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Business Investment for Construction Management Company

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ABSTRACT

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Aim of this study is to create an analysis of potential business investment, which would be required for business expansion to Nordics region. Key element is to understand first what it needs from organization point of view and after this that what it will cost. Potential market needs to be analyzed and the turnover and profit expectations forecasted based on history but more importantly to future market evaluation.

This study is completed by main stakeholder interviews and several workshops, where the investment figures are being planned with company's senior management. Based on the workshops, the investment has been studied with 2 different cases by selecting the strategy, completing profitability calculations and assessing the potential business risks which are part of the investment period.

Biggest challenge of the investment study was to estimate the potential future turnover and profit. Both investment cases could be implemented, but the final investment would be between case 1 and 2. This study is very useful as an analysis of investment needs but also as creating a model which can be used anywhere in the world.

TABLE OF CONTENTS

SYMBOLS- AND ABBREVIATIONS	5
1. INTRODUCTION	7
1.1 Thesis background	7
1.2 Thesis target	8
1.3 Thesis outlines	9
1.4 Thesis structure	9
2. BUSINESS INVESTMENTS.....	11
2.1 Business targets.....	11
2.2 Available resources	13
2.3 Strategies	13
2.4 Strategic investments	18
2.4.1 Investment proposals	18
2.4.2 Investment categories	20
2.5 Investment calculation methods.....	24
2.5.1 Present value	24
2.5.2 Internal rate of return	27
2.5.3 Payback period.....	30
2.5.4 Return of investment.....	33
2.5.5 Recapitulation of investment calculation methods.....	33
2.6 Risks and sensitivity factors.....	36
2.6.1 Investment risk management	36
2.6.2 Risk and uncertainty factor concepts.....	37
2.6.3 Direct risks	39
2.6.4 Indirect risks	40
2.6.5 Decision making as part of risk analysis	44

2.6.6 Sensitivity analysis	46
3. CASE STUDY BACKGROUND	50
3.1 Construction management business model	50
3.2.1 Investment category	52
3.2.2 Information background	52
3.2.3 Investment structure and outlines	54
4.0 ANALYSIS OF THE INVESTMENT OPTIONS	56
4.1 Case 1	58
4.1.1 Cost structure	60
4.1.2 Profitability study	64
4.1.3 Sensitivity analysis	67
4.2 Case 2	69
4.2.1 Cost structure	71
4.2.2 Profitability study	74
4.2.3 Sensitivity analysis	77
5. SUMMARY / CONCLUSIONS	79
5.1 Study structure	79
5.2 Results	81
5.3 Conclusions	82
REFERENCES	84

SYMBOLS- AND ABBREVIATIONS

Symbols

CF_t	Net cash flow of period t
n	Number of periods
i	Investment Interest rate
C_0	Initial investment cost
r	Internal interest rate
$E(R_i)$	Expected profit for investment
$E(R_m)$	Expected profit from market market-index (Nasdaq, Hex, Nikkei)
B_i	Unit for systematic risk or the sensitivity of the expected excess asset returns to the expected excess market returns
R_f	Riskless rate of interest for example interest from government bonds
r_{WACC}	Expected return on capital (profit)
r_e	Average rate for external capital
r_i	Return of equity
E_c	External capital
I_c	Equity capital
μ	Expected value of profit
x_i	Possibility of profit (i)
p_i	Probability to achieve (i) profit x_i
n_p	Number of possible profits i.e. results
$f(x)$	Density function of (x)

Abbreviations

PV	Present Value
NPV	Net Present Value
FV	Future Value
IRR	Internal Rate of Return
MIRR	Modified Internal Rate of Return
ROI	Return Of Investment
PMT	Payment / Payback period
CAPM	Capital Asset Price Management
WACC	Weighted Average Cost Capital
IT	Information Technology
ICT	Information and Communications Technology
IoT	Internet of Things
SBU	Strategic Business Unit
SBA	Strategic Business Area
KPI	Key Performance Indicator

1. INTRODUCTION

1.1 Thesis background

Construction management businesses are typically very similar to each other in their services and value propositions. The term construction management means a business unit which has only managers or consultants working directly and everything else is subcontracted.

Thus, the similar business models the construction management companies have challenges to raise above each other. In most of the cases the customers no matter are they public or private, they are mostly keen about money and how fast they can get their investment to the point, that it starts creating money. Companies who are developing their business models and changing their thinking to same direction as technology and global way of thinking, can typically be on the top when different companies are been ranked.

This becomes even more critical when global management companies are trying to expand their business to new market districts. Long term business expansions do not work without an investment. This means that the companies who are looking for growth in new market area must either acquire an existing company or part of its business, or they would have to invest to new organisation to start operating in new area. A key element for different companies is their strategy. If the company who is looking to expand its business is looking for immediate return to their investment, then its more recommended to look for alternative options for business acquisition.

When the business strategy is more incremental rather than radical, it might be worth investing to people and start looking for options to build new business organisation. This means that typically the company who is investing, has already some level of start-up organisation on the area where they are looking to grow. By starting to build a new foundation to new market area, the companies do not lose much even in case the market would be quiet for few first years. The key driver

and element of investments is the level of risk, thus when the risk level needs to be low, it makes sense to build the new business unit incrementally. This is also a way to bring the same core values to the business as its having in other areas as well.

The purpose of this thesis is to indicate how much additional information can be used to support decision making process when planning to implement the investment.

In traditional investment process the individual investment plan has been studied separately from company's core business model. In this case the cashflow forecast will be defined as single-valued and the discounting rate will present the investment risk. Sensitivity analysis indicates that how much cashflow / profitability can vary, before the investment project will start creating loss to the business.

1.2 Thesis target

This thesis study's main target is to search and highlight main potential investment requirements and create an investment analysis for global construction management company to expand their business to Finnish construction market. On the other hand, one of the main drivers is to highlight main risk elements which can impact upon profitability / cashflow forecasts. Key elements for successful outcome will be to define:

- Target / adaptability to the strategy
- Annual costs
 - Organization
 - Fixed costs, variable costs
 - Overhead costs
- Annual turnover forecast
 - Profitability
- Investment rate of return

- Capital / investment requirement
- Sensitivity analysis
- Business proposal

When the business investment requirements and model have been defined, the target is to create a excel model and a sustainability analysis to demonstrate how the local business unit will start operating on its own and how it will continue its growth with minimal additional capital.

1.3 Thesis outlines

In many occasions different business expansions are completed through business acquisition. This thesis study will outline further business acquisition research as it is very complicated to analyse without real and accurate business cases which can be compared with each other. When looking different business acquisitions, there are elements of value as order portfolio, equity ratio and all immaterial capital which are impossible to estimate to get reliable figures to the investment plan.

This study will also outline accurate market optionality examination as company's business platform can be utilized to several services in the market. Company is capable to adapt small office fitouts and in the same time can facilitate large scale multimillion euro projects. Thesis is based on existing business development project study where many different development zones have been highlighted and cultural differences explained more carefully.

1.4 Thesis structure

Business investments cannot be considered as independent business plans from company's core business model. Investment plan must be part of main businesses long term strategy. For different type or level of investments there has been

developed several investment categories and mathematical methods to measure investment financial efficiency. These methods are clarified in chapter 2.

Risk and elements of uncertainly factors are key drivers when planning an investment. Risk factor can be included either directly or indirectly to the investment cashflow forecasts. Potential risk factors will be included to the case study of this thesis. Investment risk assessment is presented to relevant level of the investment study.

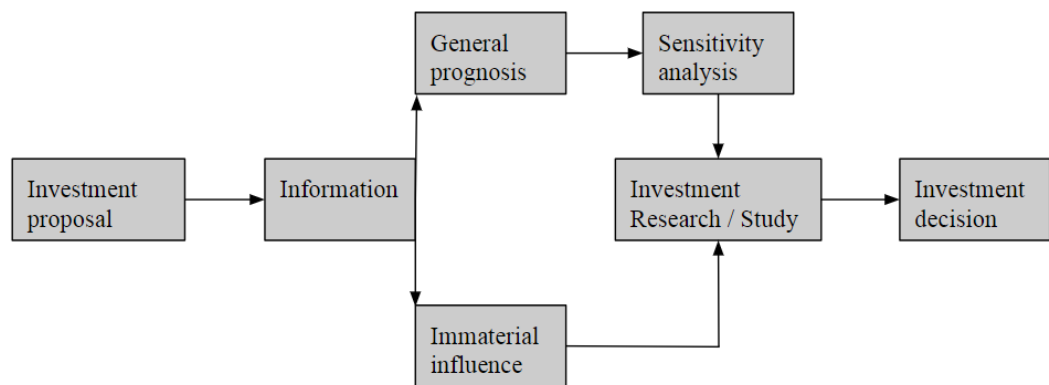


Figure 1. Risk analysis as part of investment process.

Empirical part of the study will define the potential investment plan and decision-making culture of global construction management company. Case study will present the potential investment plan business expansion to Finland based on existing knowledge of the company and local construction culture. As with every investment plan, the result is always an analysis and depending on the person / people who is creating it and his / their knowledge.

Main risks of the investment case studies are presented with sensitivity analyses based on the variations of the turnover and potential project profitability.

2. BUSINESS INVESTMENTS

Business development and investments with a target, needs a plan which can be analysed from cost, profit, risk and opportunity point of view. Proper planning for business investment creates the foundations for long-term target achievements. Company's business planning is a compromise between the targets and the resources which has been allocated to achieve them. To find an optimal solution, it requires accurate target setting and a vigilant monitoring system.

Regularity or in other words “peculiarity” for investments is that the profit or benefit comes later than the initial investment cost has been invested. This feature can be described with following column chart:

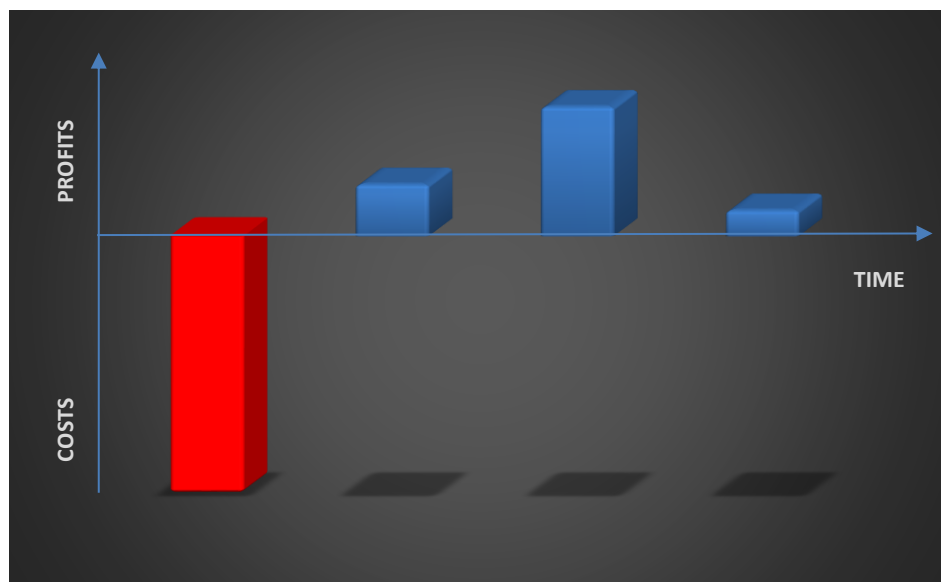


Figure 2. Initial investment cost will start making profit in future years. (Etelälahti et al. 1992, p.10.

2.1 Business targets

Typically, when companies set their targets, the main conditions to achieve them are strategic management, allocation of resources and logical investment classifications. Also, key drivers are the recognition of the uncertainty factors and risks against the working capital investments.

The term, “target” for a business unit which is operating in open market economy is problematic which many different literatures have been highlighting in the history. Because of the nature of the term “target”, the clear explanation is vague, because there is more than one description for it. Often is more realistic to speak about the company’s or business units targets rather than just one single target. (Levy & Sarnat. 1998, pp. 6-9)

According Honko typical business targets are: (Honko, 1966.)

- To achieve best possible economical / financial result
- Continues business growth
- Secure the continuity of the business
- Enforce the company’s economical position
- Expand business independency
- To create good and sustainable business relationships (internal and external)

Levy & Sarnat has described the targets slightly differently, but the main drivers for business targets are the same:

- Maximize the profitability. Target sounds very clear and easy to understand, but the key thing to understand is that the future cashflows are know 100% and that controls the business activity.
- Maximization of sales. Business unit daily operations must be coordinated that there is no operational reason which slows the sales process.
- Continuity of business. Continuity target is often mentioned to most of the companies. When continuity target is dominant, the company could easily invest to guaranteed government debentures which will guarantee the future cashflow.
- To achieve satisfactory profit margin. When the company’s decision-making culture is not the most efficient or there are no resources for proper strategy planning or investment analysist, board of directors may be satisfied smaller profit margin.

- To achieve specific market share
- Minimize the employee turnover
- Efficient internal coordination with correct hierarchy, there is less unnecessary bureaucracy.
- To provide maximum profit for owners.

2.2 Available resources

Often, it's most efficient to complete a baseline analysis, when there is not accurate clarity of available resources. Some areas as professionalism or shortage of it can be replaced with other resource oversupply. In these days it's very common that companies are buying some consultancy service so there is no need to cover those resources by themselves.

Limited amount of resources and the need of additional allocation controls and some occasions, even limits the business planning. It is very hard to get to a balanced resource position where key resources can be used and shared to in every situation where the company is at the time and in the position where the business has set its targets.

The existence of resources or the shortage of them typically controls the company's strategy choice as well. Even that the company would have set the key targets, to achieve all of them depends on the chosen strategy.

2.3 Strategies

The word strategy does not have one simple explanation. Thus, it is used in several different business environments, organizations and communities. By Chandler in business organizations the word strategy describes the common business plan which purpose is to achieve the targets by organizing resources which are useable. According Honko et al. the word strategy means company's general ideology or line. By continuously following this plan the aim is complete

all targets and by completing targets the outcome should be satisfied stakeholders through the business chain. (Honko et al.1982 pp.30-31) (Chandler, 1962)

Strategy itself keeps the same indications inside through the time, but people who are creating new strategies will bring new way of setting the business strategy. In different eras people's values are changing and that is what companies must integrate to the strategy when planning sustainable plan. (Puolamäki & Ruusunen 2009, pp.16-17)

By choosing the strategy the business units main target is to achieve competitive advantage against competitors and if possible, long term business advantage. Strategy decisions are conscious planning for the basis of future business model. Main driver and basis for all business units is to grow the company's ownership value. Because of the aim of value creation, almost every analysis and information is presented in numbers and most of decisions are based on money. (Puolamäki & Ruusunen 2009, pp.17-18)

Several global effects and market changes will alter the business environment. Typically, these kinds of changes can create business opportunities, but also some threads which can cause damage to the business or in worst case scenario, drive the business down. From practical level the daily basis strategic management keeps inside forecasting and estimating of future to come. Normally the board of directors and the chairman are responsible of planning the strategies with the CEO, but normally only CEO reports these kinds of decisions to public.

Normally companies can choose their line of strategic thinking with relation to changing business environment. In general, there are three good easily understandable examples: 1) Business unit can adapt their core business procedures to the dominant market changes. This means that the company will bind their strategy to their main customers business strategies and follow the changes which they are doing. Good example would be the contractors who are working for example to Google, Amazon, Facebook or Apple. 2) Company or business unit will choose their own market area. This normally means that the company is ready to leave out from some smaller market sections and just

concentrate on one or few larger business areas. This kind of strategic changes normally needs a structure change in the business organization as well. Good examples for this kind of thinking would be for example Kone or Nokia in the past. 3) The company will modify their business environment. This is outcome from the fact that the company must have a very strong position in the market and they will have ability to impact the market development. Probably best example would be information technology (IT). Good examples are when the customers are forced follow the business strategies and processes. The best possible example company would be Microsoft which has had almost a monopoly position with their computer software products. (Puolamäki & Ruusunen 2009, pp.17-18)

One of key tasks for business directors is to make sure that the company's value development is always competitive against the competitors. Money should be directed to the location where the profit is the highest with expectable risk levels. Money does not have clear boundaries and it does not have ethical or moral conscious. Social factors are far away when investment decisions are being made. The value of the company has been tied to profitability and the facts of future success and growth i.e. the growth of revenue should never stop for many following years. (Woltering et al. 2015, p. 66.)

Companies core business activities are based on the effective use of resources. The core know-how needs to be distributed effectively inside the company and in the market. Almost every company has the target of profitable growth. The business environment is changing faster and faster every day. To find the correct opportunities for growth and to recognize the potential of it, requires accurate market analysing and estimation from the business directors. By effectively managing the business, it requires daily decision making where the risks and opportunities are being analysed, reflections of the causalities need to be considered and based on those factors, final conclusions can be done. (Liu & Chen 2010, pp.229-230)

Normally business includes many different type of strategies, but typically strategies are classified as concern level strategies and business strategies. Concern level strategy includes strategic elements in much larger picture. This

keeps inside the all business activities which can be called business folder. Most important decisions concerns typically resource planning for each business sections and the direction of the research and development. All investment cost's and the allocation of them is included in concern level strategy. The baseline strategies, financial targets and organization development are part of concern level strategy category.

