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Virtual Reality in education

Changing the future of education.

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The thesis produces a detailed analysis and considerations of the Virtual Reality system, considering the information and produces a budget for the next possible implementation regarding for a sale to educational institutions, as well as, one-time setup for the individual company itself in order to launch the service concept itself. Additional primary data has been gathered from the industry experts who already have done some results within that business industry. Finally a cash flow forecast is made in order to better understand the underlying business that would be taking place when the concept would be launched in the near future.

| Keywords | Virtual reality, project casting, pricing framework, strategy implementation |
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1 Introduction

Today we live in the world with high tech technologies. World today present new challenges and put new demands on us, because of the rapid changes and increased complexity. In the continually changing and highly demanding environment, there has been generally a growing awareness of the necessity to improve the preparation of students for productive functioning and being more efficient. Technologies today allow us to study quicker and effective than ever before in the history. Because of the new and more powerful computers, Virtual Reality (VR) and Augmented Reality (AR) technologies has moved from being the purview of the military to the mainstream and have claimed increasing benefit from immersive experiences. The topic I am going to study is important, because a lot of things in education are retained or either missing, which is something that has been always missing from education. Students do not retain as much information if they are just reading textbooks. Virtual Reality and Augmented Reality are having more real applications allowing students being more interactive and experienced with environment, as result, it increases the retention. Which is why VR in education are so beneficial.

Today VR is used mostly for gaming industries and market expected to grow to $15.9 billion industry by 2019 (Reede and Bailiff, 2016). However, in my research I am going to Virtual Reality only as a useful tool to be implemented in education.

The goal of my research is to identify why and how VR and AR may have the value in the educational reality. Undoubtedly, there are no simple solutions to those complex problems, but some of the solutions have the common sense among other and this is what I am going to identify.
1.1 Main Concept of the research

The main concept of my study is to make a research about Virtual Reality in education and how interested companies are going to enter the educational market. I am going to study and analyse existing companies and what they already have done in order to get findings from investors and what they have done testing their products in educational environment in order to prove that it make sense to implement it. The goal of my research is it investigate the theory of the concept and end on it being theoretically applied to the education industry. Additionally, research being conducted in order to gain additional data from the experts in the industry. Visually the structure of the thesis is displayed below. (Figure 1.)

1.2 Background
Since the 1950s, Virtual Reality (VR) has been used mainly as a military technology without achieving mainstream application or commercial adoption. Since 2012, VR start-ups have raised more than $1.46 billion in venture capital (When Virtual Reality Meets Education. 2017. TechCrunch).

Today Virtual Reality systems are starting to emerge and already have been delivered to some larger organisations in Finland, and to a much larger extent in other markets globally. A VR (Virtual Reality) is a system comprised of a VR headset with built-in projectors and lenses plus two controllers for each hand. The system consists also two sensors on two opposite sides to track the movement of head and controllers. The main engines for computer graphics are Unreal Engine 4 and Unity which make an real-time renders within room-scale area, resulting in an immersive virtual reality experience.

The Virtual Reality systems are used to serve as game devices, collaborative platforms and simulators. VR systems also might not only be used in construction projects as visualization tool, but can also be employed by a wide array of their types of businesses, including game development studios, industrial enterprises and research organizations. The system price that based on the present market usually starts from about 1000 euros when implemented in its standard form without additional equipment, which makes it affordable for studios and other enterprises, however, challenging for a schools or other education institutions in regards of acquiring a full VR set for the whole class.

1.3 Characteristics of the Virtual Reality system

To better understand the subject of the study, the new concept in question should be defined in clearer terms for the reader. Within the next few paragraphs are explained what does the concept consist of, who it is targeted for, and what is the main value that will be derived from it by the customers.

The concept of Virtual Reality is multifunctional and provides either collaborative space, that includes all of the necessary services provided for students. On the same time, it is used as simulator to facilitate an effective feeling of learning subject, such as chemistry, biology, physics to better understand the process.
Displayed below is a typical construction project process and the purpose of the VR tool system in its various phases

(Figure 1. Construction phases).

Although the concept can be also serve various other purposes, such as product-design processes, marketing cases, and scientific researches, the process of a full construction project is expected to be the main customer of education institution of to-be-built VR system environment in class.

