territory and would like to obtain more information about its neighboring countries.

Except the description of the Nordic region, the chapter also introduces Grib as a product. The researcher mentions the story of the start-up and briefly explains, how the application works and what makes the product different and outstanding.

5.1 Norway

The public education system of Norway is one of the best in Europe. It is represented by primary schools, lower secondary schools and upper secondary schools. Everyone aged 6-16 is obliged to attend schools. Public education is free of charge and classes are taught in Norwegian. (Schools in Norway. The Norwegian Education System 2018.)

Primary and lower secondary schools in Norway are for pupils aged 6-15 from first to tenth grade. With respect to the report **Facts about the Education in Norway 2018 - Key Figures 2016**, issued by Statistics Norway, around 629275 pupils study at primary and secondary schools. Among them, 444638 pupils are involved in primary education and 184637 respectively in lower secondary education. (Facts about the Education in Norway 2018 - Key Figures 2016, 3.)

The following data is represented in Figure 19.

Pupils in primary and lower secondary education, in total	629 275
Primary education	444 638
Lower secondary education	184 637

FIGURE 19. Number of children, apprentices, trainees, and students. 2016. Pupils in primary and lower secondary education (Facts about the Education in Norway 2018 - Key Figures 2016, 3).

Another crucial area to consider, when speaking about primary and secondary education, is the number and type of schools. According to the report, as of 2016, Norway has 2858 schools. These are municipal, county, state and private schools. Statistics are attached in Figure 20.

Primary and lower secondary schools. Type of schools and ownership. 2016

	Total	Primary schools	Combined primary and lower secondary schools	Lower secondary schools
Total	2 858	1 615	746	497
Municipal	2 608	1 539	603	466
County	10	0	3	7
State	2	0	2	0
Private ¹	238	76	138	24

FIGURE 20. Primary and Lower Secondary Schools. Type of schools and ownership. 2016 (Facts about the Education in Norway 2018 - Key Figures 2016, 9).

With respect to Figure 20, the following conclusion arises: 91% of schools are municipal whereas private schools represent only 9% of all educational establishments. The share of state and county schools is even lower. In total in Norway 22721 pupils study in private schools and 49336 are on special needs education (Facts about the Education in Norway 2018 - Key Figures 2016, 8). Private schools in Norway are relatively unpopular. As it can be seen from Figure 23, less than 4% of pupils attend them.

5.2 Sweden

Sweden is the largest country of Nordic region with the population over nine million people. Out of these nine million, almost two live in the Stockholm area whereas Northern areas of the country are barely inhabited.

Since the case study is shrunk by mainly secondary schools, it seems important to analyze the Swedish population in terms five to nine, 10-14 and 15-19 age groups. The information regarding the state of these groups is provided in Figure 21.

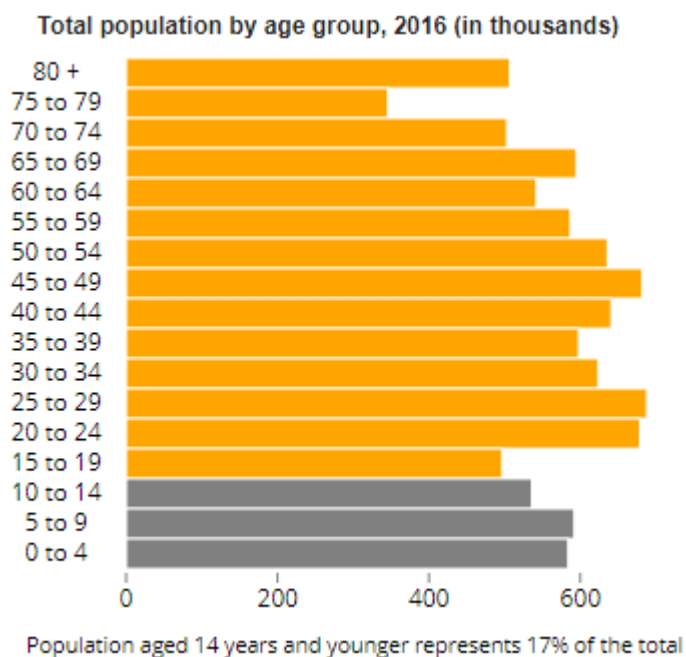


FIGURE 21. Total Population by Age Group, 2016 (in thousands). 2016. (Unesco, Sweden, Education and Literacy, General Information 2018).

As can be seen from the latter chart, the age group five to nine is represented by almost 600 thousand people. The second age category 10-14 includes slightly less Swedish people and its share ranges from 560 to 580 thousand. The last age group under

examination, 15 to 19 years old, is the smallest one out of the entire research selection and has roughly 500 thousand people.