Typical business strategy analyses and points out the company's long-term competitive advantage and the position of the company in the changing market. Normal business targets as growth and competitive position are part of business strategy category. Large scale companies are typically divided to regional / global strategical business units which all has its own strategies depending on the market environment. Strategic business unit can be based on customer service, products or it can be formed from production unit. These functions normally create a comprehensive business unit, which has its own business result and asset and liability statement. In colloquial language the strategic business unit can be also called independent profit centre. The external term for internal strategy business unit is normally defined as strategic business area (SBA). Strategic business area describes the combination of products / services and marketing factors, where demand, competitive position and customers technology solutions differs from other areas so that it needs to be treated as separate business unit from strategic point of view. (Ansoff 1965)

Large scale companies have had very important role for official explicit strategy planning for a long time. By Mintzberg, the strategic planning works only in equity intensive business branches, stable business environment and in business units which are big enough to maintain the strategy planning systems. Typically, these kinds of companies have well integrated functions and it requires coordination between business units and sectors. (Mintzberg 1994)

Different business units are normally forced to strategic business planning when the concern strategy is requiring this in high level strategy. Strategy planning is demanded especially when the business unit wants to get investment money. This means that the business unit senior management must be able to show an accurate

long-term business plan and which are align with the concerns strategic targets. Key driver for business strategy planning is that the key directors and senior management would need have an accurate forecast for the future long-term trends and direct the operational business activity to correct direction.

One of key terms in strategic planning is real optionality which describes the company's potential to invest to something to some active or trend business element. Real optionality also means that the company can postpone, reject or modify the investment decisions. Typically, key figures in this is that the business unit should understand the cashflow uncertainty factors. All the risks must be scaled with the potential opportunities. (Puolamäki & Ruusunen 2009, p.21)

Different strategy concepts for companies:

- Function based strategies are defined for company's main functions.
- Marketing strategy creates the foundations for whole business activities and defines the company's marketing principles.
- Product strategy is fixed to product development which defines where to aim and where to invest with future products.
- Customer strategy defines how to evaluate and face the different customers and customer groups. Which are the future key customers and how to define them before competitors.
- Technology strategy defines the baseline thinking for the future technology solutions. This is an important role for new business opportunities and part of the implementation as well, when the question is that is the company in head of time for example what comes to IoT and ICT in construction or is to business going to follow what other do first.
- Human resource strategy defines the organizational needs for roles and purposes for each individual in each organization.
- Environmental strategy will be one of the most important when looking to the future. Future clients will be more and more active with their "green marketing policy". This is becoming highly important in company's sustainable development plans. Good examples are energy consumption.

Lots of opportunities with different risk impacts to think in the strategy.
(Puolamäki & Ruusunen 2009, p.22)

As a concept strategy can be often understood incorrectly or it has been used for wrong purposes. The reason for this is that global literature has so many different definitions for the word strategy. Although the concept can be sometimes used in incorrect situations or understood wrongly, the common understanding is that the definition for strategy is long-term business plan including allocated resources and aim for target vision.

2.4 Strategic investments

Companies general investment policy normally gives guidelines for people who are planning the investment targets and alternatives. Investment policy is part of company's long-term business plan. Investment decisions must be aligning with long-term resources and it needs to follow the chosen business strategy. (Alkaraan & Northcott 2007, p. 135)

According Etelälahti et al (1992, pp.11-12) main idea of investments are the aim to impact positively to company's result or profitability of the business unit. Investments can have positive impacts on result by developing one or several components of the business which are economic efficiency, productivity and general efficiency. The impact of the investment in the final result or profit needs to be examined in complex view by studying through all the parameters. If the accurately considered investments does not have positive impact for the company's result or profitability, the investment proposal should be rejected.

2.4.1 Investment proposals

Company or business unit is alive complex environment where turning investment proposal to investment project can be very difficult but often inevitable and useful. When thinking big, the specific analysis, logical ideas and the concept will

start build-up. Implementation of new ideas in existing (old) organizations is not self-explanatory. Usually the main obstacle is the old way of working where everybody has used to operate. It feels safe for middle management, but most probably is inefficient. When placing the problems in the spotlight, the barrier of new thinking can be removed. (Houni et al. 1997, p. 9)

Large scale investment case can be described through following steps (Kärri 2016):

- Feasibility study stage, when the main goal is to get the answer to the question, is the investment option so interesting and good that it makes sense to use more resources for further investigation.
- Preparatory planning, when the answer needs to be clear for previous question and the aim is to get the clarity of how close the planning stage is to the actual optimization point i.e. when is time to move from the research / study stage to decision making stage.
- Investment planning, which means the technical study stage where the cost structure, profitability calculations and sensitivity analyses are been investigated.
- Final investment decision making stage, where the alternative investment proposals are being evaluated and the most interesting option will be chosen which sets the risk matrix to expectable level.
- Investment implementation, where new facility, equipment, resource or service will be ordered / executed.
- Project kick off and monitoring, where the implementation takes place. Investment project might have small changes, but the key figure is to make the investment profitable in planned schedule.

According Puolamäki & Ruusunen (2009, pp. 134-135) the investment project progresses from the idea to the operational execution goes through planning and efficient implementation. Investment process takes typically 2-3 years depending on the market view. Some processes might have multiple evaluating and decision-making stages. Most important part for investment plan is the accuracy of the

market future review and the fact that how well the idea matches to company's strategy and timing. In the investment implementation stage, the key driver is the efficiency of the project group, decisions are done quickly and the processes or bureaucracy do not disturb the project itself. Some elements of the investment plan can change in live business environment so government needs to be prepared, but also flexible to make changes and re-iterations. Biggest changes for future investment plans are typically new ownerships and higher management re-positioning. Complex investment project can be described with following figure.

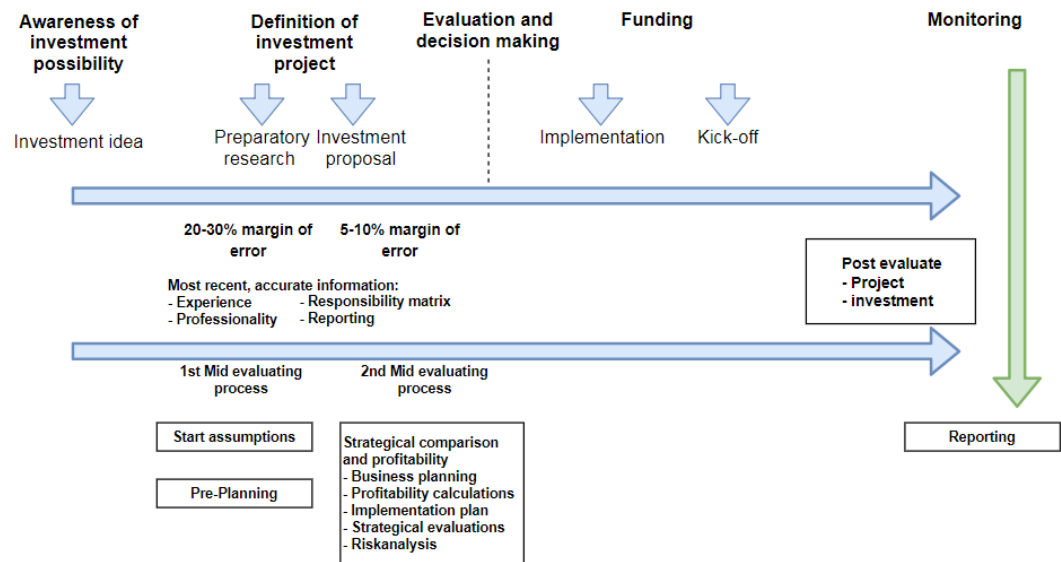


Figure 3. Typical investment process.

2.4.2 Investment categories

Investments are typically understood as financial management in different ways and its purpose it to create profit. Financial investments are known as investing money to business activity and either in shape of internal equity capital or external non-equity capital. In real investments the money is tied to the productional costs. In this study the case example presents the method when the equity would be bind to people and organisation i.e. productional costs.

All investments have the same nature as they bind equity to the business activity, risks are included in many levels depending on the value or target and cashflow forecast is critical as its key element when divided for planned investment period. According Puolamäki & Ruusunen Investments are typically divided to operational, strategic and research & development investment.

Operational investments funds are typically generated from business operations. Main idea for operational investment is to maintain the existing business and competitiveness in the market. Investment case implementation and monitoring is typically delegated to the operational organization after the board of directors has approved the financial governance for investment case. Decision making is based on general quantitative information based on calculations provided by business accounting team.

Operative investments can be for example small capacity expansions, replacements and other maintenance investments which main purpose is to maintain and improve the reliability and usability. Idea of continues improvements with small investments is one key element to maintain positive work environment. These kinds on of small organizational investments should be dealt fast and close by the source of the investment idea. Typically, the profitability of small operational investment is good since it improves the employee efficiency.

Investments which are forced by law and regulation changes are inevitable for business organizations and those can be classified as operational investments. The driver for these kind of investments is typically environmental or occupational health and safety feature which have authority demand for improvement. If the company does not comply with global and local regulations the authoritative function can temporarily close the business activity or give fine for not following the regulations. In large scale business units or corporations there is typically few options for investments to comply with all regulations. (Puolamäki & Ruusunen 2009, pp. 23-25.)

When the business is looking options for strategic investment the directors needs to consider the fact that strategic investments will change the nature of the business activity. In most extreme cases the investments are implementing new business model in new marketing area, when the risks are high and the business is vulnerable for changes. In strategic investments the role of experienced business directors is huge when planning and implementing the investment. Qualitative and subjective factors are also carefully considered during the decision-making process and the impact to the business unit.

The profitability is analysed very carefully and the investment calculations are typically provided by few different stakeholders and can be often compared to an external consultancy unit calculation to minimize the risk. Strategic investments are typically funded with combination of equity capital and external capital. In most of cases the investments equity-asset ratio and WACC rate. As strategic investments can be counted all investments which are implementing the target strategies set by business leads. Strategic investments are new business model set ups and remarkable business expansions which will support the growth of developing business unit. Sometimes the development of business portfolio may require selling of business units or shutting down production lines or factories. When making this kind of decisions as closing a business unit, it often involves massive lump-sum expenditure. (Puolamäki & Ruusunen 2009, pp. 23-25.)

Third key investment category is often described as research and development investments. Aim of research and development investments are typically to create new products or services. From strategic point of view, the most important development investments for business units are IT and product development.

Investment classification is important for the management team to help their job to present the investment to the board of directors. Often strategic investments are good examples when the content of investment can deviate from the company's activation regulations. This means that when the investment is in planning stage, the plan includes more long-term cost impacts than the accounting allows to spend when the investment has been implemented. Contradictions are typically noticed when the profitability calculations of strategic investment are being combined to

the activity accounting and keyperson rewarding which both are based on accounting data.

Companies who are looking for remarkable growth needs to invest to foreign countries at some stage if continues growth is part of long-term strategy. Decision to invest to foreign countries is considerable call from the business directors and it means that the company is going to have a substantive start for global growth. Businesses who are investing to the global growth must consider their risk matrix the next level also. Cultural differences and the distance between the decision makers will create challenges to management in strategic level but even more in operational level. Foreign country or in other word global investments are typically divided in two categories, direct global investments and portfolio investments.

In direct investments the company who is investing has a majority of the shares or decision-making authority to the business unit or part of its which is operating in the destination country. These kinds of business fusion investments can be divided to developing business investments where the existing organization starts to grow and create new business alternatives or produce better services or in other hand to complete business acquisitions. When talking about the portfolio investments, the typical target result after investment is minority shareholding of the potential fusion. From practical point of view there is no clear line between direct global investment and portfolio investment to the foreign countries. (Puolamäki & Ruusunen 2009, pp. 23-25.)

According (Etelälahti et al. 1992, p.11) investment categories can be classified in material and immaterial investment classes, but also based on matter. Different investment categories:

- Compulsory investment. Companies might have to invest on H&S elements or environment when new law regulations have been set by government.

- Market position secure investment. Companies must invest on their competitiveness when aim is to keep the market position or improve the productivity.
- Replacement investment. Companies often must renew old equipment without growing the capacity.
- Restructuring investment. Restructuring investments are mainly since the business unit wants to improve the economical position or profitability.
- Expansion investment. Companies are executing expansion investments when they want to increase their production or other influencing element which has positive impact on the production.

On additional way to divide the investment categories is to separate them to real and financial investments. Investments which have long-term impact on the company's production or services in actual operational level, can be called real investments. When the company is investing on financial elements as stocks, deposits or banking activities as loans, the investment can be called financial investment. (Etelälahti et al. 1992, p.11)

2.5 Investment calculation methods

Investments are being measured from the profitability point of view with different calculation methods and measurement tools. Typically, measurement tools are qualitative meters which are combining the financial, strategic and operational risk factors and then the other perspective is quantitative. Quantitative meters are based on numerical facts based on the best potential market analysis. Four most typical quantitative measurement tools i.e. calculation methods are presented in next subheadings.

2.5.1 Present value

Phrase "time is money" might be quite worn-out in many occasions, but in the end, it is true. Value of money is one key factor in investment management. Thus,

today's 1€ is not the same 1€ tomorrow as it has been influenced by the market inflation. With common language explained, inflation means that the general price levels are growing which means that money's purchasing power is decreasing through time. (Leyman & Vanhoucke 2017, pp.758-760)

Typical capital asset investment decision requires comparison of present costs and future profits. The ratio of risks between the future profits and the timing for present investment costs are the key factors when placing the investment. When the focus is in money's time value, the assumption is that all costs and future profits are known in alternative investment project's. Even though the cashflow's are known the timing of the cashflow's needs to be considered when analysing the profitability of the investment proposal. (Leyman & Vanhoucke 2017, pp.758-760)

Let's assume that an investment project's immediate cost is 10 000€ and it will make 11 000€ profit with 100% accuracy in one year. When analysing is the investment profitable enough, there needs to be other option of how the same money could be invested somewhere else. If an alternative option would be to deposit the same 10 000€ to the bank for one year with 13% interest ($10\,000\text{€} \times 1.13 = 11\,300\text{€}$) the first investment would not be cost-effective, when the bank deposit profit would be more profitable.

In the other hand, if the bank would offer only 9% interest the investment profit would be only 10 090€ which would mean that the investment project with 10% interest would be more profitable. This example has been studied through by using so called present value system. The uncertainty factors, which are typically involved when estimating the cashflow in capital asset investment's, have not been considered in this present value example. When comparing the bank deposit investment to the capital asset investment, the cashflow in bank or government obligations are much more reliable.

In net present value (NPV) calculating method all profit and costs are discounted to present time by using the agreed interest rate. Investment is profitable, if the net present value is positive. (Leyman & Vanhoucke 2017, pp.771)

By simplifying the above, it can be said that precondition for profitable investment is that all of created positive net cashflow's present value is higher than the initial investment by using the agreed interest rate.

Identification

NPV = Net present value

CF_t = Net cash flow of period t

n = number of periods

i = interest rate

C₀ = Initial investment cost

NPV formula gives the net present value of net cashflows

$$NPV = \sum_{t=1}^n \frac{CF_t}{(1+i)^t} - C_0$$

Formula 1 (Gallo Amy. 2014.)

In the other hand, if the net cash flow is known that it is same amount every year through the planned payback time, the formula can be following

$$NPV = \sum_{t=1}^n \frac{1 - (1+i)^{-n}}{i} * CF_t - C_0$$

Formula 2 (Kärri. 2016.)

Net present value calculations can be explained with an example where initial investment cost (C₀) is 5000€ and the net cash flow (CF_t) is 1300€ / year for 5-year payback period. Let's assume the interest to 10%. By solving the formula, it gives -71.97€ as a present value for the investment.

When present value is used to evaluate the investment project's, the company's main business targets needs to be considered. If the main driver for investment is to create maximal profit, the following code of practice can be used when evaluating the investment project:

When present value is positive, the investment project should be approved

When present value is negative, the investment project should be rejected

With this code of practice, the second investment project should be rejected when the evaluating method is present value.

2.5.2 Internal rate of return

Another method which take's time into account when evaluating investment is internal rate or return (IRR). Internal rate of return is the interest rate value which gives 0 as a present value. (Aho & Virtanen 1981, pp.1.) It follows with a formula:

$$C_0 = \sum_{t=1}^n \frac{CF_t}{(1+r)^t}$$

Formula 3. (Schmidt.2014.)

When,

CF_t = net cash flow of period t

n = number of periods

r = internal interest rate

C₀ = initial investment cost

The profitability of the investment depends on the fact, that is the internal rate of return as high or higher than the interest rate which has been set for the

investment. When the internal rate of return is lower than the investment interest rate, the investment is not profitable. From different investment alternatives, the most profitable is the one which has the highest internal rate of return. (Aho & Virtanen 1981, pp.1-2.)

To explain the formula further, internal rate of return can be presented as below:

$$\sum_{t=1}^n \frac{CF_t}{(1+r)^t} - C_0$$

Formula 4 (Kärri 2016)

When IRR is chosen as main evaluate element for investment project, the criteria is following:

$$r > i$$

When,

$$i \quad = \text{target interest rate}$$

Accurate internal rate of return calculation typically requires iteration or interpolation method to find the exact rate. Typical guideline for iteration process:

- Estimate the IRR
- Calculate present value by discounting method
- When present value > 0, set higher rate, or vice versa
- Calculate new present value
- Continue to the point that IRR hits the margin (PV=0)
- Interpolate the rate to hit PV=0

(Kärri 2016)

Without using excel formulas for calculation, practical iteration method would be quickest way to estimate the IRR. Let's assume that initial investment (C_0) would be 10000€, the set interest rate (i) for project to 10% and the profit or positive cashflow (CF_t) is 3000€ per year for 5-year period.