1.4 Expected Benefits

The thesis I am writing is intended to benefit several parties at once. First of all, companies will get a detailed estimation of cost involved in carrying out the project. It may receive important data for providing the value of such systems in companies where previous projects and have been utilized before, as well as, recommendations regarding the pricing strategy to be taken. Finally, companies might receive recommendations on what are possible uncertainties and risk worth considering when pursuing the venture.
If the concept in question will eventually be successful, the future clients such as educational institutions will have a chance to familiarize themselves with the concept and see benefits from the resulting research. Information gathered from the interviews during the thesis process, as well, as personal investigations will help both parties to get to know with various ways of how the Virtual Reality systems have been used to cut costs and make the visual collaboration on various projects more efficient. Gathered information will be extremely valuable to the client who wants to sell and implement the VR system concept.

1.5 Key concepts

The section introduces the main theoretical concepts that are being used throughout the thesis work.

Project cost management is the process of estimating, planning and later controlling the costs involved in a project undertaken by the business.

Project budgeting is an essential aspect of planning a project. Budgets are used to set clear goals, understand the resources need and see the correlation between costs and income of a project. (Cammack 2010, 2.)
Pricing model is the framework set by the business, according to which it charges the customer for the products or services produced. (Cambridge Business Dictionary 2017).

Cash flow forecast are made by companies in order to predict the inflows and outflows of cash, thus ensuring liquidity and sustainable operation of the business. The forecasts are intended to aid the decision-making and keep the businesses from running into a cash flow from crisis. (Scotianbank 2017).

Sensitivity analysis can be used to evaluate the riskness of different scenarios, as well as solve towards the most optimal approach in undertaking the project by the company to improve the quality of the decision-making process. (Pannell 1997, 2.)

VR – Virtual Reality system can be described as follows: the computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside and/or gloves fitted with sensors. (Virtual Reality Society 2016.)

1.6 Project objective and tasks involved

This thesis discusses the reality of implementation and setting-up of a particularly oriented high-tech class rooms with VR systems. The result of this thesis will be a projected set of budgets, as well as a valuable set of recommendations for both parties, derived from the collected cost information and budgets. The pricing model is also discussed in greater details, based on the benefits that have been achieved from the projects which already have been successful. With the information that is gathered and presented in this work, the commissioning parties will be able to make better informed decisions when attempting to set up rather new and risky concept.
The main objective is to finally clearly represent the main picture of the project from the financial perspective, while also pointing out the problematical aspects (e.g. cost uncertainty, budget, pricing, etc.) that are involve and look at them from different perspectives.

In short, the main project objective can be written as follows: **Producing cost and benefits recommendations for both parties involved (potential clients and developers) to launch Virtual Reality systems in educational market.**

To lead the project towards its main objective, a following tasks were set and described below:

1. Gather the information and evaluate the costs to set up the system, as well as operating it for a time horizon of three years.

2. Collect information on benefits and the main value derived by the existing usage VR systems already implemented in or outside the Finland area.

3. Assess an applicable pricing framework for the concept and combine the acquired information to form an easily adjustable project budget.

4. Analyse plausible scenarios and their effects on budget, discussing possible uncertainties and main risks that may appear.

### 1.7 The project scope

This thesis is focused on gathering and calculating the cost involved in setting up the VR system concept with adjustable parameters in mind.
This thesis process does not involve detailed planning of the financing sources for the project or evaluating project management mythologies that could be applied. It does not include building a project proposal to the participating parties, or consulting considering parties regarding its content or structure. The thesis process does not include acquiring new customers to participate, nor finance the new concept.

Out of the scope of this thesis were the following aspects that can also be considered a to-do list for the author and the commissioner after the thesis process is completed:

- Feasibility analysis (SWOT, PESTE, etc.)
- Marketing aspects of the concept
- Service design and development
- Scheduling of the implementation

1.8 International aspect

The international aspect required by the degree program is covered by gathering the cost information for setting up a VR system from foreign countries and international software developers. Communication with foreign developers is a must to comprehensively gather all of the required data for this thesis.

1.9 VR Business Models

Virtual Reality and Augmented Reality platforms shifting everyday, which makes very difficult to define the right business model for the new technology. The technology is so now, that the business model even creates more questions than answers and in that section of the thesis, I am going to consider the most common business models used today.

At Slush 2017, Tekes company announced that the market is evaluated to 1,5 billions euro in Finland and Tekes has 30 millions euros to support VR/AR companies in next year.
“Government understand the potential market opportunity for VR/AR technologies in Finland” said Pekko Soini, director of Tekes during the Slush presentation.