Figure 22 ties up the level of education with age group and Figure 23 illustrates the number of schoolers per each education level. According to this Figure, pre-primary education is meant for three to six age range. Primary education involves the pupils of 7-12 years old. Over 680 thousand of children study at primary leveled educational establishments. The secondary one is for 13-18 years old while tertiary education is for 19-23 age categories. Secondary schools educate more than 599 thousand of pupils and around 688 thousands belong to tertiary education level. Compulsory education lasts for nine years from the age of seven to the age of 15.

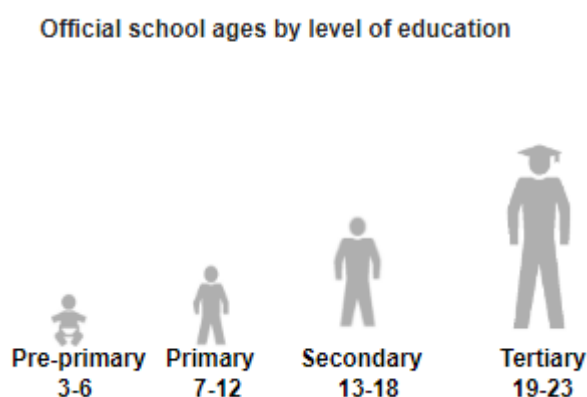


FIGURE 22. Official School Ages by Level of Education. 2016. (Unesco, Sweden, Education and Literacy, Education System 2018).

School-age population by education level

Pre-primary	479,947
Primary	680,394
Secondary	599,452
Tertiary	688,068

FIGURE 23. School-age Population by Education Level. 2016. (Unesco, Sweden, Education and Literacy, Education System 2018).

To cover completely the topic of education in Sweden, it seems crucial to introduce some data regarding education expenditures. Figure 24 provides a broad overview of education expenditures in terms of time gap and types of expenses.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Government expenditure on education										
as % of GDP	6.39	6.86	6.62	6.49	7.66	7.72	7.68	...	...	...
as % of total government expenditure	12.94	13.16	13.2	13.09	15.12	15.02	15.2	...	...	...
Government expenditure per student (in PPP\$)										
Primary education	10378.9	10626.89	10908.54	11254.62	11897.86	10326.44	10398.23	...	...	...
Secondary education	12219.61	12383.9	12592.79	13600.69	13903.12	11255.03	11488.44	...	...	...
Tertiary education	16368.15	16826.9	16504.28	16834.63	18178.33	19704.93	20338.07	...	...	...

FIGURE 24. Education Expenditures. 2014. (Unesco, Sweden, Education and Literacy, Education Expenditures 2018).

As can be seen from the table, in 2014 Swedish spent 7,68% of its GDP on education what is slightly less than in 2013 but higher than in 2012. Speaking about expenditures per education level, it seems obvious that tertiary education is the most expensive one for the government. In 2014 it spent approximately 10398 on the students of primary education level, 11488 on the students of secondary level and 20338 on one of tertiary level.

The last paragraph concerning Sweden deals with the access of Swedish schoolers to smartphones as 3D modeling with the help of Grib is impossible without any devices. Figure 25 demonstrates how many students of 11-13, 14-16 and 17-19 age categories have own mobile phones.

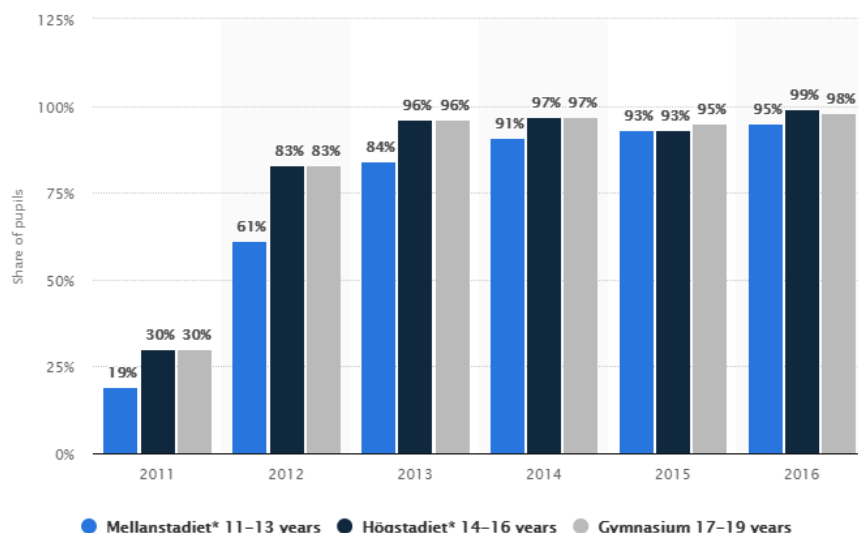


FIGURE 25. Mobile Phone Usage Among Children by Education Level in Sweden in 2016, by Education Level. 2016. (Statista 2016).