When inserting this information to formula 2 (Kärri.2016), the present value is 1372.3€ (pv_1) with 10% (i_1) interest in 5-year period. After this let's estimate the IRR rate (r) to 15% (i_2) and recalculate the formula 2. It gives 56.4€ for present value. This means that the IRR is close by 15% for the investment project. When setting the rate to 16% the present value is -177.11€ (pv_2), so the IRR rate is between 15% and 16%. After iteration the result needs to be interpolated with typical interpolation figure and formula:

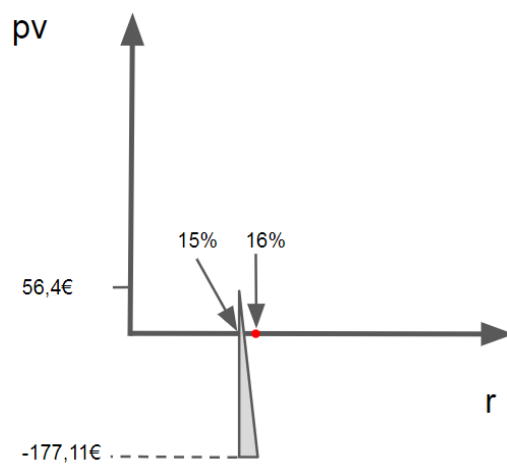


Figure 4. IRR interpolation ratio for present value & IRR (r).

$$\frac{r - i_1}{i_2 - i_1} = \frac{pv_1}{pv_1 + pv_2}$$

Formula 5. Example of typical interpolation method.

When inserting the values to formula 5, it gives the IRR result:

$$r = \underline{15,24\%}$$

When,

15,24% > 10%, the investment project would be profitable.

Even that internal rate of return can be calculated with simple methods, its economical meaning might not be clear. For example, what is the difference

between 15% or 20% internal rate of return? Numerical table clarifies it more carefully:

Table 1

Year	0	1	2	3
Cashflow	-228.3	100	100	100

Regular cashflow (100€) and initial investment cost (228.3€) gives us discounting figure $P(3, R) = 2.283$. When looking to the discounting table (attachment 1) it shows that internal interest rate is 15%.

When explaining it in practical way, it can be said that when project profit is 15% and the financing costs are less than 15%, the project is profitable. After financial costs and banks interest costs are paid, the project creates you more capital.

Instead if the financial institute requires more than 15% interest from their investment, the investment project should be rejected. Generally, if company's WACC (weighted average cost capital) is higher than the profit, the investment should not be approved. WACC will be explained later more carefully. When IRR is the evaluating method for investment project, the following code of practise should be followed:

When internal rate of return is higher than discounting rate, the investment should be approved.

When internal rate of return is lower than discounting rate, the investment should be rejected.

(Percoco & Borgonovo 2012, pp. 526-527)

2.5.3 Payback period

Even though the payback period is generally very concise for investment evaluating method, it can be used as a guideline and supporting information especially when 2 different investment proposals have same present value. Thus, the proposal which has shorter payback period is more profitable option. Payback

period also evaluates the risk as the longer payback period you have the more risk the project includes. (Puolamäki & Ruusunen 2009, pp. 236-237)

Payback period defines that period of time when the net cashflow reaches the same sum as the initial investment value. For example, when the initial investment (C_0) is 10 000€ and the yearly net cashflow (CF_t) is 2000€ the investment payback period is 5 years (10000/2000). When the investment interest rate is not included, the payback period can always be calculated as C_0/CF_t .

Payback period method typically highlights the investment financing impacts. When payback period is used to evaluate investment profitability, it favours the projects which has pays the invested capital back in short period. In the other hand the payback period method might not tell the accurate profitability because some investments can be profitable just because it is creating profits for long period of time. (Puolamäki & Ruusunen 2009, pp. 236-237)

Payback period without interest presents the payback time i.e. the time when the restricted capital will be released. It does not measure accurately the profitability but the liquidity impact of the investment project. Payback period without interest can be calculated as:

$$\sum_{t=1}^{n^*} CF_t - C_0 = 0$$

When $CF_t = CF$, then $n^* = C_0/CF$. Otherwise the exact payback period is calculated from cumulative cashflow.

Formula 6. Payback period without interest rate. (Kärri 2016)

When involving the interest rate to the calculations it measures the profitability much more accurately. Payback period with interest is calculated as:

$$\sum_{t=1}^{n^*} \frac{CF_t}{(1+i)^t} - C_0 = 0$$

Formula 7. Payback period including interest rate. (Kärri 2016)

Approving criteria with interest is that $n^* \leq n'$, when n' is the agreed target for the project. (Kärri 2016)

When the business needs to have the accurate payback period when comparing several investment options, the result needs to be interpolated with net present value function.

Mathematically it can be explained that when the investments net present value is 0, that is also time the exact time for investment payback period. For example, let's set 2000€ as initial investment, yearly net cashflow to 600€ for 5-year period and the interest rate to 10%. When inserting the numbers to present value formula (formula 1), it gives 274.5€ as a NPV value, it means that the investment payback period is nearby 5 years when it's close to 0.

After calculating the cumulative present values after each period, it shows, that the exact result is somewhere between year 4 and 5.

Table 2. Cumulative discounted cashflow.

Period	CF	Disc. CF	Cum. Disc.
			CF
0	-2000		-2000
1	600	545.5	-1454.5
2	600	495.9	-958.6
3	600	450.8	-507.8
4	600	409.8	-98
5	600	372.6	274.6

When the cumulative discounted cashflow's (NPV) are calculated, the values from both side of 0 needs to be inserted to interpolation formula (formula 5), but little bit in different order.

The exact result for payback period is:

$$\frac{5 - n}{5 - 4} = \frac{274.6}{98 + 274.6}$$

$$n = \underline{4.3 \text{ year}}$$

2.5.4 Return of investment

Return of investment (ROI) is very common way to evaluate an investment project. When calculating ROI, it must be kept in mind that there are different variants for ROI and it gives the different result in the end so you must know the correct figures. The basic idea is to compare the investment net cash flow to the initially invested restricted capital.

One option to explain ROI:

$$\text{ROI} = (\text{average net cashflow} / \text{initial investment (allocated equity)})$$

2.5.5 Recapitulation of investment calculation methods

This study does not include all possible methods to evaluate investment profitability. Examples presented on this study shows the idea of how many different views the investment profitability study can have. Every method includes benefits and limited factors which may affect the result compared to each other. In every presented method has an element which can be financially questioned.

Challenge in present value calculation is the definition of discount rate. Single figure which is defined for one period is used to discount the cashflow in many following periods.

The benefit in payback period is that it is very simple to use. In the other hand the problem is that it does not consider the time factor for money. If the cashflow

turns to negative after the target payback time is complete, the profitability cannot be justified. When using internal rate of return, the discount rate does not need to be defined, but the internal rate of return presents the investment profitability against the initial investment i.e. sum above neutral (0) present value indicates the IRR.

Following numerical example presents how different calculation method for profitability can affect to the result. Aim for this example is to highlight why it's important to review the investment with different calculation methods.

Table 3. Four same value investments with same period but different cashflow.

Year	Investment options			
	A	B	C	D
0	-2000	-2000	-2000	-2000
1	200	0	200	400
2	1800	0	400	600
3	200	600	600	1000
4	-400	1400	800	1000
5	-800	2700	2600	1200
Initial investment = 2000				

A) Payback period

Table 4. Option A is most profitable when determining factor is payback period.

Investment option	Payback period
A	2 (200+1800)
B	4
C	4
D	3

B) Return of investment (ROI)

Table 5. Option B is most profitable (best profit for invested capital).

Investment option	Return of investment (ROI)
A	10% (200/2000)
B	47%
C	46%
D	42%

C) Present value with 10% interest rate

Table 6. Option C is best as it has highest present value, option A goes to negative and should not be implemented.

Investment option	Present value
A	-950
B	1083
C	1124
D	1039

D) Internal rate of return (IRR)

Table 7. Option D is best with highest IRR. Option A goes highly to negative.

Investment option	Internal rate of return (IRR)
A	-196.5%
B	21.5%
C	23.4%
D	25.4%

As a conclusion of this numerical example, it can be said that different calculation methods have huge deviation for the result of profitability study. Different methods will provide different result. Because of this it is very important to understand what method is recommended to use for alternative investments.

This example outlines the theoretical study of the calculation methods. From the example it can be concluded that present value and internal rate of return typically gives same result or close enough when both methods consider the time factor.

Payback period and return of investment (ROI) does not include the interest rate so both methods should only be used a support material for investment calculations.

When comparing present value (PV) and internal rate of return (IRR), it can be said that present value is the most reliable and recommended calculation method for investments. Problem with IRR is that when project cashflow is negative during the project, it creates multiple-IRR problem when giving more than one result or it will not give the result at all. This would mean that the cashflow would need to be modified i.e. the company would need to invest more money to the project. (Aho & Virtanen 1981, pp.1-2) This would be called modified internal rate of return (MIRR). MIRR typically eliminates the multiple-IRR problem and it gives the investments same boundaries as present value. (Kärri 2016)

2.6 Risks and sensitivity factors

In the foregoing chapters are explained different investment calculation methods and different KPI's which are generally used and approved when investigating an investment profitability. These are not counting the risk factors for the forecasted cash flows. Investments which are based on capital assets, includes the risk or assumption that the figures for costs and profits are not known 100% in the profitability study which is the reality in finance life.

2.6.1 Investment risk management

As (Puolamäki & Ruusunen 2009, pp.243-244) have mentioned that future cannot be forecasted with 100% accurate details, but by using different risk analysis methods in side of calculated indicators one can get additional information about the critical factors and the uncertainty of those. This will be valuable information to support the decision-making process.

Typically, the risks in the investments cannot be changed or removed, but when transferring the risks to the stakeholders who have the best ability to manage them, the risk level will decrease comprehensively. When the complete risks are decreasing, the profit for every stakeholder can be increased by dividing the investment particularly defined segments. When the risks are not allocated correctly, the costs which are included in the risks can be increasing to the level that the investment should not be implemented. (Kankainen et al. 2000, p.18)

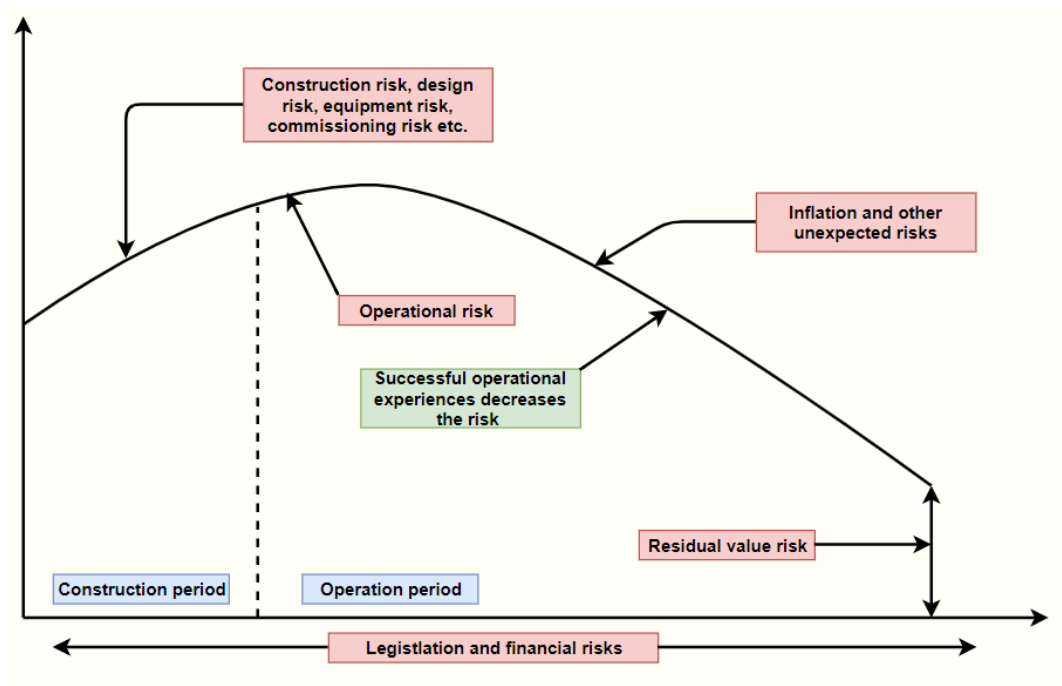


Figure 5. Typical risk profile for construction project. (Kankainen et al. 2000, p.22)

2.6.2 Risk and uncertainty factor concepts

Different changes and business environment occurrences can be presented in qualitative and quantitative models. Qualitative model concerns more the facts of occurrences which uncertainty can affect more and these risks are being analysed. Most of the qualitative risk assessment cases will refer to quantitative factors for example presenting the uncertainty to increase or decrease without defining the approximate quantitative level of risk. (Honko 1966, pp. 66-67)

To get reliable results to define quantitative level of risk, there must be suitable units which will clarify the risk measurement. With correct figures it leads to most accurate conclusion for probability factors which Honko (1966, pp.66-67) has defined as:

Probability can be explained in simple form by defining the proportional frequency of specific occurrence when the number of changes is increasing by infinity.

$$\frac{a_n}{n} \text{ limit, } p = \lim \frac{a_n}{n} \text{ and } n \rightarrow \infty$$

Formula 8. General probability formula (Honko. 1966)

Term risk is used very often to describe an investment, which has lots of uncertainty factors and the profit or yearly cash flow are not known with 100% accuracy. Even though the profits and future cashflows are not exactly known, there are always some groups of alternatives and the probabilities are known. It can be presented that the investment which includes risk is an investment where the distribution of profits can be forecasted. The distribution can be based on objective or subjective probability study. (Levy & Sarnat 1998, pp.216-217)

By taking uncertainty factors into account when planning an investment, it normally means that the company needs to manipulate the profitability figures by decreasing those. When decreasing the profitability figures without mathematical purpose, it doesn't show the real value in the investment calculations which are theoretically correct. Good example is positive approximate manipulation of the rate of interest, when the investment value is in large scale, the additional risk allowance in the rate cannot be justified. By applying CAP- model, the risk levels can be defined theoretically correctly. The risk can also be considered by decreasing the future cashflows, but when doing this, the study must not consider the same risk when iterating the rate of interest. (Puolamäki & Ruusunen 2009, pp. 244)

Graphical diagram is often very useful tool to present the investment profitability where horizontal axel presents profit's and the vertical axel presents the probability of the expected profit. In the diagram underneath is shown 1% risk level which means there is 99% likelihood that the investment risk will stay between the indicated risk zone. (Puolamäki & Ruusunen 2009, p.245)

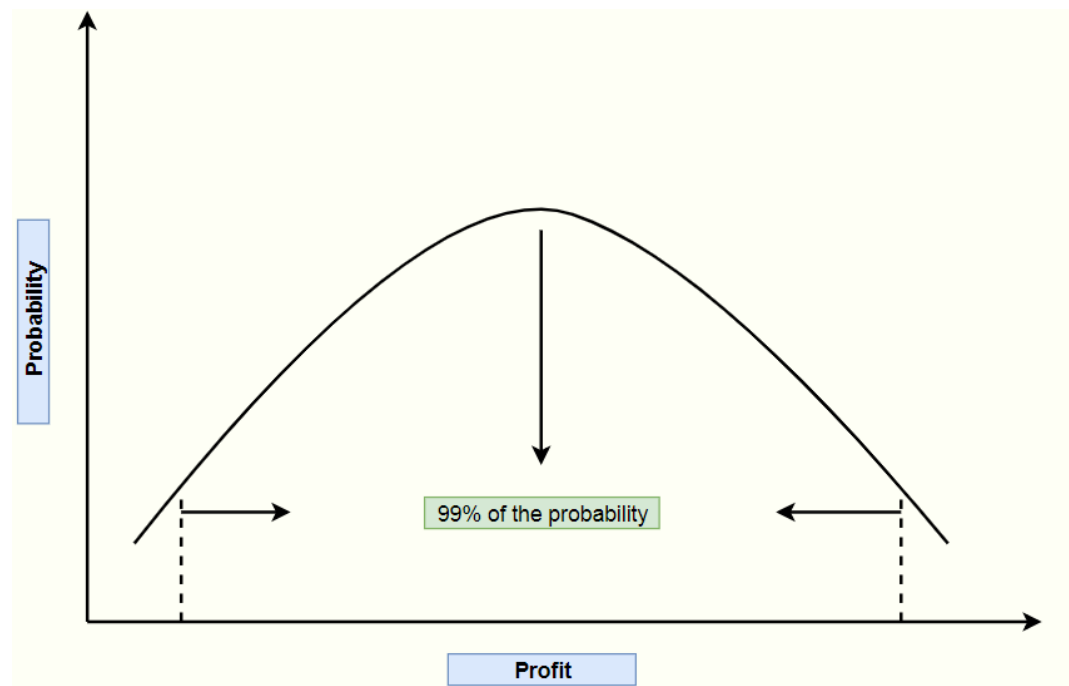


Figure 6. Risk profile & probability diagram (Puolamäki & Ruusunen 2009, p.245)

2.6.3 Direct risks

Previous chapters have presented investment calculation methods which are experienced complicated time to time. Reason behind this is that those formulas use often very detailed mathematical calculations with very detailed figures between different investments profitability comparison and factors which are influencing to the investments combination examinations. Best examples for this are NPV and IRR calculations. When these technics have been developed the mathematics have come even more detailed in a way that discounted cashflows can be calculated to the fractional part of percentage. Behind the accurate details of calculations, is information which is not always as correct and details as the result of the calculations. Most of the scenarios the results of profitability

calculations are average from several opinions. When the expectations are close by to each other with investment options, there is always an immaterial impact which will affect to the decision makers.