(Figure 1. VR/AR Business models by 2020).

1.9.1 Hardware Sales

As we see from the diagram, the hardware sales have the biggest market share by the year 2020. AR/VR could have an installed base in the low single-digit hundreds of millions by 2020, ranging from low-end VR Cardboard up to premium AR Magic Leap (and everything in between). With long-run unit prices from free up to something equal to top-end smartphone prices, hardware sales could drive more than $4 of every $10 spent on AR/VR by 2020.

Current investment's by companies to hardware:
Facebook – $2 billion for Oculus,
Google - $1.4 billion Google,
And other commitments by such companies as Microsoft, HTC/Valve, Sony, Samsung.

### 1.9.2 E-commerce sales

E-commerce sales make almost 20% margin using AR/VR, which makes it very profitable as not in-app purchases services. Today's retail giants as Alibaba, Amazon, eBay and range of other companies will be able to sell a new stuff in a completely new way, allowing us to experience completely new experience. Currently Alibaba led 795,5 million round to Magic Leap.

### 1.9.3 Advertising sales

For big companies and smaller application content developers (not hardware, nor good services sales) the advertising sales is the most valuable business model, allowing already create 10% profit from every $10 generated by AR/VR. From the standard banners in our web-browsers to real 3D objects around us by the power of our pocket engines (mobile phones). The market is constantly growing as around 40% only today have mobile phones. AR/VR advertising is more immersive than any other media, which forcing movement of the eyeballs.

### 1.9.4 Mobile network data/voice

As the technology is growing and constantly developing, mobile phones becoming more and more powerful to allow us experience virtual reality, as well as, augmented reality applications. For AR, mobility is even more fundamental than for VR.

### 1.9.5 In-app purchases

The most common business model for mobile developers still have a big value in VR/AR industry – in-app purchases. It might be a bit tricky though, to convince people buy something within the environment and not to discourage other users, however, some developers doing it very well. It is still going to be a major business model for AR/VR developers. The biggest attraction for the user is that the application is published for free, with all features, but some limitations, as time to use the app. In-app
purchases will still be the big role in AR/VR industry as they already do in the mobile and web markets.

1.9.6 Enterprise / Business to Business

Microsoft, Meta and other big players already serve well enterprise market, as well as a range of VR service/solution providers. With Microsoft HoloLens today AR will reach new heights for enterprise users. There will be a new market for graphic providers, like Unreal Engine 4 graphic engine, 3D model distribution on Sketchfab and more. For the topic of my thesis, I am going to consider potential institution or company as enterprise provider, as well as, business to business model.
2 Project cost management

The aim of this chapter is to reasonably estimate, capture and evaluate the costs of undertaking the project from the side of commissioning institution. The costs of the Virtual Reality system itself, as well as other incurring expenses will be discussed in deeper detail.

Estimation of the costs involved is one of the first steps in understanding the viability of a project, as well as an important consideration for the company developers when evaluating the profitability of the initiative as a whole. Well prepared projections of the involved costs bring transparency to the future stakeholders of the project and serve as an important piece of information when setting up the pricing of the new concept. In addition, knowing the price amount of money to ask when planning the financing aspects of a project is important for several reasons. Firstly, to avoid running out of funds through the project, and yet also to avoid excess capital that is not needed. Also for the developer’s side it is important to show a confident impression to the interested parties.

Perhaps some of the main causes that result in failed business cases in general, are the lack of integrity and sufficient seriousness when evaluating the costs of a project (Gambles 2009, 89).

2.1 Gathering and evaluation of project costs

For a complex project to be successful, a multitude of important aspects need to be taken into account when constructing an extensive project budget. The fundamental difference lies in whether a bottom-up or a top-down procedure is chosen when gathering the information. These two approaches, when both applied on the same case can end up in very different results, and although the former approach (bottom-up) is considered to be a much more extensive, as well as thorough of the two, an optimal equilibrium between the resources required and the needed quality of the results should be chosen for a given case. (Pinto 2010, 263.)

2.3.1 Top-down budgeting

In the top-down budgeting approach, managers take the initial step to estimate the project's costs. After management's projections, the information trickles down through or-
ganizational levels, where the hands-on staff will provide for additional corrections and adjustments based on the particularities of the project at hand. Although less resource intensive of the two, the top-down budgeting approach can introduce additional friction between the layers of the company as the operational levels need to adjust their estimations to fit the pre-defined budget window. (Pinto 2010, 264.)