Taking a look at the chart, the following conclusion arises: the access to mobile phones has significantly increased from 2011 to 2016. To be precise, almost by three times and

nowadays from 95 to 99 percent of various educational levels have smartphones at their disposal.

5.3 Grib Oy

In 2014 Grib was created in the open environment of Aalto University and recognized as an innovative project. The idea eventually grew into a start-up company and its creators, in cooperation with designers and 3D enthusiasts, started developing an app. This cooperation resulted in a community called GribTown. (Gribbing Oy 2018.)

Pouria Kay, the Chief Executive Officer of Grib, truly believes that in the 21st century, users do not have weeks or days to learn how to use the software. They should instantly understand how the software works and take advantage of it. Pouria Kay and his team have built an extremely user-friendly app that offers excellent experience to its users and encourages them to use their creativity to the fullest. (Gribbing Oy 2018.)

The main issue of the majority of 3D modeling and AR tools is that they require time before the users are able to freely work with it. Grib solves that challenge by being ten times faster than other tools and having only two buttons instead of hundreds. (Gribbing Oy 2018.)

Grib's users are required to have only a pen, paper and a mobile device. The users can make 2D sketches/ drawings and transfer them into 3D models with the help of the app. The process can be seen on Figure 26.

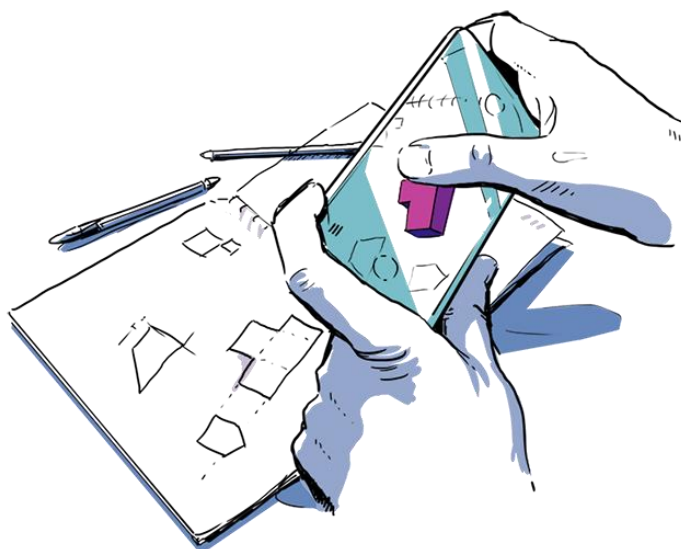


FIGURE 26. 2D Sketch Recognition (Gribbing Oy 2016-2018).

Grib's operators can grab the entire drawing, relocate and resize it so that it perfectly fits their preferences and needs. The application is rather comfortable to use as all

manipulations with 3D objects can be achieved with thumbs while holding the phone with both hands. The operators are not required to have any software skills and do not need time to learn new buttons. The app has only two buttons that give users the entire control over their models. The edit mode is reached by double tapping where colors, materials and other features can be modified. (Gribbing 2016-2018.)

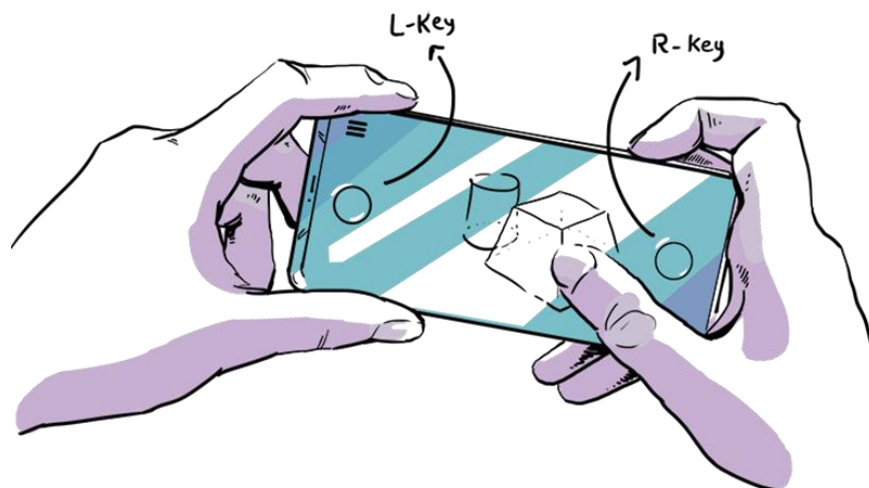


FIGURE 27. Two Universal Buttons (Gribbing Oy 2016-2018).