Usually decision makers have more additional supportive information than just expected profit or single figure as present value. Supportive information is typically associated to the nature of variables and to the current format of information which are used in the investment calculations. These items include factors as uncertainty, probabilities and opportunities which are linked to the profit and risk in large scale. Typically, direct risks are considered in cashflow changes, market competition and global economy. (Javier & Garcia 2017, pp.4-6)

2.6.4 Indirect risks

When planning an investment and completing the profitability study, for example calculating present value, the risk will be included to the rate of interest. This is typically used to describe indirect risk consideration. This kind of perspective the value of the investment is presented with unambiguous indicators as risk adapted present value. Indicator includes the risks indirectly which are part of the investment and when doing this, it cannot explain every variable result or the probability of the results. A numerical example for the method clarifies more.

When the initial investment cost is 1000€ and the profit is 500€ or 1500€ (50% / 50%) per year for ten years' time. The forecasted yearly cash flow is 1000€: $(0,5*500€) + (0,5*1500€) = 1000€$. If assuming the price for the “riskless” money to 5%, the present value is 6722€ (see chapter 2.5.1, formula 1.)

As the future cashflows are not known with 100% accuracy, can be assumed that the company typically requires another 5% risk allowance to the discount rate to compensate the uncertainty factor. The future cash flows need to be discounted with 10% interest rate and the present value alternates to 5145€. Always when the risk of investment is considered high, then the discount rate which is subjectively defined, will be high as well. When considering the financial risks in more detail

level, there is financing risk management tools as CAP-model which was mentioned in previous chapter as well by Puolamäki & Ruusunen. The same tool is also known as CAPM (Capital Asset Pricing Model) which can be used to calculate the correct discount rate for investments.

CAPM is used for capital pricing in investments which has been developed by Treynor, Lintner, Moss and Sharpe in 1960's. Main idea of CAPM is to decrease the capital profitability by increasing the "riskless" rate of interest with the current stock market risk allowance rate. The rate fixing needs to be always defined for exact company and should not be generally used. The risk allowance rate in CAPM is done by so called beta-factor.

The purpose of beta-factor is to describe the market risk which the stock includes; i.e. main point for beta-factor is to indicate that what happens to the company's stock value when the general stock index is changing. The forecasted cashflows are tight to the marked environment changes. As the cashflows are having multiple changes in relation to market or economy, the beta-factor is always increasing and the risk gets bigger against the investment.

Main issues when using CAPM comes when beta-factor and stock market's risk premium or in other word allowance is decreasing. Both beta-factor and risk premium are influenced by time i.e. unstable and this fact decreases the reliability of the model itself. Empirical evidence shows that the estimations of CAPM own equity profitability are not in line with stocks general profitability.

The stock's marketing value's ratio to the book value and the size of company explains stock profitability much comprehensively. Unfortunately, the financing theory cannot produce unambiguous model which can tolerate all these factors. (Zhang 2017)

The inferential formula for CAPM is following:

$$E(R_i) = R_f + B_i[E(R_m) - R_f]$$

Formula 9. CAPM-formula.

Where:

$E(R_i)$ = Expected profit for investment

$E(R_m)$ = Expected profit from market market-index (Nasdaq, Hex, Nikkei)

B_i = Unit for systematic risk or the sensitivity of the expected excess asset returns to the expected excess market returns

R_f = Riskless rate of interest for example interest from government bonds

In general, can be said that the expected profit from investment is a sum of two different factors; risk-free rate of interest and factor which represents the required risk premium.

The assumptions for CAPM are that there is perfectly efficient capital asset market situation ongoing and the investment parties has homogenic expectations from the market. Another assumption is that requested rate of interest for investments is not depended only from the company's investment policy. As the investment should be evaluated only by systematic risk, the market expects and requires profit which as at least as good as any other business unit equal investment project. (Zhang 2017)

Practically most of the problems in CAPM or usage of CAPM are align with the assumptions of efficient, perfectly balanced market factors as:

- Expectations for market variations are neutral
- Information is equally shared to every stakeholder
- Credit and debit loans are borrowed with similar rate of interest

(Zhang 2017)

Accordin Puolamäki & Ruusunen (2009 p.270) the economical failure is not pure calculations and mathematics. It is derivable directly to the business management and their skills in decision making process. Ultimately, the success and failure in business investments is a question of pure business management skills.

When defining the cost ratio for the equity of the investment, it typically comes from the estimation of CAPM which is based on shareholders expectations of the profit margin. Another main item is the rate of interest which is set for external capital which the company must pay after tax from the external funding. By combining these two elements, WACC (Weighted Average Cost of Capital) can be created. WACC means the average of combined cost for invested capital (internal & external). Combined WACC is used as a discounting figure when calculating investment profitability's.

To use WACC is recommended especially when single investment is treated as copy of risk for the entire business unit. Cost of combined capital, internal and external is not always recommended to be used as rate of interest for new investments as those will most certainly include higher level of risk than the existing investments. (Javier & Garcia 2017, pp.345-346)

Example of WACC calculations before and after investment with operational capital structure of:

Table 8. Example of capital structure.

Capital source	Market value	Capital cost
Financial institution (Loan)	€1 000 000	5,5%
Debenture bond (Loan)	€500 000	9,0%
Equity capital	€5 000 000	12%

Business unit is planning an investment of 2M€. Investment funding will be shared with 40% external capital (bank loan) and with 60% internal capital (equity capital).

WACC comes with formula:

$$r_{WACC} = \frac{(r_e * E_c + r_i * I_c)}{(E_c + I_c)}$$

Formula 10. WACC calculation. (Kärri 2016)

Where,

r_{WACC} = Expected return on capital (profit)

r_e = Average rate for external capital

r_i = Return of equity

E_c = External capital

I_c = Equity capital

WACC before investment:

$$r_{WACC} = \frac{(0,055 * 1Me) + (0,09 * 0,5Me) + (0,12 * 5Me)}{1Me + 0,5Me + 5Me}$$

$$\underline{r_{WACC} = 10,8\%}$$

WACC after investment:

$$r_{WACC} = \frac{[(1Me + 2Me * 0,4) * 0,055] + (0,09 * 0,5Me) + [(5Me + 2Me * 0,6) * 0,12]}{6,5Me + 2Me}$$

$$\underline{r_{WACC} = 10,4\%}$$

This calculation example clarifies clearly that when the ratio of capital structure items changes it changes the WACC as well. In this case the WACC decreases by 0,4%.

2.6.5 Decision making as part of risk analysis

As investment process comes closer to the final decision making, the management likes to see figures which they can easily understand, when there are two or three potential investment plans in the table without huge differences. One of the most popular tool for the final comparison process is called mean-variance. Chalfant et

al. (1990) have described that “*mean variance approach to decisions under uncertainty requires estimates of the parameters of the joint distribution of returns*”. In common language the mean-variance can be explained as average-distribution. It is based on the expected profit and variance of the investment forecasted cashflow. (Chalfant et al. 1990).

Mean-Variance rule can be clarified with an example as:

Project X is more profitable than project Y, If or when it another of following terms will be fulfilled:

- 1) Project X’s profit is higher or equal with project Y’s expected profit and X’s variance is lower than Y’s variance or
- 2) Project X’s expected profit is higher than project Y’s expected profit and project X’s variance is lower or equal to project Y’s variance.

Expected profit indicates the project profitability and the variance indicates the potential risk level of the project.

Numerical example clarifies more:

Table 9. Numerical example of mean-variance results.

Result	Project X		Project Y	
	Profit, €	Probability	Profit, €	Probability
E	2000	0,5	0	0,5
	4000	0,5	6000	0,5
D		3000		3000
		1000		3000

$$E(X) = (0,5*2000) + (0,5*4000) = 3000$$

$$E(Y) = (0,5*0) + (0,5*6000) = 3000$$

Project X variance:

$$D^2 = 0,5*(2000-3000)^2 + 0,5*(4000-3000)^2 = 1000000$$

And the average distribution:

$$D = \sqrt{1000000} = 1000$$

By using same formula, the project Y's variance is 9000000 and the average distribution is 3000.

By following mean-variance rule, investment decision should be project X. Both projects have same profit expectation values, but project Y contains higher risk level as the variance is higher than project X. (Levy & Sarnat 1998, pp.240-243)

2.6.6 Sensitivity analysis

Probably most common way to analyse different deviations of the investment is to create a simple sensitivity analysis. The idea is that once the basic profitability study is done with chosen interest rates and profit expectations, the company board or directors can easily change the figures and shows how sensitive the project is against market changes. As a result, sensitivity analyses are a table where positive and negative factors are compared to the initial investment figures. After the table is created, it is typical to present the deviations with figure where the changes are shown clearly (Puolamäki&Ruusunen 2009, p.247)

Sensitivity analysis is used in this study to understand how sensitive the investment study cases are for turnover and profit variations and how much they can vary, that the project should not be implemented.

Sensitivity analysis can be implemented with one or several profitability factors at the same time. Following example defines how multiple variations with different factors will affect to the investment profitability.

Net Present value sensitivity analysis:

$$NPV_{\alpha} = NPV_0 + \sum_{t=1}^n \frac{\alpha CF_t}{(1+r)^t}$$

Formula 11. Sensitivity for Net Present Value.

Where:

NPV_{α} = Defect fixed NPV

NPV_0 = Planned NPV

α = Defect factor

CF_t = Cashflow for period t

r = Equity cost/rate

n = investment period

Table 10. Example investment. (Puolamäki & Ruusunen 2009, p. 248)

Initial investment	C_0	650 000€
Equity cost/interest	r	8,00%
Investment period	n	10-years
Discount rate	i	6,710
Yearly cashflow	CF_t	
Sales	800 000€	
Raw material	-350 000€	
Work	-200 000€	
Energy	-100 000€	
Others	-50 000€	
Cashflow	100 000€	

$$NPV_0 = -650\,000 + 6,710 * 100\,000 = 21\,000$$

Table 11. Fixed NPV sensitivity analysis table. (Puolamäki & Ruusunen 2009, p. 248)

Defect factor	Fixed NPV				
	Sales €	Raw material €	Work €	Energy €	Others €
-30%	-1 589 400	725 550	423 600	222 300	121 650
-20%	-1 052 600	490 700	289 400	155 200	88 100
-10%	-515 800	255 850	155 200	88 100	54 550
NPV ₀	21 000	21 000	21 000	21 000	21 000
10%	557 800	-213 850	-113 200	-46 100	-12 550
20%	1 094 600	-448 700	-247 400	-113 200	-46 100
30%	1 631 400	-683 550	-381 600	-180 300	-79 650

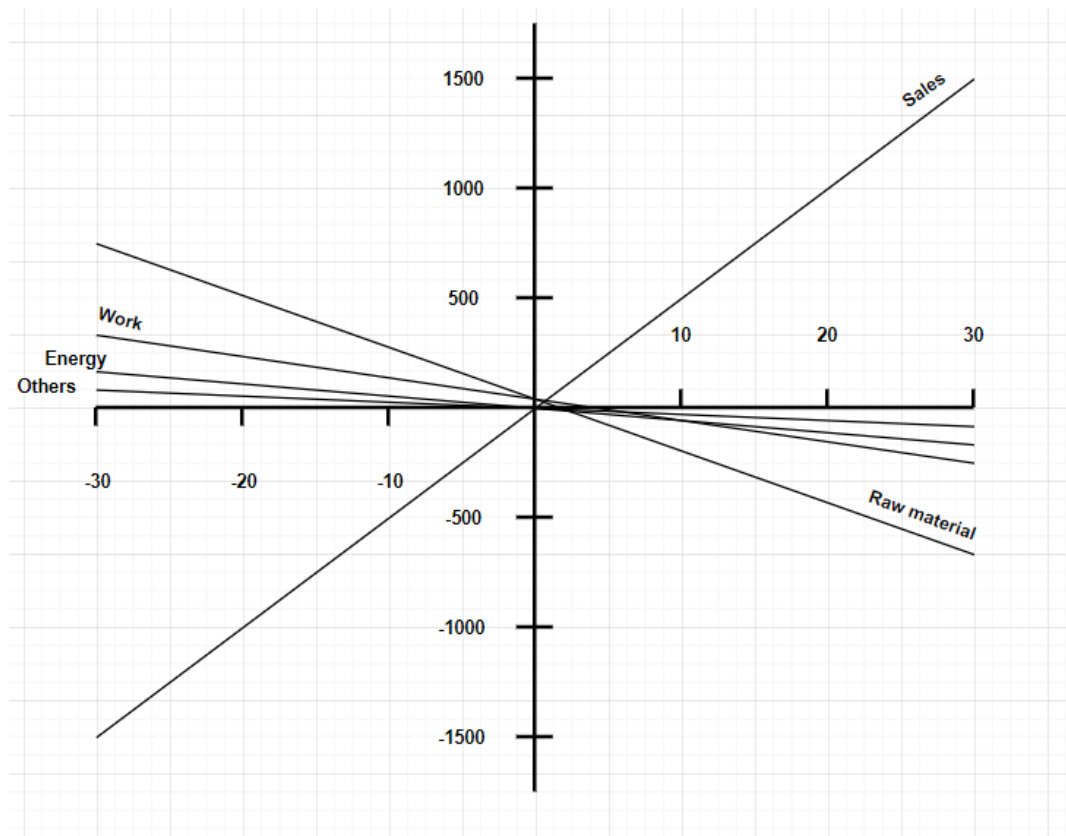


Figure 7. Sensitivity analysis. (Puolamäki & Ruusunen 2009, p. 249)

As the table 11 shows, the impact of defect factor α is varying a lot depending of the profitability item. Main value of the sensitivity analysis for decision makers is the process which clarifies or triggers the biggest impacts of the investment calculations. Analysis presents clearly the order of impact for the different profitability item variations. Figure 7 presents different variations in graphics. (Puolamäki & Ruusunen 2009, p. 249)

3. CASE STUDY BACKGROUND

Case company of this thesis will be handled as anonymous for global NDA (Non-Disclosure Agreement) reasons. In the further text the company will be called company. Company is operating in four global hubs which are: Europe, Middle East, Asia and United states. These hubs include 24 countries in total so the global management chain is in large scale. Company's core service lines are: Fit out, Technology, Construction and Development. Underneath main service lines the operations are divided to five sectors as: Offices; Technology & Health; Retail; Hospitality & Leisure and Education & Public sector. Company is currently employing approximately 3000 people around the globe.

Main business is run from London, but they have also permanent large-scale project offices in few other areas as Middle-East, United States and in Germany for example. Company is delivering large scale projects around the world and as the aim of this study is to understand what are the investment requirements to start a single business unit to Finland, it leads to the main goal to create sustainable business to whole Nordics region.

3.1 Construction management business model

This thesis is based on continuum to a business development project which was done in year 2017. During several workshops and planning meetings with senior management the key issues for company are business set up, local knowledge and project implementation structure. When the business unit is only delivering large-scale so called "special projects", the business is not planned to continue in the target country with a solid business foundation but just departing to the next project even that the market would be open for more business. This leads to a fact that once there is no business unit set up in the target country, it takes lots of resources to start any new projects in the target country / district.

Company's business model has normally no overhead costs since the customer is paying project overheads separately on top of the project costs so the operations

should require minimal equity from investment point of view. Business model is so called construction management service where the contract type is “be-spoke” which means that company is adding minimal profit on top of every package of work on the project and the client has full visibility on the commercial process. This kind of business model can be treated as less risk less reward and it works perfectly when the aim is only to execute large-scale special projects. (Muuronen 2017, p.8)

Company has delivered 4 large-scale projects in Finland for a global customer. After these projects have been completed the company has set a small business unit to serve the client’s retrofitting and improvement projects which are in the same campus where the main projects are executed. Company has an office inside the client’s campus and it can only execute projects for client in question. This fact is tied in to a point that the business unit has no readiness to work elsewhere in Finland. Company has tried to tender some projects for local customers with the same business model, but without an organisation which now’s the stakeholders and regulations in Finland the outcome has always been that the project costs are far away from the client expectations.

Company has almost limited resources to develop a new business and high level global understanding of the latest information in the market. When the potential projects have been treated as “special projects” there has been lots of issues what comes to the local culture and the decision-making process which has too many platforms in the hierarchy which makes it inefficient. On top of this the potential client’s does not fully understand why the company’s internal processes needs to be so heavy and the commercial system so complicated. All these elements are creating additional costs and leads to the point that the company is not competitive in the normal market competition.

Outcome of the business development project was that new organization needs to be created, but the level of staff needed is still to be investigated by further study. (Muuronen 2017, pp.6-8)

3.2.1 Investment category

The category of this investment project is mostly combination of strategic and operational. It can be treated as strategic investment as the aim is to create completely new business unit and by doing that, expand the market area. It will still have the same core values as the main business unit, but it will start operating with local management team.

When the business model is planned to run with its own created equity, it will also be in operational investment category. Investment funds will be allocated to new organization which will start operating independently in new market area. As most of the fixed costs covered in the projects it will automatically turn the cashflow to plus when there is no major material capital where big amounts of equity will be tied in for long period.