Project manager’s direct input is pivotal during the top-down data gathering process, and thus the knowledge of key professionals within the management in addition to cost enquiries and breakdowns are assumed to be sufficient for building a realistic estimation of the costs involved (Pinto 2010, 263).

2.3.2 Bottom-up budgeting

Instead of the top-down method, the bottom-up budgeting process starts on the lower functional level of the organization by assigning costs accurately to various events and activities needed throughout the project. Based on the activities required to carry out the project towards its successful conclusion, lower level budgets are then assembled and combined to form the main budget of the project. Main task of the higher management remains to be the combination of gathered information and disposal of possible overlaps that were introduced earlier. (Pinto 2010, 264.)

This way of budgeting stresses the importance of a well-planned project with a detailed breakdown of work, events and goals that are needed to complete it. Main disadvantage being the lack of control by higher management, the bottom-up budget can introduce significant deviations from the general strategy and initially budgeted resources set by the management. The process can also consume significant amounts of time while the figures get bounced between top levels and operational management prior to being finally accepted. (Pinto 2010, 264.)

2.3.3 Variable and fixed costs

Variable cost changes proportionally depending on the amount of service or product produced, while fixed costs stay the same even if none of the value generating activities have been conducted. If for example any given restaurant would receive only few food orders and thus earn little if any income, the business would still need to pay a fixed amount of expense for renting the premises in which it operates. Although the restaurant wouldn’t necessarily spend any money on producing food which can be
considered a variable expense for the business (depending on the amount of orders taken), it would still be liable for the fixed expenses that incur in any case, no matter the business activity. (Horngren & al. 2012, 52.)

2.3.1 Direct and indirect costs

Direct costs are the expenditures that can be directly traced, and are an integral aspect of producing the service or a product of the organization. For example, to build an automobile, most of the materials needed such as the glass for windows, and the metal sheets for the car body can be easily traced to be direct materials which are needed to eventually produce the product. (Horngren, Datar & Rajan 2012, 50.)

Indirect costs can be more difficult to accurately determine than their direct counterparts, but they are none the less an important aspect when building a widely inclusive cost estimate. These are the types of costs that cannot be feasibly traced to directly producing the aforementioned automobile, but are still pivotal in enabling the production in general. Such kinds of indirect costs can be for example the administrative expenses of a production plant in which other types of vehicles can be produced at the same time. It would be unreasonable to apply the administrative costs to be part of the direct costs of a particular model, so these expenses should be thus allocated accordingly to each of the products in responding proportions. (Horngren & al. 2012, 51.)

2.3.1 Cost uncertainties

It is a well-known fact that the precise estimation of costs is challenging and some professionals go as far as to state that there is no such thing as the “right” cost estimate. It is fairly common for costs to exceed the expectations and there are many reasons due to which it usually happens, one of the main ones being the human psychological bias when attempting to estimate the costs. In addition to utilizing the expert judgement, one of the many approaches to account for the cost uncertainty has been a cost-risk analysis. It is based on assessing the cost range of uncertainty and assigning the probability to what the costs are most likely end up being when actualized. (Galway 2007, 1.)
2.2 Project work breakdown structure

Work breakdown structure cuts the project process into smaller steps and activities that need to be completed in order to reach the end deliverable of the project. It is an approach for setting the project’s scope and a further breakdown into smaller, more detailed logical steps that are needed to reach the eventual main goal. The WBS is a visual document that displays detailed steps and events from which the whole project is assembled. (Pinto 2010, 161.)

2.3 Costing the new VR concept as a two-phase project

In order to reach the goals of this thesis project and bring maximum value to the commissioning company, the system setup and operation need to be budgeted separately. The value lies in the system set-up budget being useful for oncoming deliveries to future customers, while the later operational estimations of the service concept are of major importance to ensure the long-term success of the risky venture considered by the commissioning company. The setup requires a static budget with gathered and pre-enquired cost estimates, while the operational budget is based more on assumptions and expectations of the commissioner. Among the last steps within this thesis, a cash flow forecast is made, which requires pricing, as well as cost information that is involved in running the venture.