A couple of objects can be combined into a group while smaller groups can be put together into a larger one. In addition, Grib's users can print, save and share their work with friends, teammates, and community. The objects can be also imported into other 3D software products to take the work to another level. (Gribbing 2016-2018.)

The sub-chapter has briefly discussed the story behind Grib and its features. More information can be found in the sub-chapter Interview with the CEO of Grib. There Pouria Kay explains more how the product can be used, what is the price policy and what do the teachers and students feel about Grib.

6 EMPIRICAL RESEARCH AND DATA ANALYSIS

This chapter provides an overview of the empirical research carried out for the thesis. The part starts with the presentation of the research methods, survey design and acquisition and continues with the results.

The empirical research is conducted by means of interviews. The first interviewee is Pouria Kay, the CEO of Grib. He has suggested the research field and has provided some valuable information regarding the product, its target audience, and feedback from users. The interview questions can be found in Appendix 1, Interview with the CEO of Grib. The second part of the interviews was carried out with the purpose of obtaining more data about the target markets. In order to fulfill this goal, the researcher has organized a set of interviews with school teachers in Nordic countries excluding Finland. The major areas of interest for the researcher are how schools use 3D solutions in the learning process, what is the value of 3D for pupils and do they currently have access to any 3D application. The research questions can be found in Appendix 2.

6.1 Interviews

Experts identify two types of interviews: structured and unstructured. A structured interview resembles a questionnaire because an interviewer asks certain questions to get certain answers with no or little deviation from the original plan. In comparison to structured interviews, unstructured ones enable accessing additional data. The interviewer develops a set of general questions that are supported by follow-up questions for obtaining more information when needed. (Phillips & Stawarski 2008.) For this thesis, the researcher has mainly used the structured interview with limited usage of follow-up questions.

The following timeline, represented in Figure 28, has been applied for the data collection procedure.

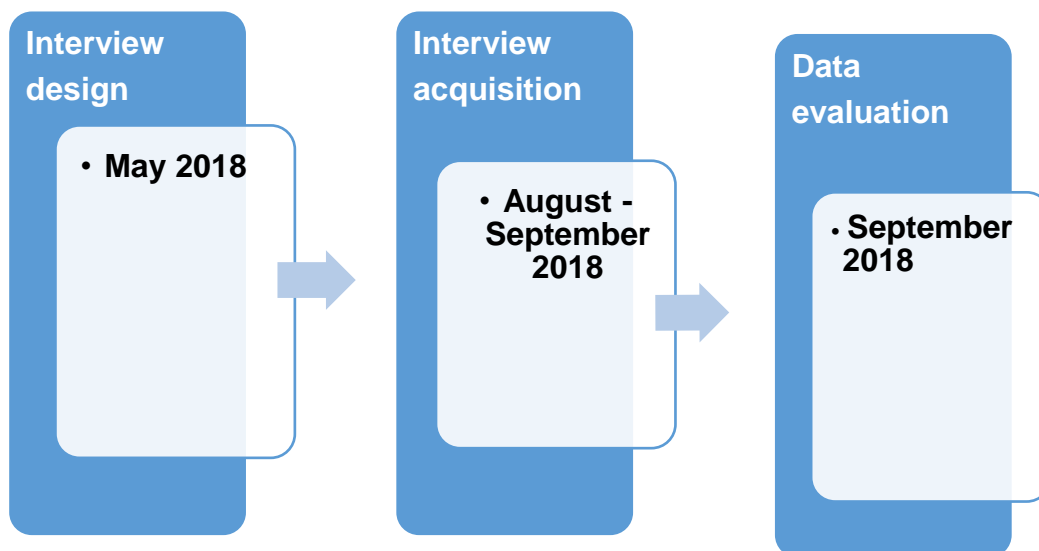


FIGURE 28. Data Collection Procedure.

6.1.1 Interview design

Interviews, as a way of data collection, provide in-depth information concerning respondents' feelings, experience and knowledge about certain topic. Researchers suggest that there are three main types of interview design that are an informal conversational interview, a general interview guide approach and a standardized open-ended interview. (Patton 2002, as cited in Magana 2018, 1.)

When researchers utilize informal conversational interview, they do not prepare and ask any specific questions. The interviewing is run based on the interaction between the interviewer and interviewee. One of the advantages of this interview type is flexibility in the interview nature as the research does not rely on a certain structure. However, critics call informal conversational interviews unreliable and unstable as they are quite inconsistent and make data coding challenging.