3.2.2 Information background

As every investment plan, the information for future estimation will hypothetical, but in every case, it is based on historical knowledge in cost point of view but also in understanding the potential market for future estimations. Kick-off for this study is based on the business development case which was a result of several workshops and presentations to the senior management of how they think the business should operate.

For this study the information collection has been done by face-face interviews with senior management but also with cost controllers to understand the cashflows in comprehensive scale. Challenges to coordinate the information collection has mostly been the fact that people are extremely busy in their day to day work, but also the distance that some of the presentations are been done through video conference where the level of interaction is never the same as when people are present in one room.

During the interviews the main goal of the study was explained briefly. Couple of senior management staff wanted to understand precisely the outcome of the profitability and to see some variations in the model from sensitivity point of view. Key element was to explain the risks of the potential investment plans and the level of initial investment. Positive thing was in every interview that people were open and keen to see how different elements will affect to the outcome.

Project was split in to four different milestones. Before every new project milestone, there was always a project workshop with the senior management staff which included the Operations Director, Operations Lead, Global Commercial Lead and the Finland Campus Lead.

First workshop was to explain the potential thesis work and explain the potential proposal as part of the business unit development. Timing for this was very good when the company was struggling with one very potential customer and because there were no local resources to execute their project. Project got a good kick-off and the main part of the first workshop was to analyse the potential construction market in Finland and briefly in Nordics. Outcome of the workshop was that there are already potential customers in Finland and Sweden where the business would need to start operating imminently, but there is issues with the business start-up and in supply chain management.

Second workshop was held 1 month later and the milestone was to get understanding of the strategical lines and the investment proposal. Firstly, the new business unit strategy was explained by the operations director and after this it was discussed that how the Finland business unit could start operating under the same core strategies. It was clarified by senior management team that even that the core business unit have some profit goals in the strategy, this new business unit must be able to start creating profit incrementally without over estimated expectations. Potential investment proposal was explained, and the outcome was that there should be 2 case studies build with different parameters. During the second workshop the potential organisation fixtures were defined for the case study.

Third workshop was done with the Operations Lead and with the Global Commercial Lead. Third project milestone was to explain the profitability study elements to the management and iterate the parameters for the calculations. Outcome was that both investment cases got revenue stream for 10 years period, project profit was determined and the interest rates were defined. Key thing on the workshop was that the revenue expectations were based on two different existing business units where another one is doing small scale project with 15-million-euro turnover and another one is executing 50-million-euro turnover with less staff involved. These turnover expectations were chosen as target turnovers for the case study.

Fourth and the last workshop included all the senior managers involved in the project. The workshop included the profitability study presentation, potential risk management and sensitivity analysis parameter iteration. It was defined that both investment studies are potential to be implemented, but the final case study needs to include the sensitivity analysis and the model where the figures can be easily changed.

3.2.3 Investment structure and outlines

Both investments have same basic structure and the key element is people and employees. When investing to people to good part of it is that there is not much material assets needed which would need lots of equity and it would create more indirect costs (VC + FC). Challenging part for incremental strategy execution is continuity. Company needs to find the right tools to keep the people in the business. Most common tool for this is either by selling part of business to the employees, or by creating rewarding bonus system. In the end, all people are looking for more money, but when there is healthy working environment plus core values, it helps to keep the good people on board.

Investment plan will be outlined from business acquisitions so both investment cases can be compared to each other as the baseline strategy is same. From the

profitability point of view, the WACC study will be left out as the senior management has stated that external equity would not be needed in either investment cases. What comes to general CAPM study, it has been agreed that profit risk premium will be implemented in sensitivity analyses and once the excel model is complete and tested it will work as CAPM tool also.

As WACC, and CAPM will not be fully implemented in this study, it needs to be pointed out that ROI calculation will be based on complete estimation as it would have needed further investigation including company's balance sheets. Senior management nominated 300 000€ for yearly equity to run operations.

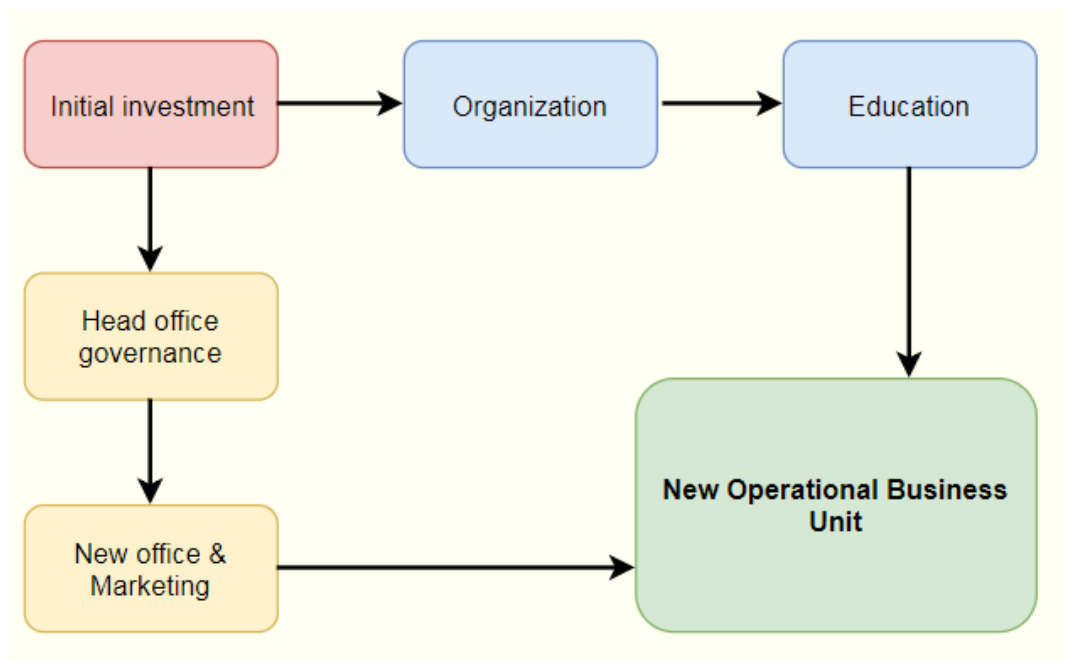


Figure 8. Business investment structure.

4.0 ANALYSIS OF THE INVESTMENT OPTIONS

Company's senior management is keen to expand the business to Nordics but they have outlined that first the business investment needs to be investigated and analysed from the risk & profitability point of view. One key element of this study is to create a model where the different cashflow variations and sensitivity can be presented clearly.

As part of the workshops the planning has been decided to separate to two different cases which would both be able to be implemented with minimal equity / initial investment cost. Both investment cases have potential to be implemented but the company has already made a point that the probability and risks are key elements for decision making. Investment study period has been nominated to 10-years.

Strategically investments are different to each other. Case 1 is planned to be implemented with bit more realistic and incremental strategy. Case 2 instead is more radical and creates more profitability potential to the business, but it includes lots of optimistic probability expectations. As Finland's construction market total value is 33,7 billion euro, both investments can be considered realistic once the case 1 aims to 15 me. turnover so it would be only 0,045% from the market size and when case 2 aims to 50 me. turnover in ten years' time, it's not more than 0,15% from the market size.

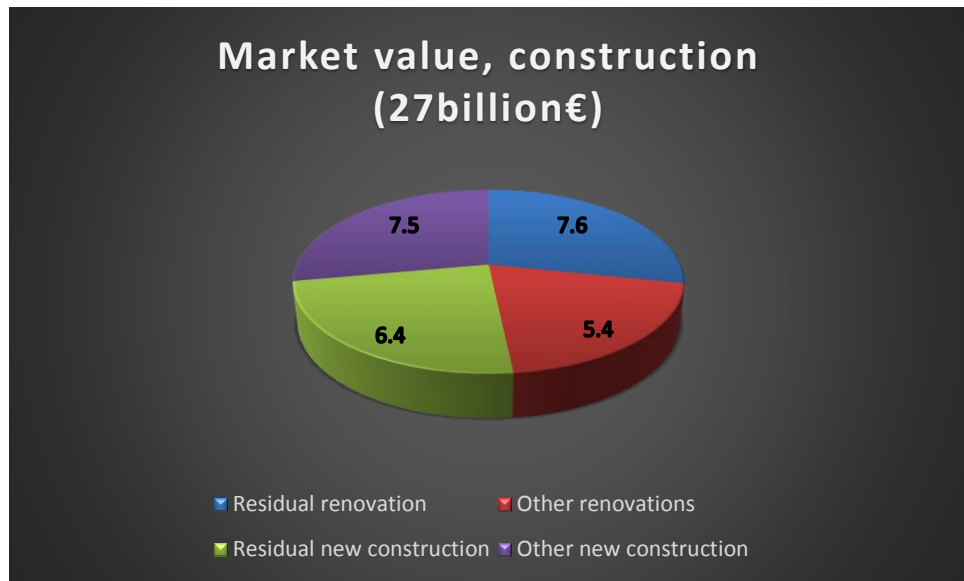


Figure 9. Finland market value, construction March 2017. (Rakennusteollisuus. Suhdannekatsoaus kevät 2018. p.2)

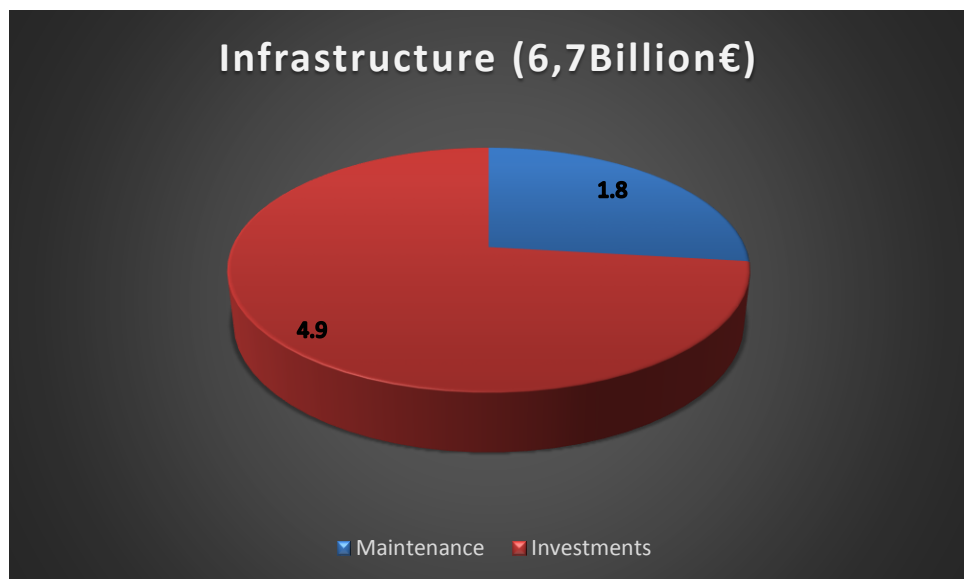


Figure 10. Finland market value, infrastructure March 2017. (Rakennusteollisuus. Suhdannekatsoaus kevät 2018. p.2)

4.1 Case 1

First scenario is that a completely new business organization will be created and the organization will start operating from the office located in Helsinki. Case 1 will require more new employees to the organization, but the rolling costs to head office are less as the business is mostly led and administrated from Finland.

Organization will start operating with 9 employees in year- 2019 and staff will grow to 18 employees in year 2029. Investment estimated turnover will start to grow incrementally from €1M. to €15M. Project profits the company has nominated to 15% and the initial investment rate of return to 10%. Case 1 will require investments to first three operational years. Full cost & profit growth and segregation can be seen from table underneath.

Table 12. Case 1 investment calculation model.

Investment Profit requirement		10%										
Project profit		15%										
Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	TOTALS
Turnover	1000	2000	3000	4000	5000	6000	7000	9000	12000	13500	15000	
Profit	150	300	450	600	750	900	1050	1350	1800	2025	2250	
Staff	470	564	564	642	749	959	1204	1584	1584	1782	1782	
TOTAL sales	620	864	1014	1242	1499	1859	2254	2934	3384	3807	4032	
Profit PV	620	785	838	933	1024	1154	1272	1506	1579	1615	1555	12,880 €
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	
	0	1	2	3	4	5	6	7	8	9	10	
Staff	940	940	940	1070	1070	1370	1720	1980	1980	1980	1980	
Head office	100	100	100	100	150	150	150	200	200	200	200	
Office rent	42	42	42	50	50	50	80	80	80	80	80	
Education & Marketing	10	10	10	10	25	35	50	50	50	50	50	
TOTAL COST	1092	1092	1092	1230	1295	1605	2000	2310	2310	2310	2310	
TOTAL COST PV	1092	993	902	924	885	997	1129	1185	1078	980	891	11055
Profit	-472	-228	-78	12	204	254	254	624	1074	1497	1722	4863
NPV	-472	-207	-64	9	139	158	143	320	501	635	664	1826
NPV	1,826 €											
IRR	30%											
NPV Check	1825.72											
Payback period	6.9											
Estimated Equity	300	300	300	300	300	300	300	400	400	400	400	
ROI	-157%	-76%	-26%	4%	68%	85%	85%	156%	269%	374%	431%	
	0	1	2	3	4	5	6	7	8	9	10	
Cumulative Profit	-472	-700	-778	-766	-562	-308	-54	570	1644	3141	4863	
Cum. Discounted pr	-472	-679	-744	-735	-595	-438	-294	26	527	1162	1826	

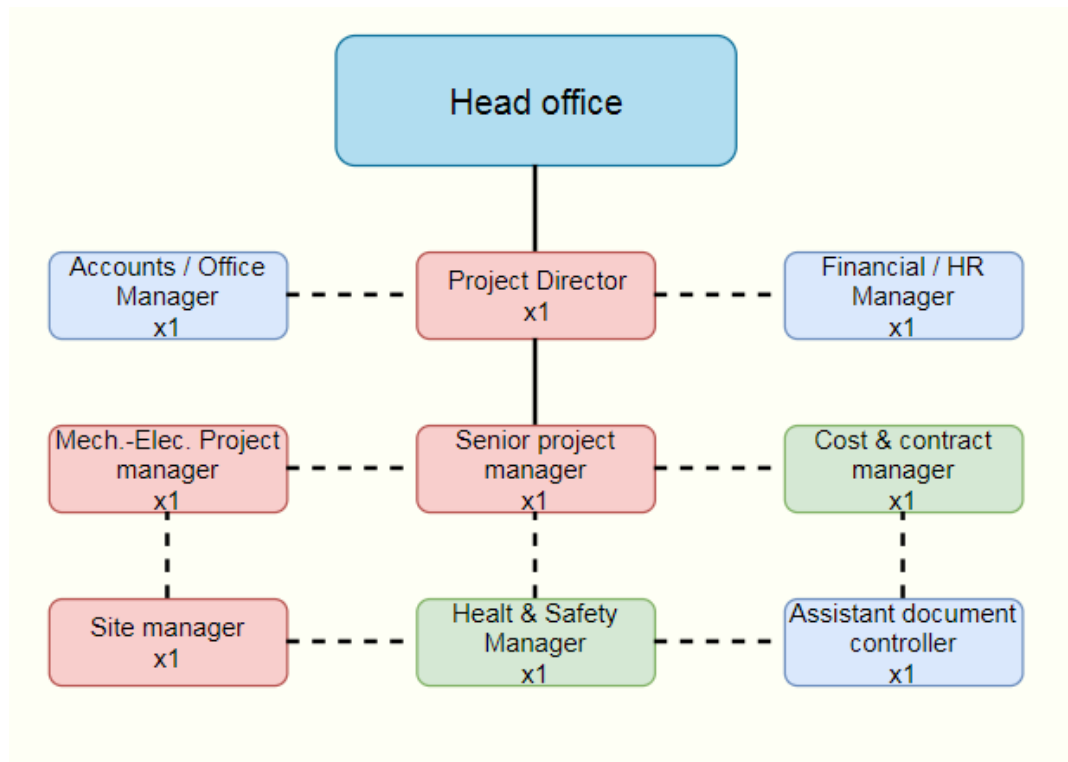


Figure 11. Staff organogram for 2019.