![Figure 4. Main budgets of the project.](image-url)
2.3.1 Costing the VR system hardware and setup

Due to the fact that the concept is rather new and the core team in charge of the implementation consists of only a few integral people, the top-down approach to costing the VR hardware is chosen in order to get up to speed quickly. Armed with the experience and data from one previous delivery in early 2017, this approach is further solidified to be the best option when considering a VR-system and its setup.

Main tool that is helping the company to achieve the most realistic top-down estimate is the previously delivered system and costs that were involved in its setup. Thus the project cost structure can be realistically estimated from the recent experience. Additional cost enquiries are made to gather the latest up-to-date information. In this thesis I am going to consider only the most advances headsets for the educational use. The goal is to acquire it for the long usage, not until the new generation is coming. (Figure 5).

<table>
<thead>
<tr>
<th>Price</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>480</td>
<td>ANTVR II PC VR 3D</td>
</tr>
<tr>
<td>340</td>
<td>VR Sony PlayStation</td>
</tr>
<tr>
<td>720</td>
<td>HTC Vive</td>
</tr>
<tr>
<td>460</td>
<td>Oculus Rift</td>
</tr>
<tr>
<td>105</td>
<td>Samsun Gear VR</td>
</tr>
<tr>
<td>80</td>
<td>Google Daydream view</td>
</tr>
</tbody>
</table>

Figure 5. Price cost of the most advance VR headsets on the market. (Google Daydream view is the least advances, but affordable item in the description.)
While the system setup costs are relatively simple to project into the budget, the new concept’s further operational cost estimations require a whole different approach. The management has never set-up a similar a concept before, so it is unreasonable to expect that the budgeted numbers for the concept are going to serve anything more but a rough guideline at such an early stage.

### 3 Benefits achieved during the previous usage of equivalent systems

This chapter aims to look into some previous use cases of VR systems. With the help of the online publishes and researched made, a light assessment of benefits achieved, a better understanding is gained to choose the right pricing model for the service concept explored in this thesis. Chapter discusses the benefits of using this technology in a learning environment.
3.1 Benefits of the VR in the classroom

- **Active rather than passive experience**
  By utilizing the technology of VR students engage in activities, such as reading, writing, discussion, or problem solving that promote instant analysis and evaluation of class content.

- **Immediate engagement**
  In education, student engagement refers to the degree of attention, curiosity, interest, optimism. The passion students show when they are learning or being taught, which extends to the level of motivation they have to learn and progress in their education.

- **Helps understand complex subjects/theories/concepts**
  3D visualization and computer graphics helps better to understand complex subjects. For example, it is hard to understand chemistry and physics when you do not actually see the particles. By utilizing computer graphics, Virtual experience might better explain complex theories and increase retention of the subject.

- **Immersive experience means no distraction**
  Retention of the student has a parallel correlation with the attention to the subject manner. Virtual experience helps to use maximum attention of the student without outer distractions.

- **Suited to all types of learning senses**
  In Virtual Reality students do not only see computer graphics, but also having a sound explanation, as well as, additional text. All senses combined together result in higher retention of the student.
4 The pricing framework

In this chapter a couple of different ways for pricing products and services are discussed in greater detail. Of the various approaches under consideration, a recommended pricing model is chosen from the perspective of the new service concept and its unique aspects. A clear pricing model gives important perspective to what kind of income can be expected within the first three years of operation, thus filling up some of the pivotal information within the project budgets.

Price is one of the most important aspects in the marketing mix of a new venture. Being the single point of focus that is able to produce revenue for the business, the rest of the P’s in a marketing mix can be considered to be costs. Price is important as it can be said to determine how much revenue the business is able to generate. While sending a message to its target market, the price can communicate the premium materials that the products are made of, cutting edge technologies that are being used, or additional features being included in the product or service, thus resulting in higher prices for the customers. (Barringer & Ireland 2006, 234.)

4.1 Pricing models

Many companies use an incremental approach to pricing their products. By using their previous product and its cost of production as the sole reference, they look at how much more the production of the new product costs in relation to the old one, ending up proportionally increasing also the sales price. This way of pricing often underestimates the value attainable by customers from the new product and thus in the worst case for the business, if the product is revolutionary from the customer perspective, fails to capture the full profit for the business that otherwise could have been captured by setting a higher initial price. (McKinsey & Company 2003.)