The second type is known as a general interview guide approach. Compared with the informal conversational interview, it is a more structured approach though it still remains quite flexible. Questions wording is up to the researcher. One of the key benefits of this interview type is that it gives a possibility to collect the same general areas of data from each interviewee and it also provides researchers with a certain level of freedom and flexibility. (Patton 2002, as cited in Magana 2018, 1.)

The third type is called a standardized open-ended interview. These are the most structured interviews from the viewpoint of question wording. All respondents have to

answer identical open-ended questions. By utilizing this standardized open-ended interviews researchers gain an opportunity to obtain as much detailed information as possible. It is also quite common to use follow-up question if there is some need for clarification. Briefly discussing the weak side of standardized interviews, it seems crucial to mention that data is challenging to be encoded and systemized as the answers, received from interviewees, are extremely diverse. (Patton 2002, as cited in Magana 2018, 1.)

For this thesis, the researcher has created two types of interviews. They are both standardized open-ended interviews. They have been developed to be very simple, clear, structured and formal. The first interview, specifically designed for the CEO of the case company, consists of six questions. Almost every question has a couple of follow-ups for clarification purposes.

The second interview has been created for other respondents who are represented by school teachers of Nordic countries. The interview includes five questions that are accompanied by follow-ups. The question set has been identical for each respondent. The question order has never been changed. All these measures have been undertaken to simplify information encoding. However, in practice, despite similar questions used, data encoding was quite challenging. The reason is that each teacher and each school has had a unique experience with 3D and that experience could hardly be systemized. The interview design is explained. The next subchapter will discuss how the data has been acquired.

6.1.2 Interview acquisition

All interviews were acquired within a period of four weeks. The first interview was arranged with the CEO of Grib, Pouria Kay, and it served as a starting point for the entire research process. Information was acquired by means of email.

The second part of the research was committed to interviewing teachers from Nordic countries. Based on the data, received from the company's CEO, the following target group for interviewing has been developed. This group is represented by computer science, mathematics, geometry or handicraft teachers of secondary schools living and teaching in Nordic countries except Finland. The teachers were either reached on LinkedIn or by sending personal letters to schools and later giving a phone call.

Interview acquisition process was carried out by following principles suggested by McNamara:

- 1) Explain the purpose of the interview
- 2) Address terms of confidentiality
- 3) Explain the format of the interview
- 4) Indicate how long the interview takes
- 5) Mention how to get in touch with the interviewer in case the respondents would like after the interview
- 6) Recode all the answers (McNamara 2008, as cited in Turner 2010, 757).

All latter principles were applied to enable smooth interview acquisition. The thesis researcher has explained to the respondents that the main purpose of the interview is to understand how well Nordic schools are equipped with 3D facilities and at the same time obtain comprehensive research for the thesis. Moreover, the researcher has mentioned that all data is going to be used only for Grib's inner purposes and partly discussed in the following thesis as general trends. Finally, the researcher has stated that the interview consists of six questions and it will take approximately 20 minutes to answer them.

6.1.3 Interview with the CEO of Grib

The interview with the CEO of Grib is the starting point for the entire research process. It helps to narrow down the search for potential interviewees and also provides quite relevant piece of data about the product. The interview has been conducted by email. The researcher has been asked five questions that can be found in Appendix 1.

According to Pouria Kay, the CEO of Grib, the product can be used as a useful learning tool. Nowadays many schools have at their disposal 3D printing facilities. 3D modeling is the basis for 3D printing and Grib is a 3D modeling solution in Augmented Reality. Pouria Kay also claims that the product can be applied to computer science, handicraft/ art and mathematics classes as it helps to develop problem solving skills, encourages creativity and introduces, for instance, geometry in a relaxed and playful manner. Finally, Grib is an efficient tool for self-learning which has already become the priority in education.

Grib has already been tested on four schools in Finland. Kay states that pupils are almost instantly learning how to use the tool. In general, it takes around 10-15 minutes for a pupil to start building his/ her own simple 3D models. Teachers are inclined that Grib is an excellent solution to replace traditional approaches and get pupils engaged. According to children themselves, Grib provides them with freedom and liberty and allows seeing the creation instantly in front of them.

Pouria Kay says that Grib is mostly suitable for pupils aged 10-14. Based on tests, they get more engaged than other age groups. In order to use the tool, children need a mobile phone or a tablet with a chipset power \geq A8 (relatively new), paper and a pen. However, they (pupils) are not required to have any skills.