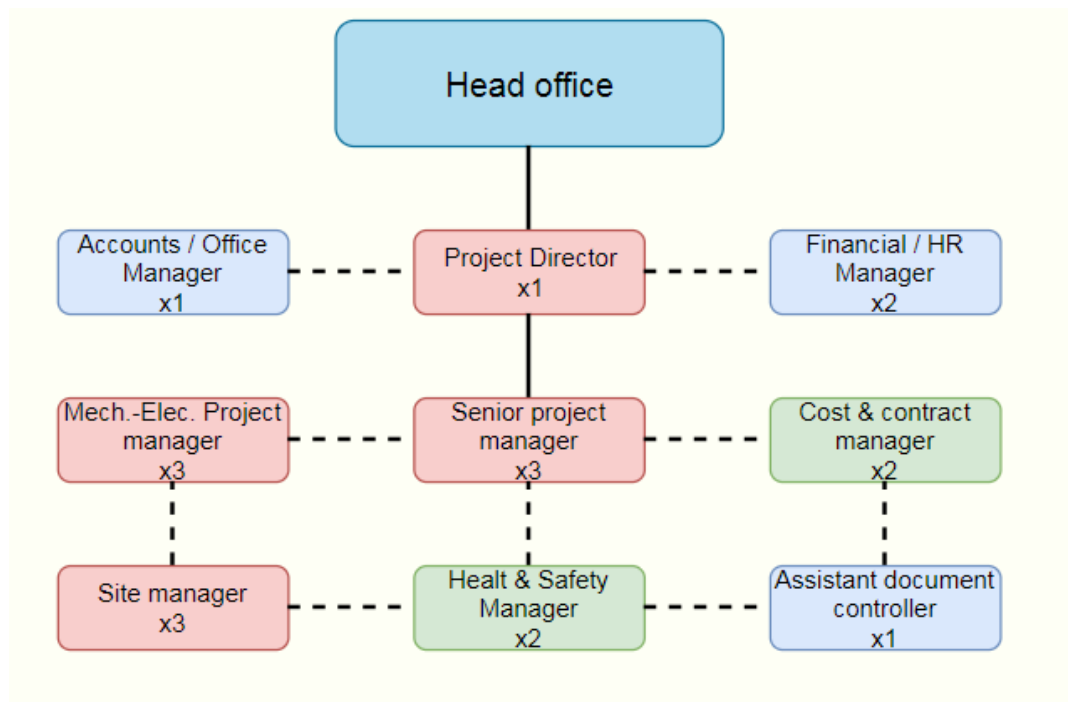


Figure 12. Staff organogram for 2029.

4.1.1 Cost structure

Company's cost structure will be based on the outcome of the business development project where it directed towards the local market business model where the company can keep the overhead costs lower than in special projects and by doing this increase their competitiveness against the competitors. The customers are willing to pay from quality and program, but in many cases the customers have questioned the high-level overheads as they see lots of "air" compared to local construction companies.

As normal construction business the idea is that all overhead costs (staff costs) can be allocated to the projects so business profit can be allocated to development or shared to shareholders. In this study the staff costs will be allocated to projects with 50% from year 2019 and it will increase to 90% towards year 2029. This is realistic as there can always be 10% margin for the executed project profits.

Staff (2019)

Table 13. Staff costs for 2019.

Title	Cost (1000€)
Project director	150
Cost & Contract manager	130
Financial / HR manager	120
SPM - Construction manager	130
PM -Mech - elect. - Cost controller	130
Project Manager - Health & Safety	70
Assistant - Document controller	50
Accounts / Office manager	60
Site manager	100
TOTAL COST	940

Cost includes employee salary, social security / health care and insurance costs. General factor for overhead employee cost is 1,7.

Other costs (2019)

Table 14. Other costs for 2019.

Item	Cost (1000€)
Head office rolling cost	100
Office rent	42
Education & Marketing	50
TOTAL	192

Head office rolling costs and education /marketing are estimated by company's senior management. Office rent cost has been taken from average Helsinki office rent costs and in this case 3500€/month.

Staff (2029)

Table 15. Staff cost for 2029. Staff cost will increase by 53% in 10-years' time.

Title	Cost (1000€)
Project director	150
Cost & Contract manager	260
Financial / HR manager	240
SPM - Construction manager	390
PM -Mech - elect. - Cost controller	390
Project Manager - Health & Safety	140
Assistant - Document controller	50
Accounts / Office manager	60
Site manager	300
TOTAL COST	1980

Other costs (2029)

Table 16. Other costs for 2029. Other costs will increase by 42% in 10-years' time.

Item	Cost (1000€)
Head office rolling cost	200
Office rent	80
Education & Marketing	50
TOTAL	330

As the organization structure shows the business unit is growing with 50% so other costs included will go up as well. Business will need more governance and a bigger office space in Helsinki.

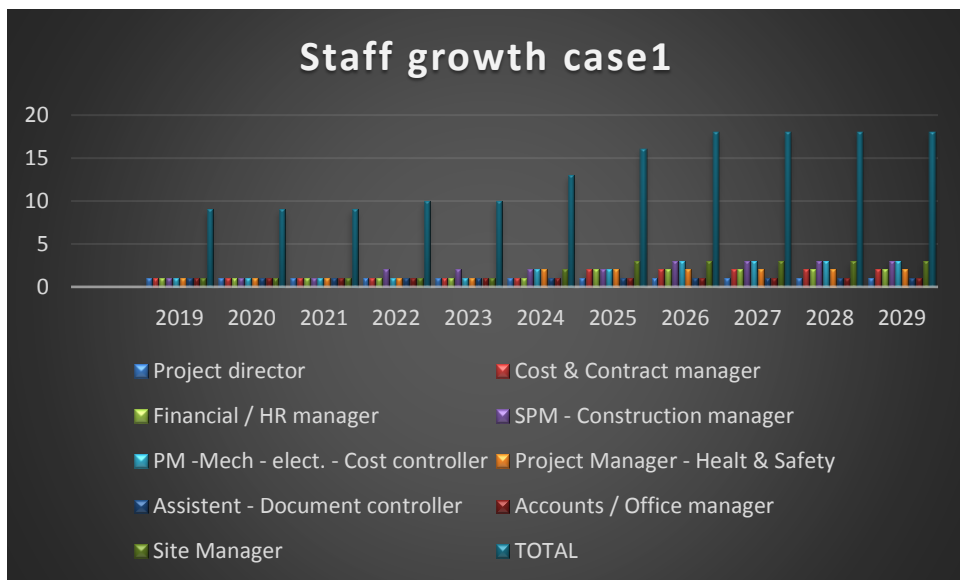


Figure 13. Investment case 1 staff growth will be 50% in 10-years' time.

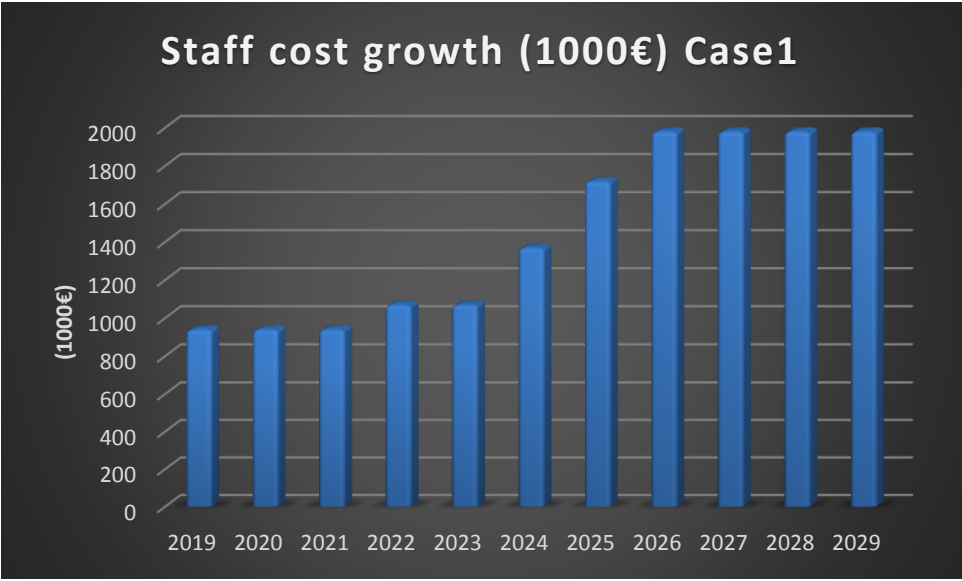


Figure 14. Investment case 1 staff cost will increase almost to 2 million euro in year 2029.

4.1.2 Profitability study

Case 1 initial investment cost will be 778 000€ which will be divided to first three (3) years with descending order. Yearly project profit is set to 15% and investment interest rate to 10%. Study period will be 10-years.

Table 17. Business investment estimated cashflow table for case 1.

Year	Turnover (1000)	Costs (1000)	Profit (1000)	Cashflow (1000)	Discounted cashflow (1000)	Cumulative discounted cashflow (1000)
0(2019)	1000	1092	620	-472	-472	-472
1(2020)	2000	1092	864	-228	-207	-679
2(2021)	3000	1092	1014	-78	-64	-744
3(2022)	4000	1230	1242	12	9	-735
4(2023)	5000	1295	1499	204	139	-595
5(2024)	6000	1605	1859	254	158	-438
6(2025)	7000	2000	2254	254	143	-294
7(2026)	9000	2310	2934	624	320	26
8(2027)	12000	2310	3384	1074	501	527
9(2028)	13500	2310	3807	1497	635	1162
10(2029)	15000	2310	4032	1722	664	1826



Figure 15. Case 1 turnover expectations.

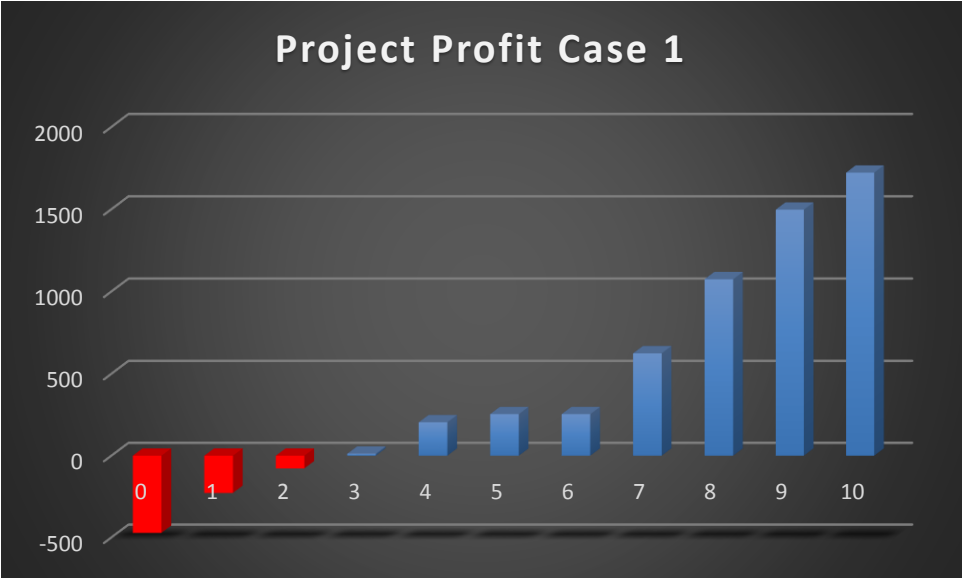


Figure 16. Investment will turn to positive cashflow in year three (3) (2022).

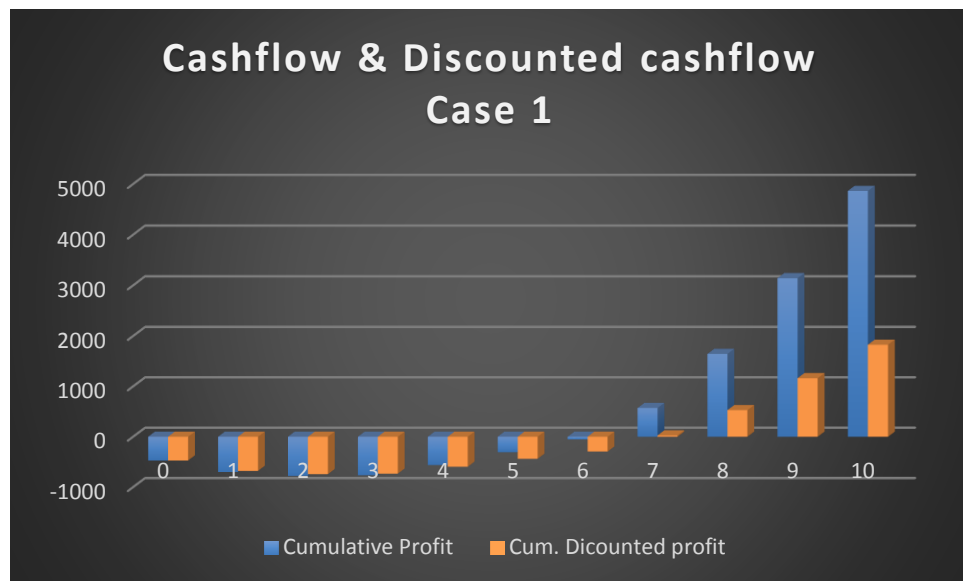


Figure 17. Investments cumulative cashflow indicates that the payback period is somewhere between year 6 and 7.

Case 1 Results:

NPV	= 1826 Ke.
IRR	= 30%
Payback period	= 6,9a
ROI (avg.estimate)	= 110%

Case 1 investment is positive and realistic to implement. Investment payback time is reasonable and end net present value is highly positive as IRR result (30%) indicates. Only not accurately studied result is ROI as the company's senior management could not give accurate level of equity information and the research was decided to proceed with average 300 000€ equity for every year to run the operations.

To understand the potential risk of the investment, it was important to create reliable sensitivity analysis for the project. This was discussed during the last workshop with the operations director. One of the biggest questions was the project profit. It was questioned few times during the process that what if the profit goes under planned 15%.

4.1.3 Sensitivity analysis

Table 18. Sensitivity analysis for cumulative discounted profit against variations of the turnover.

Turnover change	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
-30%	-517	-806	-982	-1108	-1123	-1133	-1167	-1055	-806	-428	-25
-20%	-502	-764	-903	-984	-947	-901	-876	-694	-361	102	592
-10%	-487	-722	-823	-859	-771	-669	-585	-334	83	632	1209
0%	-472	-679	-744	-735	-595	-438	-294	26	527	1162	1826
10%	-457	-637	-664	-610	-420	-206	-3	386	971	1692	2443
20%	-442	-595	-585	-486	-244	26	288	746	1415	2222	3059
30%	-427	-552	-505	-361	-68	257	578	1107	1859	2752	3676

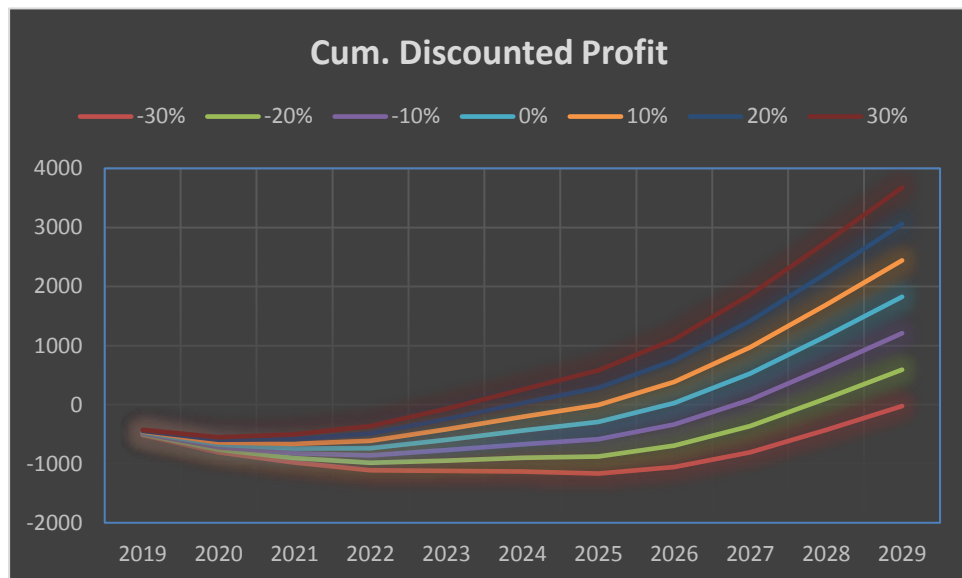


Figure 18. Diagram shows that if turnover estimation will decrease with 30%, the investment will not be profitable in 10-years' time.

After turnover variations it is normally even more important to clarify that what if the project average profit will drop. This can show the potential market risk with higher risk awareness point of view.

Table 19. Sensitivity analyses for project average profit variations.

Project profit change	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
5%	-572	-961	-1273	-1565	-1767	-1982	-2234	-2375	-2434	-2372	-2286
10%	-522	-820	-1009	-1150	-1181	-1210	-1264	-1175	-954	-605	-230
15%	-472	-679	-744	-735	-595	-438	-294	26	527	1162	1826
20%	-422	-538	-479	-320	-9	334	675	1227	2008	2929	3882

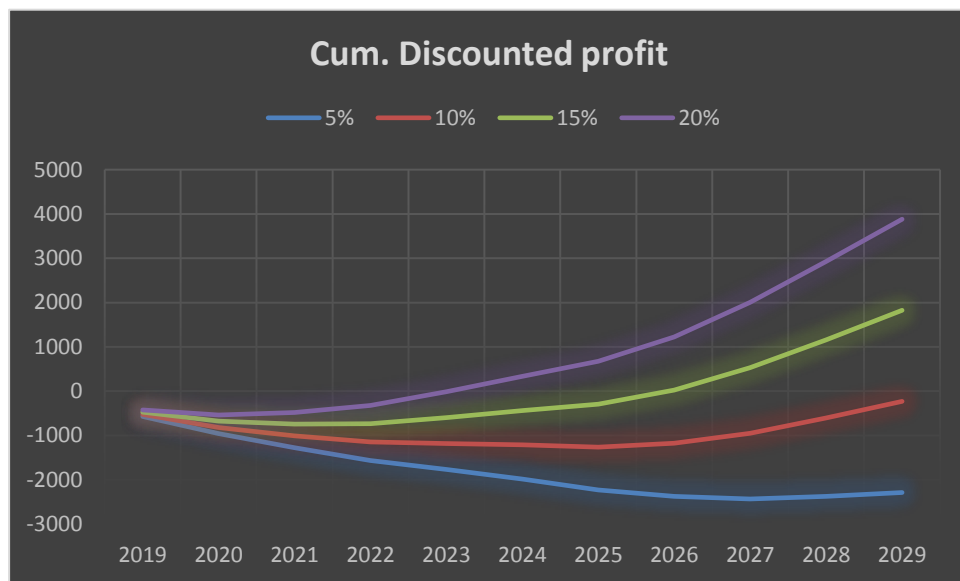


Figure 19. Diagram shows that if project average profit goes to 10% or under the payback period will be over 10 years.

