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«How do enterprises in the production sector use the Net Present Value method when conducting project appraisal?»

By

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Abstract

For the purpose of gaining an overview of the investment analysis performed in the production sector, we conducted a mixed-methods study in which we analyzed the present value analyses of relevant companies and collected questionnaire responses. The result is a comprehensive analysis in which both direct errors in the company's analysis and several opportunities for improvement regarding the figures used as a foundation are uncovered. Several companies base their analyses on varying values, as demonstrated by the results of the analyses. In addition to examining the companies' routines and practices pertaining to the analyses, we have studied the companies' use of digital tools (such as Excel) in these analyses and identified a number of weaknesses and flaws in the companies' routines.

Keywords: Investment Appraisal, Capital Budgeting Techniques, Net Present Value

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1.0 Introduction

The first section of our paper will go through the context and motivation for our research.

1.1 Background

The production sector, also referred to as the secondary or manufacturing sector, includes all human activities that convert raw materials into finished goods. In this paper, we will look at capital investments conducted by Norwegian enterprises in the production sector, which includes a variety of industries. Even though investments are not the primary activity of these corporations, there are comprehensive investment activities, e.g., acquisitions, property, and machinery. Frank et al. (2013) investigated the importance of investment alternatives selection in the decision-making process of a corporation, finding that multiple criteria should be included in the process, namely quality, strategy, and economic aspects. This paper will only focus on the economic aspect, as we will investigate the investment models, and the variables used in these, of Norwegian enterprises. Literature on decision-making has uncovered that an unfavorable investment decision can mislead the market, affecting medium- and long-term revenues and harming the company's image and competitiveness (Frank et al., 2013). Furthermore, the Covid-19 pandemic has highlighted the fragility of globally dispersed manufacturing supply chains and the significance of a mature production sector as the sector contributes to economic growth globally (CDC Group, 2020). Thus, we are intrigued by the sector's decision-making process of capital investment activities.

1.2 Area of study

A fundamental concept in financial economics describes how companies should make capital investment decisions. Specifically, the decision process focuses on Net Present Value (NPV), Discounted Cash Flow (DCF), and assessing the project risk (Pinches & Lander, 1997). In economic theory, projects with a positive NPV are profitable, while projects with a negative NPV are unprofitable. Thus, the investment analyses assist a company by determining if they should invest in a project, based on the project value and

risk. Most businesses benefit from understanding investment theory and methods. That is the case as most businesses make investments of some kind, whether small or large. However, although a large amount of research has been conducted on various investing methods, we have identified that a small amount of research has been conducted on how the NPV analysis is carried out in practice. Further, there is little to no knowledge of which considerations are prioritized in the method.

The gap in the literature became evident as we dug deeper into previous research and publications and discovered that there is a paucity of information regarding how the company conducts investment analyses. We intend to use this to our advantage by (a) investigating how companies conduct their investment analyses, (b) identifying whether there are any differences or errors in their methods, and (c) investigating whether other factors, in addition to investment analysis findings, influence whether an investment should be made. For instance, based on prior knowledge, we know that they use a discounting of future cash flows. That is standard practice in investment analysis; however, we know little about what numbers they employ.

Moreover, as a supplement to our research, we intend to (d) investigate the extent to which organizations' Excel calculations contain errors. Thus, it involves evaluating the effectiveness of their procedures, the extent to which they use formulas instead of manually calculating critical statistics, and the clarity and readability of their spreadsheets.

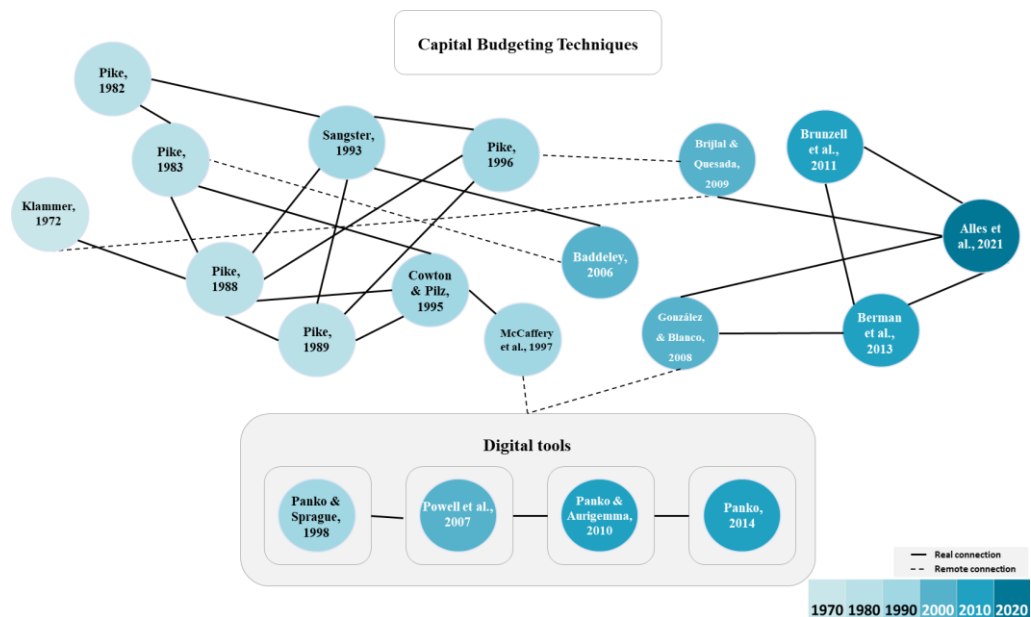
2.0 Literature Review

The second section of the thesis will provide an overview of current knowledge on investment analyses and investigate whether there are any knowledge gaps in this area. Furthermore, we will discuss how our research paper intends to fill the identified gap in the literature.

2.1 Capital Budgeting Techniques

Capital Budgeting Techniques (CBTs) refers to a set of investment appraisal methods used to determine the value of a potential investment. Throughout our

five years as business students, we have studied various investment appraisal methods such as Payback Period (PBP), Net Present Value (NPV), and Internal Rate of Return (IRR). In addition, studies, articles, and books have all contributed to a more significant body of knowledge on the topic. In Graph 1, we illustrate the relationship between the papers in our literature review by drawing lines between the related articles and using varying hues to represent the publication year. The lighter hues represent early research, while the darker hues represent newer research. Additionally, a full line represents a real connection, and a dotted line illustrates a remote connection between the papers.