Pricing is arranged through an annual subscription, in other words, school purchase annual license for pupils. Schools have to download Grib once and then it gets updated automatically. The company provides customer support and supporting materials after the purchase. It also offers some trial period free of charge.

6.2 Interviews with the teachers of Nordic countries

The research process continued with acquiring data from school teachers of Nordic countries. The researcher has developed five questions to be asked. They can be found in Appendix 2 Interview with the teachers of Nordic countries. The results are summarized in Table 1.

The researcher has interviewed six teachers who have been reached on LinkedIn. In addition, the researcher has reached out 4 schools that have also provided rather insightful points regarding 3D modeling practices and tools.

Question	Answer
1) Why has the school shifted to 3D education? What is the key benefit of 3D education for students?	The interviewed teachers have mentioned numerous advantages of 3D education: <ul style="list-style-type: none"> - 3D education allows children to act as creators and inventors; students can easily create wonderful solutions to existing problems - 3D education is more engaging than traditional teaching methods; it is more exciting and motivating and turns reluctant learners into active participators during lectures - 3D education develops a set of highly valuable skills like creativity, problem solving skills, independent learning, etc.

	<ul style="list-style-type: none"> - Experience with 3D is a rather valuable asset as these skills are already and will be even more demanded in the future; being able to use 3D will allow students to succeed professionally as even nowadays the labor market offers a wide variety of tech and design jobs
<p>2) How many students at the school do have access to 3D facilities? Is 3D already a mainstream or still a rare thing?</p>	<p>The majority of respondents have agreed that 3D facilities are still poorly accessible among students. For instance, one of the interviewed teachers has stated that although around 200 students at his school have direct and indirect access to 3D printer actually, only a few (mainly technical) students use it.</p>
<p>3) How is 3D used? In other words, for what subjects or extracurricular activities is it used for?</p>	<p>The scope of 3D usage at schools depends on the nature of this 3D product. For example, one school is considering taking to use 3D pens. 3D pens are less expensive than 3D printers but still enable easy 3D models creation. These devices can be utilized to teach numerous disciplines from geometry (building geometrical objects) to handicraft, arts. and biology (anatomy of the human body).</p> <p>3D printers are used in design, architecture and product development. They are also vastly utilized in graduate projects.</p>

	<p>One of the respondents shared that he uses 3D apps from AppStore during biology and physics classes. These apps provide a three-dimensional overview of muscles, skeleton, and brain and allow children to understand better the structure of the human body. Other programs are meant to demonstrate some simulations in physics.</p>
<p>4) What 3D applications does the school have at its disposal at the moment?</p>	<p>The respondents have mentioned many applications. Some of them are Sketchup, Autodesk suite, Rhino 5+6, Lumion, Adobe After Effects, Visual Muscles 3D, 3D Bones and Organs (Anatomy), 3D Brain and fysika.ee. One of the teachers has mentioned a very surprising thing: all 3D applications, that he has been using to teach children, were acquired because of his own initiative. He has invested around 1000 euros in them and never got any financial refund from school.</p>
<p>5) Using 3D requires certain hardware. Among students aged 10-14, how many do have a proper smartphone or a tablet?</p>	<p>Almost all interviewees have agreed that almost 100% of students have and use smartphones.</p>

TABLE 1. The Results of Interviews with the Teachers of Nordic Countries.

7 CONCLUSION AND SUGGESTIONS FOR FURTHER RESEARCH

This chapter is the last part of this thesis. It is written with the purpose of answering the research questions set at the beginning of this thesis. In addition, it measures the reliability and validity of findings and provides suggestions for further research.

7.1 Findings

This part provides all the research findings summarized in Table 2. The researcher has started with answering the research sub-questions and then shifted to the main research questions. All the answers are based on either theoretical or empirical parts.

Research Questions	Answer
<p>1) What is a B2B model and how does it work?</p>	<p>B2B is a form of transaction between businesses rather than between businesses and consumers (B2C) in order to exchange products, services or information. B2B markets are usually smaller in size than B2C markets but with longer customer lifecycles.</p> <p>As any type of business, selling to companies start from a proper market research. Market research is a structured and purposeful activity that aims at finding new opportunities, evaluating market potentials, its weaknesses and strengths. Data gathering is not the final stage of the proper market research. Instead, it serves as a middleman used to improve the company's operations.</p> <p>B2B purchasing is all about trust. In the B2B world the target audience is a decision-making committee that needs trust before starting a business. The company could use social media and</p>