In pricing it is a good practice to start by setting the price ceiling through the means of assessing the benefits of the product to the customers, and only then scaling down in accordance with the competition, market demand and other affecting factors. This approach ensures that all of the possible price points are discussed before making the essential pricing decisions. In addition to setting the aforementioned price ceiling, a price floor must be acquired in order to cover for all of the costs of producing the service or product and ensure the stable operation of the business. Between the pre-set
price ceiling, and price-floor the optimal price can then be set by the business. (McKinsey & Company 2003.)

4.2 Recommended pricing approach for VR system concept

When setting up further consecutive VR systems for outside customers, a cost-based pricing model needs to be used, as the market is more competitive and provides almost equivalent alternatives. It is of major importance to cover the incurred expenses and make a required amount of profit with each system delivery. Slightly higher price than the market competition is warranted, as the systems offered by the commissioner are tailored and hand-designed for each particular space where they will be installed. Bringing additional value by the means of high-quality tailored systems, it is a strong enticement for a customer to order from the commissioning company of this thesis, as compared to ready-made, well-packaged VR system of the competition.

5 Project budget

In this chapter all of the previously gathered information is combined into different types of easily adjustable project budgets that include the budgeted costs and the projected income from the new service concept. In addition to being easily adjustable, the project budgets allow for efficient controlling by the means of automatically comparing budgeted numbers with the realized actuals and highlighting exceptional variances. In the end of this final chapter, the results are rapidly analysed to bring out the possible problematic aspects of these project budgets.

As stated by Pinto (2010, 263), “The project budget is a plan that identifies the allocated resources, the project’s goals, and the schedule that allows an organization to achieve those goals”. Being the result of projections, gut-feeling and lots of work, the project budget should always support organizational goals and objectives instead of conflicting with them. For the project budget to be useful it should be produced as a result of intense communication with all of the stakeholders and the data should be ideally gathered from a multitude of different sources. (Pinto 2010, 263.)
5.1 Types of budgets

Structure of budgets, the budgeting cycle and their extent vary between different organizations depending on factors such as the company structure, management ideologies, as well as the complexity of the business in question. While a manufacturing company’s approach to budgeting can differ a lot from any given type of service business, some of the budgeting aspects stay the same in almost all types of organizations, a great example being the common attempt to plan ahead for a 12-month fiscal year. (Warren & Reeve 2007, 224.)

There is a multitude of different approaches that businesses utilize to develop their budget estimates, each of them having their own pitfalls and advantages. While zero-based budgeting requires that managers start the budgeting process from a clean slate each and every time, the more common way for most types of businesses is to employ some sort of a continuous budgeting process, wherein the static and flexible types of budgets are most commonly used. (Warren & Reeve 2007, 224.)

1.1.1 Static budget

The defining aspect of a static budget is that it accounts only for a single predetermined activity level within the organization. It means that the budget cannot be subjected to any changes even when the actual activity levels differ greatly from the originally projected numbers. (Warren & Reeve 2007, 225.) Simply put a static budget is not able to account for the changes in underlying cost structure when activity levels such as the amount of sales or production change within the organization.

The static budget is not a suitable solution for businesses that operate in volatile or otherwise challenging environments, nor if a company is constantly experiencing high levels of growth. In these situations, organizations may need to take other approaches by resorting to shorter quarterly, or even monthly budgeting procedures in order to tackle the constantly changing operational environment. (Lianabel 2000, 60.)

1.1.2 Flexible budget

Instead of the simpler static budget, a flexible budget is constructed in a way that is able to take into account different levels of business activity, and thus can be consid-
ered to be a more elegant solution for many organizations. According to Warren & Reeve (2007, 226), "You can think of a flexible budget as a series of static budgets for different levels of activity". It requires managers to separate the costs into variable and fixed components according to their behaviour, and then multiplying the variable costs by the relevant activity levels, giving management the ability to better evaluate actual performance.

The flexible budget is most often prepared after the activity has taken place and the exact output is already known. In other words, a flexible budget can be considered to be the initial static budget that would have been put together if the amount of output would have been known in advance. In order to prepare a flexible budget, managers need to acquire the information regarding the actual output quantity, calculate the revenues based on budgeted selling price, budgeted variable cost per output unit and budgeted fixed costs. The flexible budget can be then compared with realized actuals in order to see favourable and unfavourable variances within the budget. (Horngren & al. 2012, 252-253.)