Graph 1: Literature review

Previous research indicated that larger oil, chemical, and automotive product companies used sophisticated capital budgeting techniques, while other industries used simple methods such as payback (Christy, 1966, as cited in Klammer, 1972). Klammer (1972) found a correlation between the presence of full-time employees and the use of formal long-term CBTs. One could explain this relationship by stating that a full-time staff is more likely to have the time, opportunity, ability, and interest to maintain a long-term capital budget. Moreover, the research demonstrates that discounted cash flow methods, such as NPV and IRR, have increased over time, whereas the payback method has

become less popular. The study concluded that as the workforce grew, more sophisticated CBTs were utilized, but it could not be determined to what extent companies employed them (Klammer, 1972)

From 1975 to 1992, Professor Richard Pike of the University of Bradford investigated the Capital Budgeting Practices (CBPs) of 100 large UK corporations. In 1982, he published a comprehensive survey of investment practices in large corporations, which has served as a research foundation for numerous articles. In 1983, Pike found that corporate size, risk, and profitability affect capital budgeting behavior and that financially constrained firms adopt naive capital budgeting methods. Moreover, Pike (1988) investigated the relationship between CBPs and the effectiveness of decision-making and found evidence that senior finance executives believe that adopting sophisticated investment practices improves the effectiveness of evaluating and controlling large capital projects. The following year, Pike investigated whether changes to selected CBPs improve investment decision-making. There was a significant positive association between applying these practices and managers' evaluations of the effectiveness of capital budgeting (Pike, 1989). In 1996, Pike published his study from 1975 to 1992 on CBPs, allowing for a more meaningful comparison of investment practices over time. In addition, the study clarified the confusing picture built up from comparing prior surveys with different research designs and fluctuating response rates. Numerous articles refer to Pikes' research.

Sangster (1993) investigated the relationship between firm size and discounted cash flow (DCF) techniques and compared the results to previous research. Previous research discovered that the company's size had a significant impact on the range and type of technique used, with a general increase in methods with the company's growth (Pike, 1982; Mills, 1988, as cited in Sangster, 1993). Sangster (1993) discovered that corporations utilize more methods together that are sophisticated DCF techniques, such as NPV, PBP, and IRR, than earlier research suggested for enterprises of the size represented.

Cowton and Pilz (1995) explored capital budgeting methods in the UK retail industry, focusing on the financial tools used to assess proposed investment projects. Previous research had not examined the retailing industry. However, when disaggregated data was presented, it indicated that retailing had fallen behind other sectors in its adoption of reasonably sophisticated assessment procedures that account for the time value of money. According to the paper, retailing is now on par with other industries in terms of complex discounted cash flow methods (Cowton & Pilz, 1995). That contributes to our assumption that most sectors with investment projects utilize capital budgeting methods with procedures that account for the time value of money. McCaffery et al. (1997) investigated financial management practices in the UK retailing sector, building on the research of Cowton and Pilz (1995). Their paper demonstrated that the major issues in corporate finance, such as investment appraisal techniques, are well-known to financial executives in the retailing industry, indicating that it would be worthwhile to develop or incorporate a program for the sector's finance function (McCaffery et al., 1997). For instance, inexpensive database software such as Excel can contribute to the maintenance of consistent business practices.

It is presumed in the literature on fixed-asset investment that enterprises use complex, forward-looking methods for investment appraisal strategies based on Jorgenson's business investment model (Baddeley, 2006). According to Baddeley (2006), while some organizations utilize technique-driven approaches, they are as likely to apply simple heuristics based around PBPs as they use more advanced forward-looking strategies such as NPV and IRR. However, after controlling for firm size, the econometric evidence shows that the more forward-thinking enterprises were generally more successful in terms of turnover (Baddeley, 2006). As a result, we anticipate that organizations will adopt one or a combination of these CBTs in our study.

Further literature supports the significance of how ratios, rates of change, and considerations are used in the discounted cash flow components of the modeling. The various ratios, rates, and considerations can drastically alter a discounted cash flow model), thereby increasing the complexity of the model

(González & Blanco, 2008). González and Blanco (2008) investigated the significance of capital budgeting decisions supported by using NPV models for project risk, return, and value analysis. Their findings emphasized the importance of modeling generality, simplicity, and flexibility to avoid unnecessary complexity in large projects. Furthermore, each assumption taken into account complicates the model; as a byproduct, only the project's critical assumptions should be included.

Brunzell et al. (2011) investigated which CBT is most commonly used in the five Nordic countries. The findings were unambiguous: NPV is the most commonly used CBT, with 41.29 percent using it as their primary method. On this basis, we can confidently assert that NPV is the most popular capital budgeting technique in Norway. Additionally, research by Berman et al. (2013) found that when analyzing capital expenditures, NPV is always the preferred method. That pertains to the method's capacity to account for the time value of money. Furthermore, the method's ability to account for the cost of capital, as well as present the conclusion in today's money value, are highlighted as essential aspects. However, they conclude by discussing how the Payback Period (PBP) and Internal Rate of Return (IRR) are commonly used in discussions and presentations because the NPV method is considered complex (Berman et al., 2013).

Later research on the subject by Alles et al. (2021) states that the PBP is the preferred method for newly established small and medium-sized enterprises (SMEs), whereas the usage of NPV models increases as the company's age and size increases. Their conclusion states that PBP is the most used CBT due to its time, cost, and knowledge requirements. In addition, as a corporation grows, the need for more complex analysis increases with demand and access to capital and highly qualified employees. Brijlal & Quesada (2009) emphasize the aforementioned, arguing that financial analysts with a master's degree in Business Administration employ more advanced approaches, such as NPV. Analysts with no or a low degree of education, on the other hand, use more straightforward methods, such as PBP.

2.2 Digital tools

When performing in-depth investment analyses, it is critical to make effective and intelligent use of digital tools that facilitate process simplification. In most cases, such analyses are performed in spreadsheet programs such as Excel. However, in recent years there has been a growing emphasis on the use of various Enterprise Resource Planning (ERP) tools. ERP tools are software tools that assist in several of the firm's activities, such as managing a company's finances (Vogel, 2005).

Panko and Sprague (1998) studied error rates in spreadsheet calculation by students of Master in Business Administration (MBA) and Management Information Systems (MIS) majors. The research 35 percent of the spreadsheets that were analyzed were somehow incorrect. There was no apparent connection between the field of study and the proportion of errors in the spreadsheets (Panko & Sprague, 1998)

Further, Panko (2014) expanded his previous work and conducted a study with 547 participants on their usage of Excel. He states that, in general, around 1-5 percent of all computerized computations or codes were estimated wrong. That is close to perfect and is not considered negative. However, Panko (2014) highlights that since these spreadsheets contain formulas that are linked to several cells, potential errors in the computations will affect several cells in the analysis (Panko, 2014). As a result, it might create an incorrect result in the bottom link of the analysis. The study is based on several previous research articles, such as a study by Panko & Aurigemma (2010). They studied the most common errors in spreadsheet computations. Most of the errors were related to planning errors (82%) and domain issues (81%). Further, there were also challenges related to execution errors (18%), lapse (11%), slip (7%), and spreadsheet expression (1%). Powell et al. (2007) also studied the impact of errors in operational spreadsheets. In their study, they analyzed 25 spreadsheets and identified 381 potential computation errors. Out of these errors, a total of 31 percent were confirmed as an error by the developer of the spreadsheet. On the other hand, 36 percent of the spreadsheets did not contain

any errors. These findings indicate that 64 percent of the participants contained some errors in their spreadsheets.