	content marketing to create trust and reliability.
<p>2) What makes a product? What is the New Product Management and why do innovations fail?</p>	<p>All products are usually viewed as single tangible items though marketers see them as units consisting of 5 levels. The first level, called core benefit, is the main reason to purchase the item whereas the fifth level, named as a potential product, is represented by all augmentations and transformations. Each product level creates more value and adds more customer satisfaction.</p> <p>New Product Management is a set of procedures that plan, design, and control product development considering risks and opportunities for profit. New Product Management is highly needed as it allows replacing existing offerings on current markets and penetrating new markets. As a part of this management, marketers have developed a methodical approach consisting of six steps from idea acquisition (customers, market research, R&D activities) to product introduction.</p> <p>In spite of New Product Management, innovations still fail and the likelihood of failure is rather high. Innovations may fail because they are not meaningful enough, lack proper marketing, planning, support from the top management or because of high introduction costs.</p>
<p>3) What is the state of 3D modelling and</p>	<p>First of all, it seems necessary to mention</p>

<p>Augmented Reality industries in Europe?</p>	<p>that Europe is regarded as an attractive destination for VR and AR service providers. It is estimated that in the near future Europe is going to represent one fifth of the global VR and AR market.</p> <p>Key European frontrunners, in terms of VR and AR, are France, Germany, the United Kingdom, and the Netherland. Nordic countries, such as Finland and Norway, Switzerland, Spain, and Italy are regarded as very potential and rapidly growing. Eastern European countries are characterized by limited VR and AR activity.</p> <p>Although the industry seems to be quite developed already, only 28% of all VR and AR products are well-established and generate revenue for their creators. The rest is still either under development stage or have just been introduced to the market. The most potential buyers for VR and AR products are entertainment, gaming, healthcare, real estate, architecture, and other industries.</p> <p>However, despite all positive forecasts, European companies prefer to outsource IT services to reduce costs and due to a lack of in-house expertise. Approximately 64% of the European operators have the intention to outsource. Nearshoring is also becoming a common practice in Europe.</p>
<p>4) How are school systems organized in Nordic countries?</p>	<p>The answer for the following questions has been withdrawn from the case study. In</p>

	<p>the latter case study, Nordic countries are represented by Norway and Sweden.</p> <p>Norway has created one of the best education systems in Europe. Everyone, aged six to 16, is obliged to attend school. Public education is free and classes are taught in Norwegian. In Norway, there are 2858 schools. 91% of them are public-owned schools while only 9% are private-owned. Based on the aforementioned fact, the following conclusion arises: public education in Norway is not a very common practice.</p> <p>The population of Sweden is accounted for over nine million people. Children start attending school at the age of six and are obliged to attend school for the next ten years. Public education is free for everyone.</p> <p>Primary education lasts from seven to 12 years old. Primary school students are followed with over 7,5% of the Swedish population. Secondary education is from 13 to 18 years old. Secondary school students represent around 6,6% of the population.</p> <p>Another area of interest for the case company included access to mobile phones among school children. According to the statistics, around 95-99% of pupils of various educational levels have access to smartphones.</p>
5) How do schools and teachers in	Based on the interview results, it is

<p>Nordic countries use 3D and Augmented Reality tools to improve teaching process?</p>	<p>possible to conclude that 3D and the Augmented Reality tools can improve teaching in numerous ways. These technologies can be vastly utilized during geometry, handicraft, arts, biology, design, architecture, and product development. 3D and AR can be also used in graduate projects by high school students.</p> <p>According to the feedback of teachers, who have already had some experience with these new solutions, claim that 3D allows teaching students in a more motivating and engaging manner. Some of the teachers have also communicated that 3D has helped them to raise interest towards their subject among reluctant learners. In addition, these technologies develop creativity, problem solving skills and independent learning and allow children to act as innovators.</p>
<p>6) Main research question: What opportunities can European B2B customers bring to Grib?</p>	<p>In order to answer the main research question, it seems necessary to point out once again that such emerging technologies as AR, VR and 3D modeling are developing at a good speed in Nordic countries. However, school wise these solutions have not been integrated into the teaching process.</p> <p>There are some teachers who are technological enthusiasts and who have been highly encouraging their students to use these technologies. They have also mentioned numerous benefits of implementing 3D to the teaching process.</p>

	<p>Although the advantages are clear, financial side and prejudice towards technology are still an issue. If Grib is capable of developing an attractive pricing policy and proper marketing strategy, the start-up has a chance to succeed in a Nordic market.</p>
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TABLE 2. Summary of Answers on Research Questions.

7.2 Reliability and validity

Reliability and validity are two concepts to adequately evaluate the results of the research. Reliability is the degree to which an assessment tool produces stable and consistent results. Experts name various types of reliability. For instance, test-retest reliability evaluates whether the research results remain the same after another test carried out over a period of time. Another type of reliability, called parallel forms reliability, measures the results got by applying a different assessment tool to the same group of individuals. (Paul, Rajiv & I-Chant 2018.)