This figure triggers the alarm when it shows that the expected profit should not drop under 10% to keep the investment payback time under 10 years. This was defined as a problem during the study that if profit goes under 10%, the investment should not be implemented without increasing the potential turnover.

4.2 Case 2

In second scenario the case will be planned with more radical business growth and will less initial investment costs. Case 2 operational business is planned to be administrated from existing office and with more shared resources. This means that means that head office governance costs will be higher than in case 1 but it does not need that much new employees.

Business unit will start operating with 3,5 new employees in year 2019 and staff number will grow to 16 people in year 2029. Investment estimated turnover is planned with very optimistic forecast. It will start operating with € 1M revenue and it will grow up to €50M in year 2029. Project profit will be set to 15% as in case 1. As the investment case 2 forecasted cashflow growth is optimistic, the company wants to set 15% return rate for the investment.

Table 20. Case 2 investment calculation model.

Investment Profit requirement		15%											
Project profit		15%											
Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	TOTALS	
Turnover	1000	4000	6000	10000	15000	25000	30000	35000	40000	45000	50000		
Profit	150	600	900	1500	2250	3750	4500	5250	6000	6750	7500		
Staff	192.5	231	558	558	651	682.5	843.5	1308	1428	1606.5	1606.5		
TOTAL sales	343	831	1458	2058	2901	4433	5344	6558	7428	8357	9107		
Profit PV	343	723	1102	1353	1659	2204	2310	2465	2428	2375	2251	19,213 €	
Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029		
	0	1	2	3	4	5	6	7	8	9	10		
Staff	385	385	930	930	930	975	1205	1635	1785	1785	1785	1980	
Head office	200	200	200	200	250	250	250	300	300	300	300		
Office rent	0	0	0	0	0	0	0	0	60	60	60		
Education & Marketing	50	50	50	50	50	50	50	50	50	50	50		
TOTAL COST	635	635	1180	1180	1230	1275	1505	1985	2195	2195	2195		
TOTAL COST PV	635	552	892	776	703	634	651	746	718	624	543	7473	
Profit	32605.5	-293	196	278	878	1671	3158	3839	4573	5233	6162	6912	32605.5
NPV	11,739.9 €	-293 €	170	210	577	955	1570	1659	1719	1711	1751	1708	11740
NPV	11,740 €												
IRR	147.375%												
NPV Check	11739.90												
Payback period	1.6												
Estimated Equity	300	300	300	300	300	300	300	400	400	400	400		
ROI	-98%	65%	93%	293%	557%	1053%	1280%	1143%	1308%	1540%	1728%		
Cumulative Profit	0	1	2	3	4	5	6	7	8	9	10		
Cum. Discounted profit	-293	-96.5	181.5	1059.5	2730.5	5888	9726.5	14299.5	19532.5	25694	32605.5		
	-293	-122	88	665	1621	3191	4850	6569	8280	10031	11740		

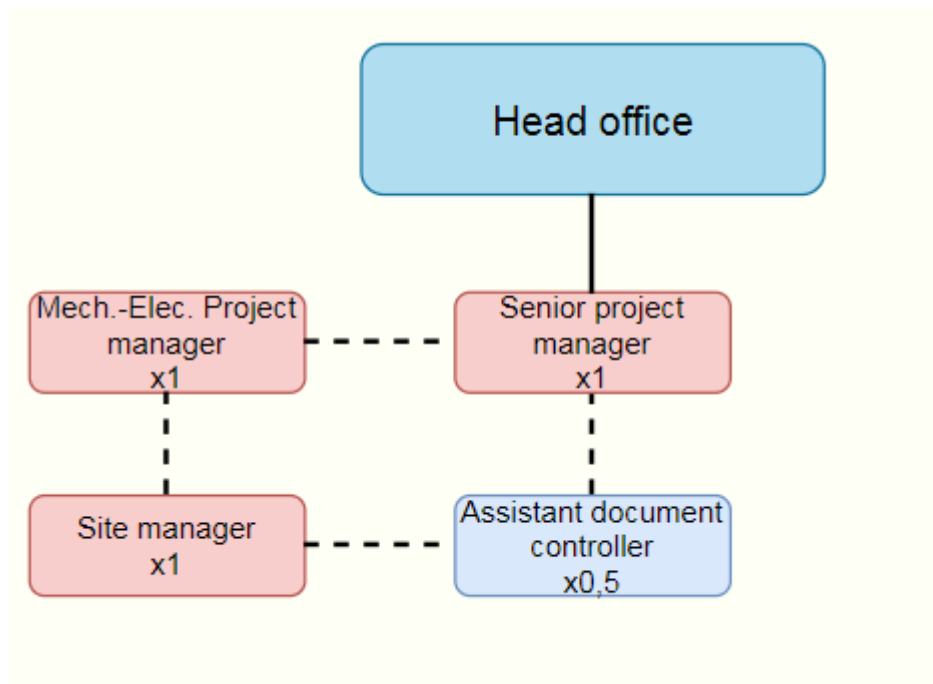


Figure 20. Staff organogram for 2019.

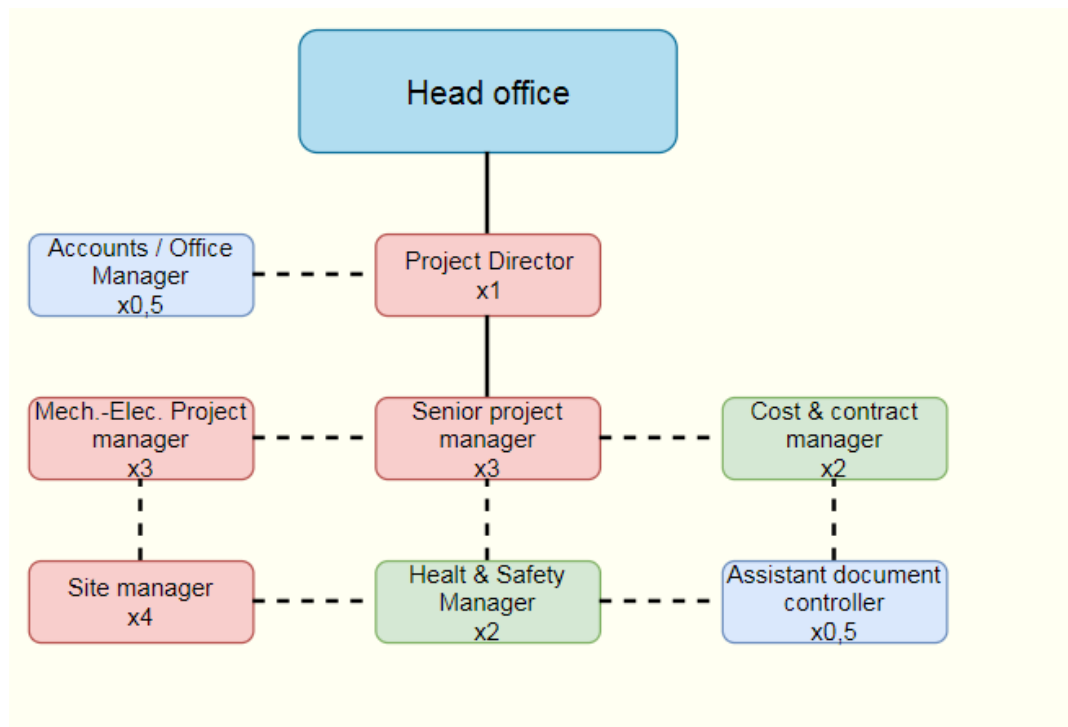


Figure 21. Staff organogram for 2029.

Case 2 is based on bit more higher value projects which are physically in small scale. This idea is tied to company's core business where the business is executing high value technology projects such as datacenter's.

4.2.1 Cost structure

Staff (2019)

Table 21. Staff costs will be minimal in year 2019 compared to case 1.

Title	Cost (1000€)
SPM - Construction manager	130
PM -Mech - elect. - Cost controller	130
Assistant - Document controller	25
Site manager	100
TOTAL COST	385

Other costs (2019)

Table 22. Other costs are higher from head office governance, but saves money as no need for new office in year 2019.

Item	Cost (1000€)
Head office rolling cost	200
Education & Marketing	50
TOTAL	250

Case 2 cost allocation follows same plan as case 1 where staff costs will be allocated to the project starting from 50% in year 2019 and ending to 90% by year 2029.

Staff (2029)

Table 23. Staff cost for 2029. Staff cost will increase by 78,5% in 10-years' time. This is explained by the radical turnover growth which means that the business unit has several projects during the year.

Title	Cost (1000€)
Project director	150
Cost & Contract manager	260
SPM - Construction manager	390
PM -Mech - elect. - Cost controller	390
Project Manager - Health & Safety	140
Assistant - Document controller	25
Accounts / Office manager	30
Site manager	400
TOTAL COST	1785

Other costs (2029)

Table 24. Other costs for 2029. Other costs will increase by 19,4% in 10-years' time. Increase is explained mainly because of new office space is needed.

Item	Cost (1000€)
Head office rolling cost	200
Office rent	60
Education & Marketing	50
TOTAL	310

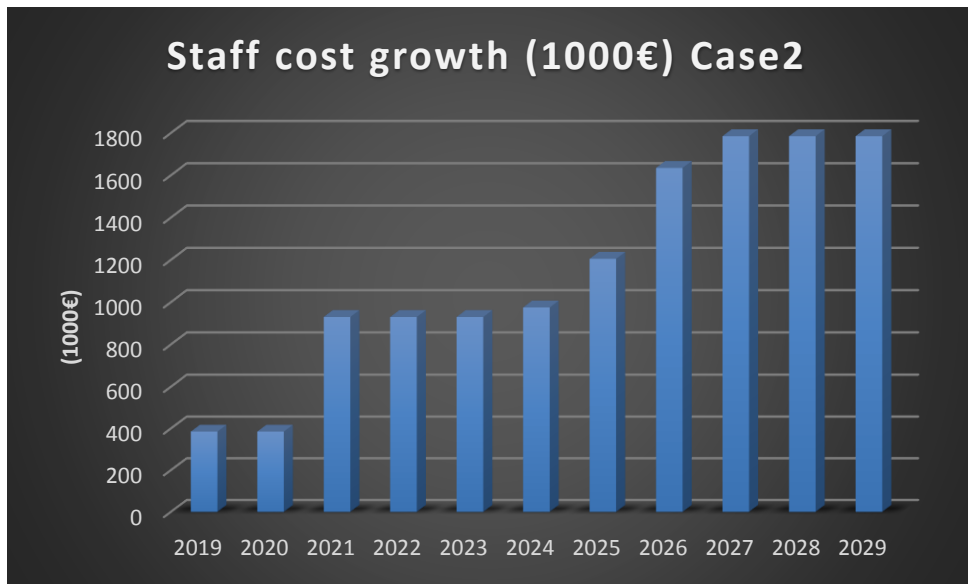


Figure 22. Investment case 2 staff cost will increase almost to 1,8 million euro in year 2029.

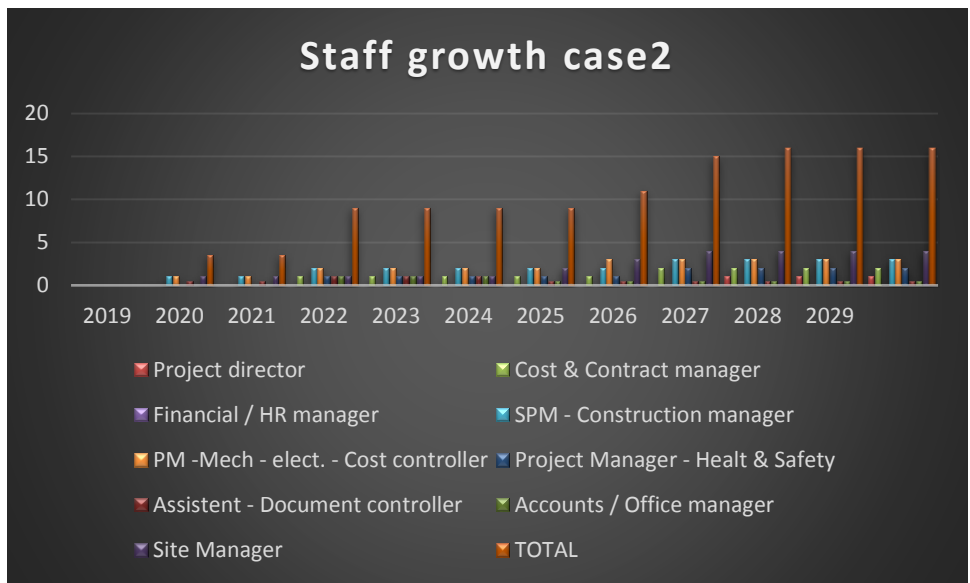


Figure 23. Investment case 2 staff growth will be 78% in 10-years' time.

4.2.2 Profitability study

Case 2 initial investment cost will be 292 500€ which will take place in only in the first year (2019). Yearly project profit is set to 15% and investment interest rate to 15% as the management wants to include 5% premium in the rate as the project is planned to be much more radical than case 1 and the probability is lower. Case 2 is planned with more optimistic way of thinking than case 1.

Table 25. Business investment estimated cashflow table for Case 2.

Year	Turnover (1000)	Costs (1000)	Profit (1000)	Cashflow (1000)	Discounted cashflow (1000)	Cumulative discounted cashflow (1000)
0(2019)	1000	635	343	-293	-293	-293
1(2020)	4000	635	831	196	170	-122
2(2021)	6000	1180	1458	278	210	88
3(2022)	10 000	1180	2058	878	577	655
4(2023)	15 000	1230	2901	1671	955	1621
5(2024)	25 000	1275	4433	3158	1570	3191
6(2025)	30 000	1505	5344	3839	1659	4850
7(2026)	35 000	1985	6558	4573	1719	6569
8(2027)	40 000	2195	7428	5233	1711	8280
9(2028)	45 000	2195	8357	6162	1751	10031
10(2029)	50 000	2195	9107	6912	1708	11740



Figure 24. Case 2 turnover target is 50 million euro for year 2029.

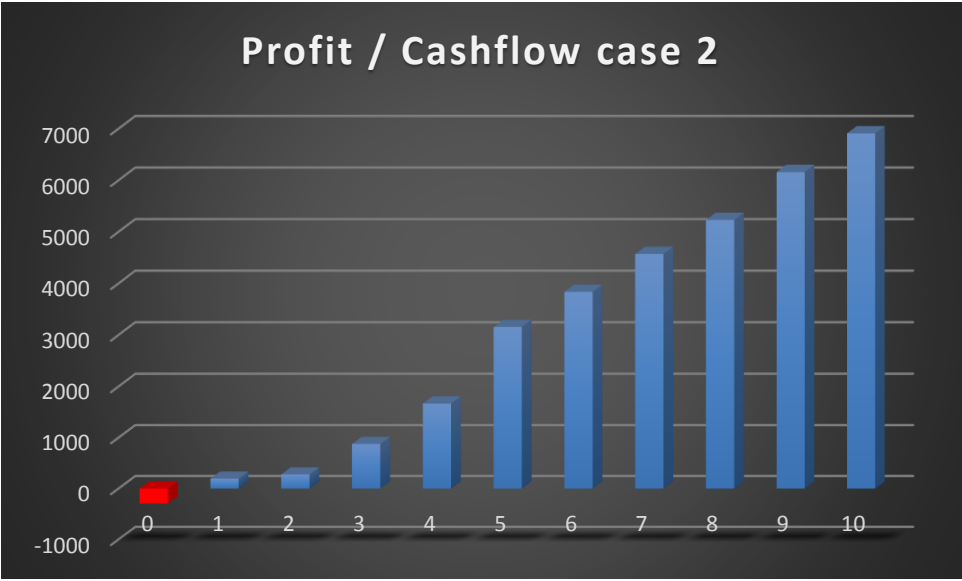


Figure 25. Investment will turn to positive after second year.

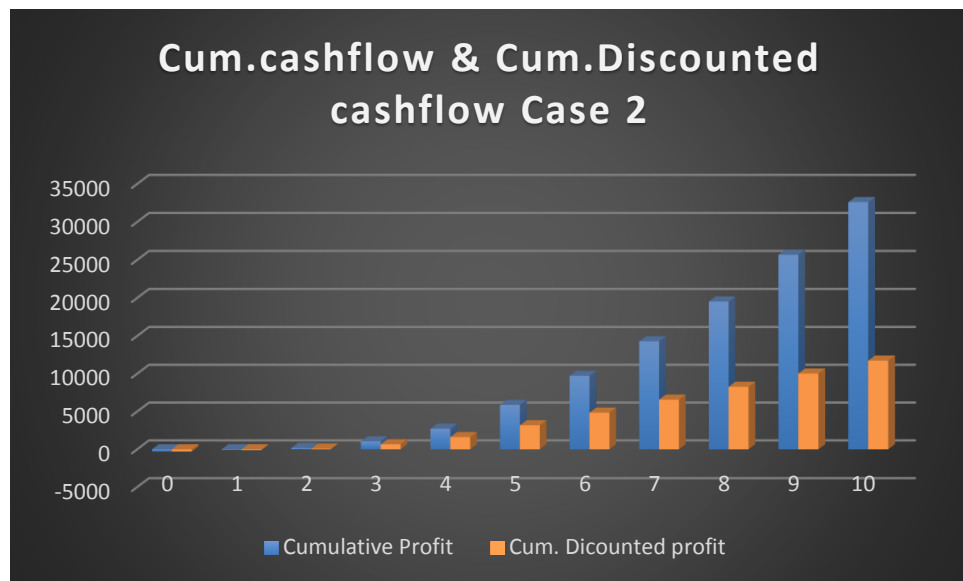


Figure 26. Investments cumulative cashflow indicates that the payback period is somewhere between year 1 and 2.