2.3 Net Present Value

Net Present Value (NPV) is the most frequently used method for estimating the value of an investment in established firms, supported by several studies (Brunzell et al., 2011; Berman et al., 2013; Alles et al., 2021). However, in an attempt to learn how the method is employed in practice, we were unable to locate any published articles on the topic. We searched numerous databases for pertinent keywords, including "the use of NPV" and "survey of NPV," but to no avail. Through these searches, we were only able to locate articles discussing NPV analyses or how they should be performed in theory. Consequently, to the best of our knowledge, there has not been any research on this topic. Thus, we were able to identify a probable knowledge gap; to our knowledge, no prior research has been conducted on this topic.

2.4 Knowledge Gap in Prior Research

As illustrated in Graph 1, several connections exist between the published articles within the Capital Budgeting Techniques (CBTs) literature. In our literature review, most papers were connected to research papers published by Pike (1988) and Sangster (1993). The first asserted that corporate management believes adopting sophisticated investment practices improves the efficiency of evaluating and controlling large capital projects, while the latter found that corporations employ a combination of CBTs that increases with company size. Other takeaways from previous literature are that CBTs are employed to a certain extent in all corporations (Alles et al., 2021), adopt one or a combination of these CBTs (Sangster, 1993; Baddeley, 2006), and that most industries with investment projects employ capital budgeting methods that account for the time value of money (Cowton & Pilz, 1995). Further, the most commonly utilized method that accounts for the time value of money is the net present value method (Brunzell et al., 2011; Berman et al., 2013; Alles et al., 2021).

In our literature review, NPV has been identified as the most prevalent CBT in Nordic countries. Consequently, we do not wish to investigate the most prevalent investment method, as we assume that NPV is the preferred method in Norway, where we intend to conduct our research. We aim to investigate how the NPV method is employed in practice since, to our knowledge, no prior research has been conducted on this topic.

After extensive research in multiple databases, we found no information on how companies conduct such analyses. By this, we mean that we did not find any information on (1) whether corporations use values before or after taxes, (2) whether corporations take inflation into account or not, (3) whether corporations use the total or equity method when estimating the discounted cash flow, (4) how corporations estimate their required rate of return, (5) whether corporations assume that the project has an infinite or limited lifetime or uses a residual value for the discounted cash flow, and (6) whether corporations use the direct or indirect method when estimating the discounted cash flow.

Further, there is a lack of information regarding how the method is implemented in practice and in which corporate functions it is used as a basis for assessment. That is an important question because the NPV analysis can be complex and thus difficult to use as a basis for discussion (González & Blanco, 2008). However, we presume several factors are used as input to the analysis to assess a potential investment, which increases model complexity. Former research on the subject reinforces that a weakness of the preferred model in the Nordic countries is the complexity of discussion and presentations of the model (Berman et al., 2013). Nevertheless, research on how the model is employed in the decision-making process for corporations in the production sector is lacking. Therefore, we intend to fill this gap in the literature by examining how firms in the production sector conduct their analyses.

Our literature review reveals that the quality of Excel spreadsheets used for such analyses varies considerably. Correspondingly, Panko, an eminent digital tool utilization researcher, has uncovered several illuminating statistics

regarding spreadsheet errors (Panko & Sprague, 1998; Panko & Aurigemma, 2010; Panko, 2014). In light of this, we wish to determine whether a corporation's NPV analysis contains flaws. Further, Myers (1984) revealed in his study that there are concerns regarding the knowledge of a company's decision-maker. By this, Myers (1984) indicates that the individual in charge of making the final decision regarding an investment does not always have the required knowledge to make such a determination. Consequently, we wish to investigate whether corporations in our study partly agree with Myers (1984) regarding the degree of knowledge of the decision-maker.

3.0 Research Question and Hypotheses

In the third section of our paper, we will articulate our research question and hypothesis.

3.1 Problem definition

As our literature review indicates, various capital budgeting techniques (CBTs) are frequently applied while making investment decisions. It validated our presumptions regarding the most commonly used investing CBT; Net Present Value (NPV). However, the literature did not assist us in determining how these analyses are carried out in practice.

Thus, the purpose of this research paper is to analyze how enterprises in the Norwegian production sector use NPV analysis. We know from previous research that these investment methods are often used in practice to calculate an investment's present value. However, there is a low degree of knowledge on its implementation in practice. Therefore, the goal is to identify differences in how the selected corporations carry out these analyzes.

3.1.1 Research Question

“How do enterprises in the production sector use the Net Present Value method when conducting project appraisal? »

3.1.2 Keywords

- Net Present Value (NPV)
- Discounted Cash Flow (DCF)
- Investment Analysis
- Investment Method
- Investment Appraisal
- Capital Budgeting Techniques (CBT)
- Cost of Capital
- Project valuation
- Decision-making

3.2 Hypothesis

Since there is little to no research on the numbers for the calculations of the investments analysis, we are interested in identifying which numbers, methods, requirements, estimations, and assumptions the corporations are implementing in their calculations; (1) numbers before or after-tax, (2) nominal or real numbers, (3) total capital or the equity method, (4) how they estimate their required rate of return, (5) project with infinite or limited lifetime or uses a residual value, and (6) direct or indirect cash flow method. Surely, the composition of an investment analysis can differ based on a corporation's numerous requirements; therefore, we will test four hypotheses in this paper to answer our research question.

- I. We believe corporations in the same industry base their investment analysis on different numbers.*
- II. We believe that, in addition to the results of NPV analysis, other considerations are taken into account when deciding whether an investment should be made.*
- III. We believe that the majority of corporations' investment analyses contain computational errors.*
- IV. We believe that the firms' Excel calculations contain a number of weaknesses and flaws.*

4.0 Research Methodology

The fourth section of the study aims to discuss the chosen methodology for our study. The methodology is a structure that delivers the essential data to support our research question's conclusion. We will discuss our choice of research method and design used in our paper, how it relates to our research topic, and assess its validity and novelty.

4.1 Research Method

Saunders (2015) defines research methods as “*techniques and procedures used to obtain and analyze data*” (Saunders, 2015, p.4). We acknowledge that secondary data is more easily obtained; however, there is no recent data that could be used for our purposes. That became clear to us after conducting our literature review. To fill the identified literature gap, we need to obtain investment analyses from corporations and preferably obtain answers on assumptions they make in order to analyze calculations in the investment analysis for enterprises in the production sector. For that reason, we are aiming to do primary data collection. Primary data is defined as “*original data collected for a specific research goal*” (Hox & Boeije, 2005, p. 593). Since we aim to answer how NPV is carried out in practice, we need to consider the methods of obtaining and analyzing the data. We will, in this subsection, consider the quantitative and qualitative methods.

We acknowledge that it can be challenging to receive such information from companies. This is based on the fact that it can be considered time-consuming for the companies to anonymize any analyzes they wish to share with us, and that they consider a risk associated with sharing such information.