5.3 Budget variance

The deviation between budgeted and actualized costs is called variance, and it is used as an important tool when evaluating project performance throughout its lifecycle. Variance comes in as an important aspect during the planning and control phase of any project, and supports the management’s strategy by highlighting the factors that are not performing as expected. Management by exception lets managers concentrate on costs that produced the largest variance compared to pre-budgeted expectations, thus improving the performance evaluation and further results for similar consecutive projects. (Horngren & al. 2012, 249.)

Many clients may require variance reports, as well as attached explanations to exceptionally big deviations from the initially budgeted numbers. A simple report, showing the variance usually includes a cumulative budget, as well as its relation to the actualized numbers as per project’s progress (Figure 19). In a well-made variance report, the concrete plans to tackle and correct the occurred variances should also be included. (Taylor 2006, 248.)
5.4 Cash flow forecasting

As a budget, the cash flow forecast ties together the expected revenues and expenses of the business in liquid cash terms, and displays an ending cash balance for each month. Essentially the cash flow forecast tells the company what is the amount of, and when is the money needed to ensure continuous operation. It is used to control the capital expenditures and make the analysis of possible under and overspending easier, thereby resulting in better decision-making by the management. (Business Liverpool & Wrexham County Borough Council 2016, 169.)

Ultimately the cash flow forecast shows the total income flows, outflows and expenditures, bottom-line net cash flows, as well as opening and closing balances for each and every month of the company’s operation. It is a good practice to include notes, clarifications and further details regarding the numbers mentioned, as the projected cash flows are some of the most important information for the potential investors, owners and lending parties to scrutinize in a business plan. (Business Liverpool & Wrexham County Borough Council 2016, 172-174.)

5.5.1 Sensitivity analysis

The sensitivity analysis is a way to see how different values within an autonomous variable will affect the reliant variables under a variety of hypotheses. Sensitivity analysis can be used for a wide variety of systems, processes and activities, being especially useful in analyzing risks within a business. Essentially it showcases the changes in output when a particular input is adjusted, while keeping the rest of input variables constant. (Edupristine 2015.)

The main reason for carrying out a sensitivity analysis is to inform the managers about variables within the cost estimates, that when adjusted from the main estimations, could significantly reshape the overall recommendations of the final budget. Information derived is important because it tells about the marginality of decisions, which elements of the estimations should be controlled most closely and where additional value could be gained by considering alternative options. One should concentrate on analyzing variables that are not very easily forecasted or controlled, in order to get the maximum value from a sensitivity analysis. (Gambles 2009, 108-109.)
One way of carrying out a basic sensitivity analysis is by employing a cost-volume-profit (CVP) approach. If a company produces tennis rackets at a certain price, quantity, as well as cost-structure, how much would the bottom-line profit change if the sales price would be increased by $25 on a per unit basis? What if the sales volume decreased by 10 percent? As can be seen in an example figure below, studying the outcomes can be very simple with the CVP financial model (Figure 20). In addition to analysing impacts on the bottom-line profit, a sensitivity analysis can be used to study effects on required target profits, as well as the company's break-even point (BEP). (Heisinger & Hoyle 2016.)

6 Summary and conclusions

The topic of the thesis was chosen by the fact of personal self learning and investigating new technologies which started to coming up in January 2016. The learning process that took place and information gained for the thesis were significant enough to prove the value of the system and could serve as additional paper for the decision making regarding VR technologies.

The result of this thesis include a costing and analysis of the benefits of the existing delivery. Additionally, the costing and pricing of the delivery of a new concept were considered.

Finally, the cash flow projection was made as one of the main results of this thesis serves as an important tool to gain additional outside funding, increasing the understanding the financial position of the venture for the certain period of operation. The cash flow forecast is a tool that can be used to reveal serious financial risks by visually helping to avoid running out of cash during the process of operation. Overall it helps to maximize the venture’s chances for success.

The amount of experienced professional and organizations interview as the result of this thesis process is relatively low, as the concept is still not fully developed and implemented.
6.1 Personal Learning

Personally I have benefited by the means of significantly deepening the knowledge and understanding of topics that were taught in the specialization studies, as well as, the topic of the thesis. By the means of growing the future opportunities in the field of business development and VR industry, the benefit of this work for the author can be considered remarkable. This thesis lays a good foundation for an interesting and challenging career after graduation.

Having not done serious academic projects before, this thesis significantly improved author’s ability to parse and employ trustable academic sources, literature and publications. Writing in accordance with the issued guidelines and safeguarding the best practices can be considered to be a good additional skill to have in any real work-life environment.
References