To ensure the reliability of the research outcomes, the researcher has utilized mainly reliable information sources. The theoretical part is supported by data retrieved from books, directives, and reports issued by official authorities and other trustworthy organizations. Primary data for the empirical part has been gathered by conducting a set of interviews. The researcher has accurately segmented and chosen potential interviewees by discussing in advance the target audience with the CEO of the case company. The researcher has also developed the identical set of questions for interviews participants in order to minimize deviations.

Validity refers to how well a test measures what is purposed to measure. At the beginning of the thesis, the researcher has set the main research questions and also a range of sub-questions. All further chapters have been written with the purpose of providing answers to the following questions. In Conclusion and suggestions for further research chapter the researcher has summarized all key ideas into one table.

7.3 Suggestions for further research

First of all, the researcher has to point out that the nature of conducted research is very complicated. It can be easily explained by a couple of factors:

- The target audience of the aforementioned research is rather limited. The target audience is limited to school teachers who teach technical sciences, natural sciences, handicraft, and arts. Moreover, these teachers should preferably teach at secondary schools in Nordic countries, to be precise Sweden and Norway.
- The target market is relatively large. Although it is shrunk to only Sweden and Norway, it still remains huge. Norway itself has at least 2858 primary and lower secondary schools. As a result, in order to carry out the research, the researcher had to utilize the results derived mainly from Stockholm and Oslo.

Considering the aforementioned information, the researcher can offer two suggestions for further research. Firstly, further research could include other Nordic countries. As has already been mentioned before, in Sweden AR and 3D modeling fields are developing at a relatively rapid pace even though other Nordic countries are growing their tech more slowly.

Secondly, the research has been limited to capital areas and other large cities. Other minor towns have not been included in the research. Thus, it could be interesting to gather data concerning smaller municipalities and compare the results with larger cities.

Thirdly, the researcher would strongly recommend carrying out a quantitative research in order to understand general trends and build a more systemized database.

8 SUMMARY

The objective of this thesis is to adequately evaluate the opportunities of the start-up Grib. The company has developed a product that enables simple 3D modeling in AR. The start-up aims at entering the Nordic market and offering it to secondary schools.

Theoretically, the study has suggested that, as in any B2B model, Grib has to focus on content marketing because it helps to create trust for young and not well-established companies. In addition, it will allow the start-up to develop product features and market them at the same time in order to understand potential customers' attitude towards it. The theoretical part also provides some statistics regarding the state of VR, AR, and 3D modeling industries in Europe. Although Nordic countries are not frontrunners in using these emerging technologies, they are still developing quite rapidly in this field.

Empirically, the study has focused on two Nordic countries such as Sweden and Norway. The interview with the CEO of Grib has helped the researcher understand that the target audience is secondary schools and secondary school teachers who teach mathematics, geometry, handicraft, arts, and computer science. The interviews with school teachers have identified that the emerging technologies, like VR, AR, and 3D, encourage creativity, promote self-learning, make the learning process more engaging and develop a range of highly required skills. Speaking about the availability of these tools, it seems necessary to mention that only a limited number of students have access to these technologies.

As a consequence, considering all aforementioned information, the researcher has come to the conclusion that Grib has a chance to succeed on the Nordic market as long as the start-up is able to build a strong brand on social media and develop an attractive pricing policy.

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APPENDICES

APPENDIX 1. Interview with the CEO of Grib

- 1) How can Grib be used in schools? In what areas (subjects) can Grib be used (mathematics, geometry, computer science, etc.) What benefit does it bring to learning process?
- 2) Has Grib already been tested on kids? Was it successful? How quickly and efficiently did kids learn how to use it? What feedback did the company get from school teachers regarding the product and learning process?
- 3) What requirements have Grib potential users to meet (age, devices, skills, etc.)?
- 4) What is the pricing policy? Are there any rough estimates on how much maximum and minimum the product can cost?
- 5) Is Grib a one-time-purchase product or a repeat purchase? Does the company offer any warranty or aftersales customer support?

APPENDIX 2. Interview with the teachers of Nordic countries

Topic: how schools in Nordic countries use 3D solutions in teaching process

- 1) Why the school has shifted to 3D education? What is the key benefit of 3D education for students?
- 2) How many students at school have access to 3D facilities? Is 3D already a mainstream or still a rare thing?
- 3) How is 3D used? In other words, for what subjects or extracurricular activities is it used for?
- 4) What 3D applications does the school have at its disposal at the moment?
- 5) Using 3D requires certain hardware. Among students aged 10-14, how many do have a proper smartphone or a tablet?