4.1.1 Quantitative method

Quantitative research methods are based on quantifying and generalizing the results of a sample from a larger population. The information is gathered using methods such as a questionnaire with either fixed options or a combination of options and open-ended questions. Data can also be gathered by participants filling out a form, calling in, or conducting an interview. The main difference is that respondents have less freedom to answer questions openly because they are looking for directions or trends in the sample to answer the research questions. The advantage of such a survey is that the responses are easier to analyze and quantify than in a qualitative survey. The goal is to compare results, which is accomplished by asking similar questions to all respondents. A quantitative survey makes it much easier to collect large amounts of data more efficiently, increasing the significance of the results. The disadvantage of the quantitative method is that the measurements may be interpreted as qualitative data that has

been "forced" into numerical form, thereby questioning the validity (Bell et al., 2019).

4.1.2 Qualitative method

Qualitative research is a research strategy that favors words over numbers in data collection and analysis. It is an inductive, constructionist, and imperative research design in general. Qualitative data is typically collected through interviews and, unlike quantitative data, is not quantifiable to the same extent. The qualitative survey results and the analyses that follow are thus distinct from quantitative data analyses. According to the literature, qualitative data is typically collected through observations, in-depth interviews, or group interviews. Compared to a quantitative survey, the sample size is relatively small in order to obtain a diverse and descriptive database. That could be a disadvantage of the method because the small sample size will make quantifying certain aspects of the research complex (Bell et al., 2019).

4.2 Research Design

Research design is a "*plan of how you will go about answering your research question*" (Saunders, 2015, p.163). In this research paper, we will collect data using a mixed-method. A mixed-method is "*a research approach whereby researchers collect and analyze both quantitative and qualitative data within the same study*"(Shorten & Smith, 2017). We are collecting data using a questionnaire with a combination of options and open-ended questions and collecting the NPV spreadsheets for analysis. The choice for the method is based on the aftermath of the collection process; the analysis. The data used for the purpose of this paper is easier to analyze with the identified method, in addition to increasing the validity of our findings. Our objective is to collect data through questionnaires and gain insight into the company's project appraisal spreadsheets. A questionnaire is a data collection method where many people respond to the same set of questions in a prearranged order (Saunders, 2015). That is a time-saving primary data collection method that ensures a large number of responses in a short period. Even though some people argue that questionnaires have several drawbacks (DeFranzo, 2012), such as misunderstandings and a lack of control over the number of responses received, we have only found benefits to using them for our study as it provides

access to a high number of respondents over a short period of time. This type of data collection method ensures a higher number of respondents, as it is less time-consuming for the person answering it. The questions from our questionnaire are presented in Appendix 1.

4.2.1 Basis for selecting the method

We presume that a mixed method is the right data collecting approach based on our topic area. By distributing questionnaires with open-ended questions to key players in the sector and analyzing their models, we will have a good enough database to answer our research question. We chose the production sector because we believe the diversity of industries will provide us with generalizable data to the sector as a whole.

We presume that the collected spreadsheets and the generated questionnaire will increase our understanding of their investment activities. It is essential and critical that we are professionally updated and possess good knowledge of the subject to generate an appropriate questionnaire and interpret the results. The research will build on existing studies, teaching materials, work experience, and the literature review. As the sector includes several industries, we presume that the answers we receive will give us a solid foundation for analyzing the methods used by market participants and, to some extent, generalizing the results.

Finally, we acknowledge that there are time constraints in primary data collection due to the given deadline of the master thesis. Thus, it is natural that we do not reach as many participants as we would prefer. As a result, the responses are not as generalizable as those obtained in a quantitative survey.

4.3 Validity of the Research

When it comes to questionnaires, internal validity refers to whether the findings from the questionnaire can answer our research question and measure what we want it to measure (Saunders, 2015). Based on this, we want to discuss whether our chosen research method is able to answer our research question. The qualitative survey allows for greater depth and, as a result, a better understanding of the research area. That improves the result's internal validity, and it is

considered highly adequate if the right questions are asked in the distributed questionnaire. Furthermore, the qualitative survey provides observations in the form of words, enriching and clarifying the analysis.

4.3.1 Description of the data

We believe that questionnaires, rather than in-depth interviews, are better for answering our research question because they allow us to get feedback from a greater data selection. Additionally, in-depth interviews are more time-consuming. By using questionnaires, we may identify how a firm performs as a whole, which discounted cash flow method they utilize, and which preconditions they consider before conducting their analysis. In addition, we also want access to any spreadsheets that have been used to estimate the NPV of any future investment objects. We realize that getting this information from companies might be difficult, but we believe it is a valuable source of information if they are willing to share it with us.

4.4 Novelty of the Research

The novelty of the research refers to whether the research is novel, that is, whether the research will lead to new knowledge and hence fill a knowledge gap (Research Synergi Institute, 2019). Therefore, we can most definitely say that our research will contribute to more excellent knowledge in this field. There is a clear knowledge gap regarding how the NPV analysis is carried out in practice.

5.0 Theory

This section will provide an overview of the theories and ideas upon which our analysis is based.

5.1 Capital Budgeting Techniques

Before deciding whether an investment should be carried out or not, one should determine the potential value of the investment. That is accomplished in three steps. First, one must determine the cash outlay for the investment. That involves estimating the costs associated with an investment. For example, it may be the cost paid at the beginning and/or during the investment period. Further, one must estimate the potential cash flows to expect the investment to generate. Finally, one

needs to estimate how much the potential cash flow is worth. That is accomplished by utilizing a Capital Budgeting Technique (CBT).

The choice of CBT is one of the most discussed subjects in financial theory (Sarwary, 2019). CBT is a set of techniques that can assist any decision-maker in determining whether or not an investment is profitable and should be pursued (Alles et al., 2021). When one talks about CBT, there are normally three methods that easily come to mind: Net Present Value (NPV), Payback Period (PBP), and Internal Rate of Return (IRR). All of these methods intend to estimate the value of an investment and thus be used as a tool for decision-making. In the following section, we will present each of these techniques.

5.1.1 Net Present Value

Based on findings in our literature review, the Net Present Value (NPV) is the most frequently used CBT. Several arguments underline this argument: it considers the hurdle rate, reflects the amount of money the investment will add to the firm, takes the time value of the money into the account, and provides a result in today's money. The last two arguments are especially significant for investments with long horizons, which is often the case. The method estimates what the investments' future payments are worth today minus the investment expense. According to the theory, if the NPV is larger than zero, the investment is considered profitable and will add value to the company if it is realized. However, if the NPV is less than zero, the investment is not considered profitable and should not be performed as it will not add value to the company. At times, the net present value can be equal to zero. The idea in such circumstances is that the corporation is unconcerned whether or not the investment is carried out. Other factors, such as goodwill, can help assess whether or not the investment should be made in such cases. If so, the firm will not increase its economic value if the investment is carried out, but the outcome of the investment may alter the value in the future due to other factors (Berman et al., 2013)

Furthermore, it is critical to form an opinion in relation to the lifetime of the investment. This means deciding whether the investment expects to have an infinite or limited life, or whether a residual value can be assumed. The residual

value includes the value of the fixed asset at the end of the project, and it signifies that the asset can be sold to provide additional cash inflows to the project.