Case 2 Results:

NPV = 11 739€

IRR = 147%

Payback period = 1.6a

ROI (avg.estimate) = 815%

Case 2 investment is highly profitable as the initial investment cost was driven as low as it would practically be possible to start a business unit. IRR is related to very high NPV and indicate the interest rate which would drive NPV to 0.

Investment case 2 payback period is 1.6 years so it would pay the investment back very short period. As mentioned in case 1, ROI is extremely high and not accurate as the operational equity does not include all information. ROI shows that the initial investment is very small compared to the investment potential. Investment case 2 was planned to be optimistic with purpose.

4.2.3 Sensitivity analysis

Table 26. Cumulative discounted cashflow indicates that even with 30% drop in the turnover, the investment is highly positive in 10 years period. Payback time will vary from 1.6 years to 4.1 years.

Turnover change	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
-30%	-338	-324	-318	-36	533	1544	2620	3747	4869	6045	7197
-20%	-323	-256	-182	198	896	2093	3363	4688	6006	7374	8711
-10%	-308	-189	-47	432	1258	2642	4107	5628	7143	8703	10226
0%	-293	-122	88	665	1621	3191	4850	6569	8280	10031	11740
10%	-278	-55	223	899	1983	3740	5594	7510	9417	11360	13254
20%	-263	12	359	1133	2346	4289	6337	8451	10554	12689	14768
30%	-248	79	494	1367	2708	4837	7081	9392	11691	14018	16283

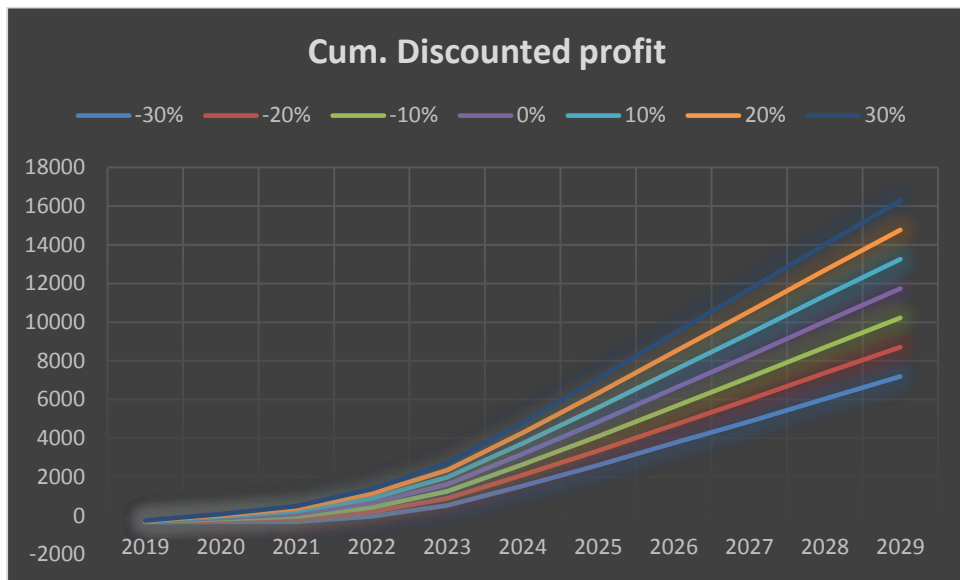


Figure 27. Sensitivity analysis with turnover variations shows that even -30% change is not too critical for case 2 investment.

Sensitivity analyses for turnover shows that the risk for small changes is tolerable for case 2 study. Therefore, the directors need to understand that how the project average profit changes will affect to the investment plan.

Table 27. Sensitivity analysis with project profit variations.

Project profit chan	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
5%	-393	-570	-813	-894	-796	-469	-106	297	700	1172	1645
10%	-343	-346	-363	-114	413	1361	2372	3433	4490	5602	6692
15%	-293	-122	88	665	1621	3191	4850	6569	8280	10031	11740
20%	-243	102	539	1445	2829	5020	7328	9706	12070	14461	16787

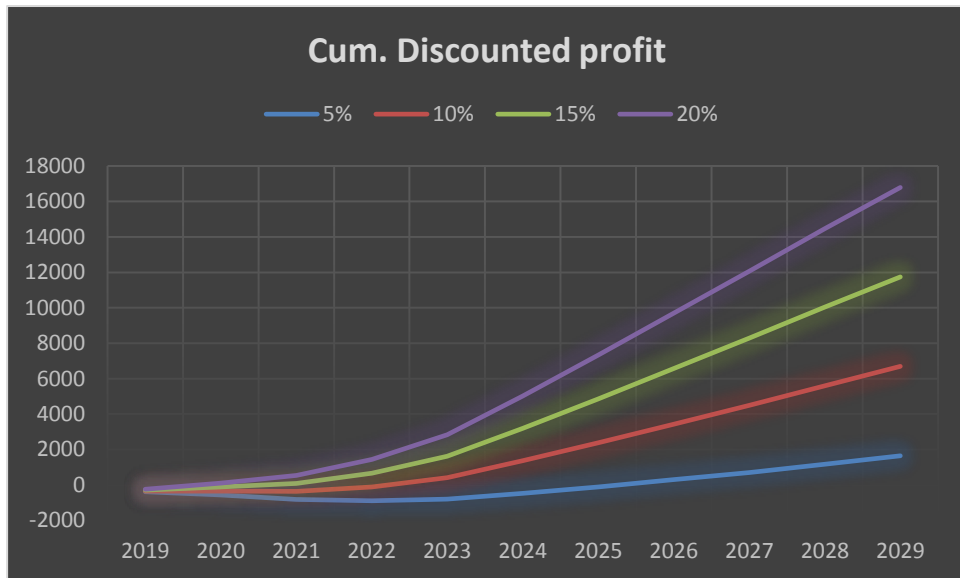


Figure 28. Sensitivity analysis for profit variations shows that the case 2 investment will be positive even with 5% project profit.

Sensitivity analysis both investment cases can tolerate market changes, but as it has been shown previously, case 2 is highly profitable investment as the initial investment level is very low and the estimated cashflow has been manipulated very optimistically.

Even without looking the excel model, based on sensitivity analyses, it can be said that case 1 is planned with more realistic costs and with incremental cashflow growth compared to case 2 where is more optimistic business plan.

5. SUMMARY / CONCLUSIONS

This study was based on business development project which was done in year 2017. During the work it came more and more useful when the continuity was so clear for this part of the work. This also brought up the value to the business where they will get very good picture of what is needed if / when new business unit plan will be executed.

5.1 Study structure

Research was separated to two different parts which are theoretical and empirical. Theoretical part contains the drivers how the business unit will be planning their investment proposal before the final investment decision. It clarifies different investment strategies and explains how different investments are segregated to categories and how it gives clarity to decision makers. Theoretical part also explains different profitability calculation examples and how risk & uncertainty factors are included in the investment plan.

Theoretical part

As different strategies are key part of the business investment, the new proposal must include value-chain as part of the plan. Today's business thinking starts from client's needs and how they would get better value for their business through your product or service. Sustainability is not in spot lights in this study, but it is clarified that how the new business unit will propose, create and capture value through the business life cycle.

Risk management is also explained in several views. Risk measurement factors includes the general level of CAPM and WACC calculations, but as this study will not concentrate on the funding these were not used in empirical part of the study. Quantitative risk / uncertainty management is one common way of thinking how the risks affect to new business plan as direct and indirect risks.

Quantitative risk management was being shown with simple simulation which is based on probability distributions. This method uses a simple table where the probabilities can be shown in numerical level. After this its typical that with different calculation functions and simulations it aims to give a margin of the risk levels and it gives a group of results / distributions which gives logical result or direction for decision makers.

Empirical part

Empirical part starts with the company's baseline analyses which is done comprehensively in business development project before this study. Business strategy and category will be based on both, strategic & operational investment. Company directors wanted to understand the market potential in Finland and the structural changes / requirements what it needs to start operating and what it will cost compared to the potential profitability.

Empirical study was divided to two different investment cases where the investment structure and potential profitability where totally different to each other.

Case 1 was planned with more radical initial investment or start up, where the business plan was to create totally new organization which will start operating from new office space based in Helsinki. Though case 1 has radical initial investment cost, the revenue stream or growth and profit was planned with more incremental way of thinking.

Case 1 includes higher risk when the initial investment cost is high, but with incremental revenue growth is includes more future growth opportunities. Main risk in case 1 is that when payback period is longer (6.9a) it means that it is more sensitive for market changes so when the business will have changes in the main revenue stream, the payback period will extend rapidly. Planned profit is also bit high so it includes risk compared to local competitors who may tender the projects with lower profit expectations.

Case 2 instead has very low initial investment cost as the plan is to start with shared resources where business administration is done with existing staff and office. Case 2 includes very optimistic and radical revenue and profit growth where the probability distribution will include more uncertainty factors than in case 1. Case 2 has low risk with the initial investment cost, but as the revenue growth is high with optimistic market expectations, it leaves less future growth opportunities.

One of the biggest challenges of this and every investment study is that the turnover and project profits are only estimated figures and by manipulations, the investment can be shown very positive when the market is not analysed properly.

5.2 Results

Case 1

Table 28. Case 1 results.

Item	Figure / result
Project initial investment	778 000€
Project interest rate	10%
Project estimated avg. profit	15%
Study period	10-years
NPV	1826 Ke.
IRR	30%
Payback period	6.9a

Case 2

Table 29. Case 2 results.

Item	Figure / result
Project initial investment	293 000€
Project interest rate	15%
Project estimated avg. profit	15%
Study period	10-years
NPV	11 739 Ke.
IRR	147%
Payback period	1.6a

5.3 Conclusions

As company is planning the create new business around Europe and looking the potential growth in the Nordics this study will work as a perfect tool for future investment estimations. As the final outcome will give both, the analysis of the potential investment needs and the excel model as tool, it can be used for any potential business investment cases around the world.

These two cases which are presented in this study are planned to describe how 2 very different investment plans will work out with different turnover and profit expectations. Outcome of this study is that the investment with either options will be very potential, but when analysing the sensitivity analyses, it can be easily decided that the potential investment plan would need to be planned between these 2 case structures.

Company will need to start iterating the potential need and will for the new organization and create accurate cost structure for the organization operations. Once the potential organization is understood, the customer networking and tender participating is key item to start the operations. As part of the start up the business unit must maintain and develop their supply chain for the areas where the business is aimed to started which is Helsinki in this case.

Company's culture is very direct with different hierarchy's and if or when this or any other investment plan will be implemented, the governance of the business must be given to local decision makers so it will create better motivation and it creates sustainability to the new organization.

As an outcome, it can be said that the company needs to combine this study to their new business plan where the existing employees are part of the development. When combining local knowledge and the international business thinking, it may create some very potential new business units.

REFERENCES

Aho, T. Virtanen, I. (1981). Tuotantotalouden laitos, Sisäinen korko ja ROI investointi kriteerinä. Lappeenrannan teknillinen korkeakoulu.

Alkaraan, F. Northcott, D. (2007). Strategic investment decision making: the influence of pre-decision control mechanisms. *Quantative Research in Accounting & Management*. Vol 4. pp. 133-150.

Ansoff, H. (1965). *Corporate strategy. An analytic approach to business policy for growth and expansion*. McGraw-Hill, New York.

Chalfant, J. Collender, R. Subramanian, S. (1990). *The Mean and Variance Decision Rule*.

Chandler, A. (1962). *Strategy and structure. Chapters in the history of American industrial enterprise*. MIT Press. Cambridge.

Etelälahti, P. Kangaspunta, M. Wallin, J. (1992). *Investointien ja pääomakustannuslaskennan opas*. Helsinki, Valtion painatuskeskus.

Gallo, A. (2014). A Refresher on net present value.

http://www.cogencygroup.ca/uploads/5/4/8/7/54873895/harvard_business_review-a_refresher_on_net_present_value_november_19_2014.pdf [Referred.

15.8.2018]

Honko, J. (1966). *Investointien suunnittelu ja tarkkailu*. Porvoo, WSOY.

Honko, J. Prihti, J. Virtanen, K. (1982). *Yrityksen investointi prosessin kriittiset kohdat*. Joensuu, Pohjois-Karjalan Kirjapaino Oy.

Houni, P. Kallioniemi, P. Krause, M. Miettinen, P. Rättö-Ihalainen, E. (1997). *Turvallisuus investointihankkeen toteutuksessa*. Iisalmi, Teollisuusvakuutus Oy.

Javier, F. Garcia, P. (2017). *Financial Risk Management. Identification, Measurement and Management*. Palgrave Macmillan.

Kankainen, J. Lindholm, M. & Roberts, T. (2000). Liikenneministeriö, Kauppa- ja teollisuusministeriö, Yksityisrahoitusmallilla toteutettavien investointien projektiriskit ja rahoituslähteet. Espoo, RTK-fakta Oy.

Kaufman, J. (2012). The Personal MBA: Master the Art of Business. England, Portfolio.

Kärri, T. (2016). Investointihankkeiden elinkaarilaskelmat. Lappeenranta, Lappeenrannan teknillinen yliopisto.

Liu, T-C. Chen, Y-J. (2010). Research and development investment strategy and market performance. Taiwan, National Cheng Kung University.

Levy, H. Sarnat, M. (1998). Capital investment & financing decisions. Hertfordshire, Prentice Hall Europe.

Leyman, P. Vanhoucke, M. (2017). Capital- and resource-constrained project scheduling with net present value optimization. European journal of operational research. Vol.256 (3), pp.757-776.

Mintzberg, H. (1994). Management accounting and control systems. An organizational and behavioural approach. England, John Wiley & Sons.

Muuronen, J. (2017). Finland Business Development project.

Percoco, M. Borgonovo, E. (2012). A note on the sensitivity analysis of the internal rate of return. International Journal of Production Economics. Vol. 135, pp. 526-529.

Puolamäki, E. Ruusunen, P. (2009). Strategiset investoinnit. Johtaminen, prosessit ja talouden ohjaus. Pori, Tietosanoma Oy.

Rakennusteollisuus. (March, 2018). Suhdanekatsaus kevät 2018.

https://www.rakennusteollisuus.fi/globalassets/suhdanteet-ja-tilastot/suhdanekatsaukset/2018/kevat/suhdanne_kevat18_valmis_luku.pdf

Schmidt, R. (2014). What is IRR and how does it work.

<https://www.propertymetrics.com/blog/2014/06/09/what-is-irr/> [Referred.
30.7.2018]

Tulenheimo, V. Hallikas, J. Asplund, D. (1984). Valtion teknillinen tutkimuskeskus, Investointikustannusten arviointimenetelmät. Espoo, Valtion teknillinen tutkimuskeskus.

Zhang, L. (2017). The investment CAPM. European Financial Management. Vol. 23(4), pp.545-603.

Present value of ordinary annuity $\frac{1-(1+i)^{-n}}{i}$

n	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736	1.713	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487	2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170	3.102	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355	4.231	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868	4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335	5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759	5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145	5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192
11	10.368	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495	6.207	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.486	4.327
12	11.255	10.575	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814	6.492	6.194	5.918	5.660	5.421	5.197	4.988	4.793	4.611	4.439
13	12.134	11.348	10.635	9.986	9.394	8.853	8.358	7.904	7.487	7.103	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533
14	13.004	12.106	11.296	10.563	9.899	9.295	8.745	8.244	7.786	7.367	6.982	6.628	6.302	6.002	5.724	5.468	5.229	5.008	4.802	4.611
15	13.865	12.849	11.938	11.118	10.380	9.712	9.108	8.559	8.061	7.606	7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675
16	14.718	13.578	12.561	11.652	10.838	10.106	9.447	8.851	8.313	7.824	7.379	6.974	6.604	6.265	5.954	5.668	5.405	5.162	4.938	4.730
17	15.562	14.292	13.166	12.166	11.274	10.477	9.763	9.122	8.544	8.022	7.549	7.120	6.729	6.373	6.047	5.749	5.475	5.222	4.990	4.775
18	16.398	14.992	13.754	12.659	11.690	10.828	10.059	9.372	8.756	8.201	7.702	7.250	6.840	6.467	6.128	5.818	5.534	5.273	5.033	4.812
19	17.226	15.678	14.324	13.134	12.085	11.158	10.336	9.604	8.950	8.365	7.839	7.366	6.938	6.550	6.198	5.877	5.584	5.316	5.070	4.843
20	18.046	16.351	14.877	13.590	12.462	11.470	10.594	9.818	9.129	8.514	7.963	7.469	7.025	6.623	6.259	5.929	5.628	5.353	5.101	4.870