After estimating the costs of the investments, as well as the future cash flows and the required rate of return, one can easily estimate the present value. That is accomplished through the discounting equation:

$$\text{Present Value} = \frac{CF_1}{(1+i)} + \frac{CF_2}{(1+i)^2} + \dots + \frac{CF_n}{(1+i)^n}$$

Where:

CF = *The cash flow for each period*

i = *The required rate of return, i.e the discount rate*

n

= *The number of time periods the investment is likely to generate cash*

However, in some cases, the investment is expected to generate a cash flow in the foreseeable future. In such a case, one estimates the present value of the perpetuity, which reflects the value of the entire investment.

$$\text{Present Value of Perpetuity} = \frac{CF}{i-g}$$

Where:

g = *The growth rate*

After estimating the present value of the investment, you can estimate the net present value. That is accomplished by subtracting the investments' cash outlay from the present value:

$$\text{Net Present Value} = \text{Present Value} - \text{Cash Outlay}$$

5.1.2 Payback Period

The payback period (PBP) is recognized as the simplest CBT. It is supported by the fact that it is easily understood, as well as unchallenging to use to calculate the value of an investment. In contrast, NPV calculates the current value of future cash flows, PMP indicates how much time a company will spend on repaying an

investment. As a result, the outcome of a PBP analysis is presented in years rather than in monetary terms, as in an NPV analysis. The payback period can be calculated as follows:

$$\text{Payback Period} = \frac{\text{Cash Outlay}}{\text{Yearly Cash Flow}}$$

In this method, the payback time is used to determine whether the investment should be carried out or not. If the payback period is lower than the project's lifetime, it is recommended that the investment is conducted. That is because one will then obtain cash flows that will exceed the cash outlay of the project. On the other hand, if the payback period is longer than the project's lifetime, the project should not be carried out. That is due to the fact that cash flows are insufficient to cover the costs, and we must consequently return the investments in other ways. If the payment period is equal to the project's lifetime, we are indifferent whether the investment is carried out or not. Then, other considerations, such as goodwill, might be used as a decision basis (Berman et al., 2013). Similar to the NPV method, the investment will not add any financial value to the organization in this scenario.

There are both advantages and disadvantages to this method. As mentioned in the introduction, it is considered an advantage that the method is easy to use and understand. That makes the methods suitable for presentations and discussions. On the other hand, there are several disadvantages to the method. As companies want to generate profits rather than just "break even," this method will not help determine how much one can earn from the investment. Consequently, the payback method is merely a helpful tool for companies that do not necessarily want to generate profit but instead provide the best possible solution to their users or members. That may be the case for companies that are categorized as a foundation. Furthermore, it is regarded as a disadvantage because the method does not consider the time value of money.

5.1.3 Internal Rate of Return

The Internal Rate of Return (IRR) reflects the value the investment provides the company. The IRR represents the rate that makes a project's net present value equal to zero. Based on this, we can explain the concept by using Figure 1:

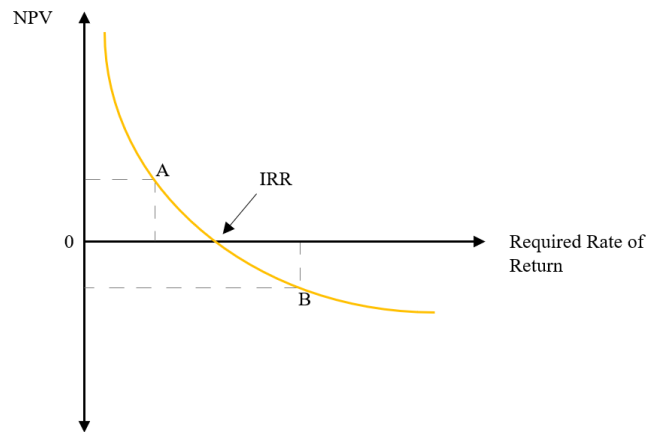


Figure 1: IRR method

In figure 1, the required rate of return is placed on the X-axis and the net present value on the Y-axis. The yellow line represents the investment. As stated, the IRR is the rate that gives a NPV equal to zero. If the required rate of return is lower than the IRR, we should accept the investment as the NPV is greater than zero. This is represented by the A point. However, if the required rate of return is greater than the IRR, as shown in point B, we should not accept the investment as the NPV is less than zero.

The computation of IRR can easily be estimated on a finance calculation.

However, it can also be done manually by setting the present value formula equal to zero and solving the equation for i .

$$Present Value = \frac{CF_1}{(1+i)} + \frac{CF_2}{(1+i)^2} + \dots + \frac{CF_n}{(1+i)^n}$$

$$\frac{CF_1}{(1+i)} + \frac{CF_2}{(1+i)^2} + \dots + \frac{CF_n}{(1+i)^n} - Present Value = 0$$

Based on its simplicity, the method is great to use for comparison and presentation. However, the downside of the method is greater than the upside: the

method does not look at what the investment contributes or for how long the investment expects to yield a return (Berman et al., 2013).

5.2 Required Rate of Return

The rate a company charges for an investment is called the required rate of return, often referred to as the *hurdle rate*. The required rate of return reflects the company's risk by investing, and thus, it can be considered a risk premium. A rule of thumb in finance states that investments associated with low risk have a hurdle rate of 5 percent, corresponding to a risk-free interest rate, such as a 10-year government bond. If the investment has a moderate risk, one can expect a hurdle rate of at least 10 percent, and at a high risk, one can expect a hurdle rate of at least 15 percent. That is reinforced by the fact that higher risk merits sounder compensation.

The estimation of a company's required rate of return is rarely linked to a formula, but rather to how the company's financial situation is, what risk is associated with the investment, and the cost of capital to the company. The rate is a combination of the company's capital cost added with various risk premiums for the investment. In addition to other factors, the company's CFO or treasury department makes assumptions about an appropriate hurdle rate (Berman et al., 2013). However, there are also various ways to calculate a hurdle rate mathematically, one presented in section 5.2.1 below.

5.2.1 Weighted Average Cost of Capital

The Weighted Average Cost of Capital (WACC) reflects the price of the capital for the firm and is a helpful tool to estimate the required rate of return for a firm, as it reflects the minimum return the firm needs - based on covering the cost of capital. This tool looks at the price of debt and equity, and adjusts it for the debt/equity ratio. The WACC is the lowest required return on an asset that a corporation must achieve to fully satisfy its creditors, shareholders, and anyone who provides capital.

$$WACC = \text{Cost of Equity} * \frac{\text{Equity}}{(\text{Equity} + \text{Debt})} + \text{Cost of Debt} * \frac{\text{Debt}}{(\text{Equity} + \text{Debt})}$$

5.2.2.1 Cost of Debt

The cost of debt reflects the interest the firm pays to its creditors for its borrowings. This is a set rate, which the company cannot influence. Normally, one adjusts the interest for the tax rate, in order to estimate the cost of debt:

$$\text{Cost of Debt} = \text{Average interest creditor} * (1 - \text{tax rate})$$

5.2.2.2 Cost of Equity

Further, one must estimate the cost of equity. This reflects the return the owners require for an equity investment, and must also be taken into account in the WACC. By using the Capital Asset Pricing Model (CAPM), it will provide one with a pricing of the equity, reflecting the systematic risk and expected return for an asset:

$$\text{CAPM} = \text{Risk Free Rate} + \text{Beta} (\text{Market Rate} - \text{Risk Free Rate})$$

5.3 Cash Flow

A key concept in capital budgeting techniques is cash flow. The cash flow represents the movement of a firm's cash equivalents, inflows, and outflows. Therefore, when estimating the value of a project or an investment, it is crucial to predict the amount of cash circulating in and out of the firm in the forms of income and expenses connected to the project.

5.3.1 The Cash Flow Statement

The cash flow statement consists of cash flow from operating, financing, and investing activities. The summation of all these activities represents the net cash flow for the given period.

When estimating the cash flow for the operating activities, we differentiate between two various methods: the direct method and the indirect method. The direct method identifies the primary categories of gross cash income and gross cash payments, while the indirect method adjusts the enterprise's profit or loss to generate cash flows from operating activities. Even though the International Accounting Standards Board (IASB) recommends using the direct method, the indirect method is most commonly used in practice. Therefore, when estimating

the cash flow from the financing and investing activities, only one method is utilized: the direct method (Dieter & Norbert, 2013).

5.3.2 Free Cash Flow

Free cash flow (FCF) measures a company's financial performance. It is calculated by looking at the difference between the cash flow and investment expenses. Operating, financing, or investing activities prompt cash inflows, while expenses or investments prompt cash outflows.

In addition to different methods of calculating the cash flow statement, a distinction is made between the free cash flow methods: Free Cash Flow to the Firm (FCFF) and Free Cash Flow to Equity (FCFE). FCFF represents the amount of cash from operating activities that are available after the expenses related to depreciation, taxes, and working capital are deducted. FCFF is also referred to as Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA). FCFE, on the other hand, indicates the amount of cash available to shareholders after all expenses have been deducted. These expenses include operating expenses, reinvestment, and debt payments. By adding the financial income and expenses to FCFF, we calculate the FCFE. The FCFF is discounted with the total cost of capital, while FCFE is discounted with the cost of equity. That is due to the fact that FCFF and FCFE are future cash flows that must be discounted to the present. When estimating the FCF, two standard errors are often made: the FCFF is discounted with the cost of equity, or the FCFE is discounted with the cost of capital. In such instances, the FCFF will be underestimated, and the FCFE will be overestimated (Palepu & Healy, 2013)

6.0 Data

This section will describe the method used to collect data for the thesis. That includes identifying potential companies to contact, acquiring contact information on relevant individuals, and making direct contact with them. We will also discuss the respondent rate on the data collection. Finally, our analysis, result, and discussion are built on the foundation of this data.

6.1 Data Collection

The selection of companies we want to analyze is limited to companies in the production sector. That includes all companies that develop products, such as equipment and machines. The justification for this is that we know multiple significant investments are being made in this field, and minimal research has been done regarding their investment analyses. After segmenting for the production sector, we received a spreadsheet from Proff Forvalt of a total of 10 001 companies. Based on the size of the sample, we had to impose a number of limitations. For simplicity, we will limit our analysis to include Norwegian companies located in Oslo and Viken.

First and foremost, we want to set a limit by looking exclusively at limited companies and cooperatives, and thus excluding company forms such as public listed companies and sole proprietorships. Additionally, we specified that the companies must be operational as of 2022. As a final criterion for the companies we want to look into, we set a delimitation that the operating revenues must be greater than NOK 100 million. This delimitation is made on the basis that we want the organizations we approach to have a certain size, as we believe this enhances the likelihood that they carry out NPV analysis.

Based on the stated delimitations, we identified a total of 238 firms that we would like to approach in order to gain insight into their investment analysis. We identified these companies through the Norwegian information provider Proff Forvalt. The identified firms are presented in Appendix 2.

After the companies had been identified, we needed to obtain the contact information of relevant people in the company. That includes the email address, phone number, and LinkedIn profile of the Chief Executive Officer (CEO) and Chief Financial Officer (CFO). As this was not always possible to identify, the sample of the companies we contacted consists of 214 companies.

To increase the likelihood of receiving positive feedback, we sent out a private email to each company's CEO, with the CFO on a copy. Each email was personalized with the name of the CEO and the company in the introduction. To

streamline the process of contacting the companies, we split the list into two and worked continuously through the list of companies. See Appendix 3 for the emails we sent to each company. For those firms who did not answer our first inquiry, we sent out a total of two reminders during a period of three weeks. That means that each company has received a total of three inquiries if we did not receive any response to the previous inquiries. In this paper, we will further anonymize the presentation of the respondents, as this was a condition for the collaboration.

Further, after completing the questionnaire, respondents were given access to a summary of a similar master's thesis that we deemed pertinent for companies to read. That served as an incentive for their participation in the questionnaire.

6.2 Responses

We aim to present the response to the data collection process using Table 1, which is a tabular overview. Table 1 provides an overview of the response and the classifications used in our research. As shown in Appendix 4, our data has three classification levels: overall, general, and detailed. In Table 1, the distinguishment of the classifications and to which category they belong is illustrated with color-coding. For example, we distinguish between the overall classification “Contributed” and “Not contributed” using the colors gray and blue, respectively. Further, the general and detailed classifications are distinguished with different hues of those colors.

Total firms identified	238	
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	Contacted	Answers
First inquiry	214	42
Second inquiry (+7 days)	156	38
Third inquiry (+ 14 days)	111	18
Total		98

Overall classification	#	%
Contributed	57	24 %
Not contributed	181	76 %
Total	238	100 %

General classification	#	%
Answered survey	16	7 %
No/few official analyzes	35	15 %
Shared spreadsheets	1	0 %
Answered survey and shared spreadsheet	5	2 %
No reply	99	42 %
Not able to participate	41	17 %
Were not able to contact	41	17 %
Total	238	100 %

Detailed classification	#	%
Has answered survey and shared spreadsheets	5	2 %
Has answered the survey	16	7 %
No/few official analyzes in the company	29	12 %
No/few official analyzes in the company as it is a subsidiary	6	3 %
Shared spreadsheets	1	0 %
Email not delivered	17	7 %
No reply	99	42 %
Not able to contribute due to Policy rules	17	7 %
Not able to participate due to capacity	24	10 %
Were not able to contact	24	10 %
Total	238	100 %

Table 1: Data and data classifications

The data collection process resulted in a 46 percent answer ratio, with a contribution ratio of 24 percent of all contacted firms. The contribution ratio is better than expected, as we encountered several challenges in the collection process, primarily connected to contact information, the time of contact, and other internal factors.

Firstly, we had to uncover the firms' contact information, emphasizing all information related to the Chief Executive Officer (CEO) and Chief Financial

Officer (CFO), as we intended to engage top management. Of the identified firms, we uncovered contact information and contacted 214 firms in our first inquiry with a personalized email (Appendix 3). To increase responses, we sent three inquiries at seven-day intervals to the firms, excluding firms as they answered or indicated no interest in contribution. Unfortunately, some of the identified email addresses were incorrect, even though we found them on trustable pages like the company's homepage. As a result, the email was not delivered, and they were never informed of our request. That was the case with a total of 17 identified email addresses.

Secondly, the inquiries were sent between March and April of 2022, which entails first-quarter reporting (Q1 2022) for most firms in our study. There was a total of 24 firms that were not able to participate due to capacity. We recognize that the inquiries were sent at an unfortunate time that presumably affected our contribution ratio.

Finally, a high number of companies did not have the opportunity to share such information, mainly based on the company's policy rules. That applied to 17 companies.

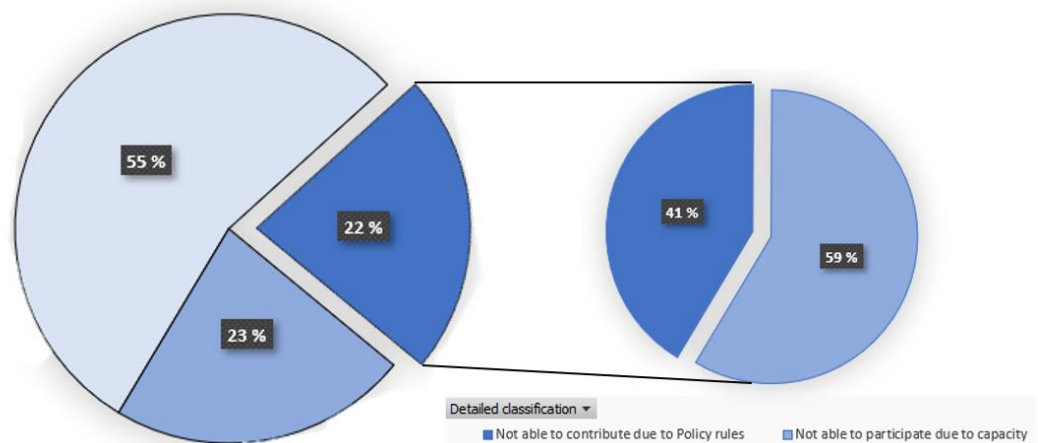


Figure 2: Not able to participate

As illustrated in Figure 2, connected to the second and third encountered challenges, the findings show that 22 percent of the non-contribution came from firms that could not participate, 55 percent were due to no reply, and 23 percent were firms we could not contact. Consequently, we presume that the data collected on “Not able to participate” due to reduced capacity and internal policy

rules apply to the 99 firms that did not reply to our email. Therefore, if one were to duplicate the study, the contact time should avoid the quarterly reporting and/or audit period.

Nevertheless, a 24 percent contribution rate to the data collection process is considered decent. We have collected 11 spreadsheets from 6 firms that will assist in identifying the practical use of the firm's approach in conducting a project appraisal. Further, Table 1 reflects that 21 firms answered the questionnaire sent out; however, we received 37 responses: 25 full-fledged responses and 12 that specified their preferred method. The discrepancy is owed to anonymized responses to the questionnaire and is therefore not reflected in Table 1. However, we presume that the anonymous contributors are included in the contribution rate through firms with few or no official analyses. In addition, 35 of the 214 contacted firms responded by email with no or few official analyses in the company, which was an unexpected remark in our research. The finding is responsible for 61 percent of the contribution to the research, as illustrated in Figure 3. When asked for an elaboration in relation to why such analysis was not carried out, 29 firms answered that there was no need for official analysis, and six firms answered that those analyses are not done in their firm as they are a subsidiary. Therefore, the finding is considered a contribution, as the firms are in the production sector, where we assume several investments are made. Thus, such analysis must be carried out in an unofficial capacity. We will further analyze the findings in section 7.3.

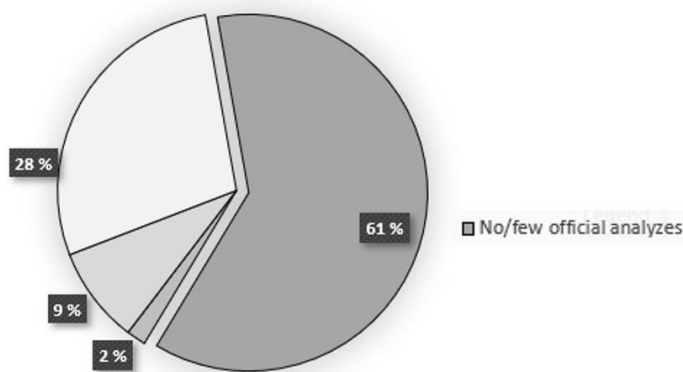


Figure 3: Contributed to research

7.0 Analysis

This section will analyze the data collected for the research paper. In the first section we will examine the results of the cash flow models, before we look closer at the responses to the questionnaire. In the last section, we will analyze the additional discoveries made in this study.

7.1 Cash Flow Model

During our data collection, six businesses provided us with a total of eleven spreadsheets. Participation in the study was contingent upon anonymizing the analysis of the participating companies. As a result, the spreadsheets' numbers, names, and titles are changed to protect their privacy. Table 2 provides an overview of the findings of the analysis of the cash flow models.

	Firm 1	Firm 2	Firm 3	Firm 4	Firm 5	Firm 6
Mistake in calculation	True	True	True	Not available	Not available	Not available
Error in model construction	True	True	True	Not available	Not available	Not available
Prone to human error	True	True	True	True	True	True

- 50% have mistakes in calculations of the cash flow model
- 50% could not conclude due to little information
- 50% have an error in the model's construction
- 50% could not conclude due to little information
- All firms in the selection are prone to a human error due to their routines

Table 2: Cash flow models

7.1.1 Firm 1

Firm 1 is a construction and manufacturing firm that works in the field of crushed stone and gravel, construction of roads and motorways, extraction of clay and kaolin, as well as development and participation of new businesses within the same areas. They have around 500 employees and a turnover of around NOK 2 billion. Firm 1 contributed to this study by sharing a copy of its investment model. Unfortunately, they were unwilling to disclose accurate calculations based on the company's policy rules. In addition to sharing the NPV model, Firm 1 also answered our questionnaire.

The model is a one-page spreadsheet with a simple NPV calculation that utilizes two languages, as presented in Appendix 5. The NPV is calculated by summing each year's cash flows, discounted by a discount rate of 15 percent. Regarding the discount rate, there are no calculations that have been presented. However, the firm's questionnaire responses indicate that the required rate of return for the analysis is based on data from their treasury department. The model does not estimate any residual value for the last year in the cash flow or adjust the last cash flow for an unlimited lifetime, indicating that the investment has a limited lifetime. That is consistent with their questionnaire response, stating that they assume the investment has a limited lifetime. For its cash flow analysis, the company bases figures before taxes on its analysis and adjusts those figures for inflation. Due to the absence of taxation in the analysis, depreciation has not been considered.

Moreover, the working capital is not released at the end of the project's duration. That is blatantly incorrect, as improper working capital management results in an incorrect estimate of the project's NPV. Aside from calculating the NPV, the model also allows for estimating the PBP and IRR for the investment. In the model, the PBP is calculated using an Excel function (IF-function) that estimates the year the payback turns from negative to positive, indicating which year the project is fully paid back. The IRR is calculated using the IRR function in Excel with the input IRR estimate and the project cash flow values.

The document is straightforward to use and comprehend in terms of Excel usability. Several cells are formatted with formulas, facilitating data navigation and modification. They are, to some degree, using formulas such as the IF-function and SUM-function, as well as locking the cells. That increases the efficiency. We observe an apparent error in the column displaying the year in the model. The majority of years are entered using the formula of adding 1 to the previous year. That lets one easily adjust the years in the analysis. However, this formula was omitted from the final two columns of the analysis, causing the final two years to be incorrect. As a result, the cash flow from these years was miscalculated, positively affecting the NPV because the cash flow is discounted

for a shorter period. Consequently, it demonstrates flaws in the company's Excel procedures and model construction.

Overall, we have identified errors in the model, its construction, and calculations. For example, the model utilizes two languages, omits parts of the cash flow calculation, and is flawed in its construction. In addition, the model could improve by, e.g., automatizing and locking sheets to minimize employee data entry errors.

7.1.2 Firm 2

Firm 2 is a subsidiary of a prominent aluminum and renewable energy company and has around 3000 employees and a turnover of approximately NOK 50 billion. They provided us with four spreadsheets in addition to responding to our questionnaire. Each spreadsheet reflected the actual investments made by the organization. Since the calculations in each spreadsheet were identical, we only analyzed one of them. That demonstrates that the organization is consistent and conducts analyses uniformly within the organization.

The NPV calculation model for the company can be found in Appendix 6. Due to confidential data, the company assumed a fictitious 10 percent return requirement in its models. In their cash flow analysis, the company uses post-tax numbers and assumes the investment has a finite lifespan. Additionally, the spreadsheets include NPV, IRR, and PBP calculations for the investment. The NPV and IRR formulas are used to calculate the respective values, while the PBP is calculated manually. All of these calculations are in accordance with the company's responses to the questionnaire.

The company utilizes a single sheet that represents an NPV analysis. Pertaining to Excel usability, several cells are formatted with formulas; however, the model does not employ locked cells and relies on employee input, making it more susceptible to error and miscalculation. Moreover, the structure and presentation of the model can be hard to comprehend and may lead to misunderstandings. Further, we observe that the model calculates the cash flow before and after tax, and accounts for the depreciation of the investment. In a cash flow analysis, an investment should be depreciated by the conclusion of the project; therefore, the

total depreciation should equal the investment. For this project, that is not true; the model contains a miscalculation.

7.1.3 Firm 3

Firm 3 is a subsidiary of a publicly traded Norwegian company engaged in construction and real estate development. The firm has around 1100 employees and a turnover of around NOK 4 billion and operates solely within the construction industry. We were provided with three spreadsheets, each of which contained actual investments that had been carried out - for simplicity, we have chosen to analyze only one of the spreadsheets since the numbers and calculations in the three received spreadsheets are performed on the same basis. In addition, the CFO of the company has responded to our questionnaire.

The model is a multiple-sheet excel model with explicit instructions for the user. The spreadsheet contains a comprehensive investment analysis with calculations for sensitivity, cost calculations, capacity, depreciation, macroanalysis, and profit and loss statement. For an inexperienced user, the document may appear demanding to comprehend; however, it is simple in its design and usage. The sheet with the output of the cash flow calculations (Appendix 7) contains formulas with no need for external inputs, minimizing the possibility of error. As the sheet is not locked, it is possible to overwrite the formulas, which is an area where the model could be improved.

The model calculates the cash flow using the data input and assumptions. The discount rate is manually inputted in the model with 15 percent. There are no presented calculations concerning the discount rate, as the user is instructed to input the desired discount rate. The NPV is calculated using the NPV formula in Excel with the input discount rate and the project cash flow values. The cash flow calculation is calculated before tax and contains the project investment and payments. The model calculates the depreciation for the project's investment; however, it does not incorporate it into the calculations. The depreciation method utilized in the model is a straight line, but for the purpose of tax depreciation, one shall utilize the declining balance method. However, an investment should be

depreciated by the conclusion of the project; therefore, the total depreciation should equal the investment. For this project, that is true.

Additionally, it is peculiar that the analysis does not include working capital. By excluding working capital, the company assumes, among other things, that all accounts receivable will be paid in the same year they are issued, which is an unreasonable assumption for such a large project. We suspect that the model is flawed in its construction due to a human error, as the information is available in the spreadsheet.

Aside from calculating the NPV, the model also allows for the estimation of the PBP and IRR for the investment. In the model, the PBP is calculated using an IF function that estimates the year the payback turns from negative to positive, indicating which year the project is fully paid back. The IRR is calculated using the IRR function in Excel with the input IRR estimate and the project cash flow values. The CFO specified that the NPV analysis is the basis for most fixed asset investments; however, when acquiring a company, the decision-makers place most emphasis on strategy.

Overall, we consider Firm 3's Excel model adequate, given that it is automated and the spreadsheet's construction and presentation was intuitive. We suspect, however, that the construction error was caused by human error in the aftermath of its construction, as the primary calculation sheet is not locked against edits. Locking the sheet to mitigate this risk and including cash flow calculations after taxes could improve the model and analysis. For example, taxes and depreciation provide a more accurate financial picture in a cash flow analysis. In addition, incorporating all available data into the model would result in a more precise NPV calculation.

7.1.4 Firm 4

Firm 4 is a firm that operates in the production and sale of baked goods, owned by a Norwegian listed firm within the grocery chain. The firm has around 1000 employees and a turnover of approximately NOK 2 billion. The company provided us with limited information for our study in the form of a screenshot of a

previous NPV calculation, as presented in Appendix 8. However, the CFO of the company has responded to our questionnaire.

The forwarded screenshot displays a straightforward NPV analysis, along with calculations for PBP and IRR. Provided that we have only received screenshots and not spreadsheets, we have no additional information on how the data is calculated—resulting in a limited evaluation of this company. A straightforward cash flow analysis is displayed on the forwarded model, including the NPV, IRR, and PBP computations. Moreover, the analysis is based on an assumed exchange rate between NOK and EUR, indicating that the investment is made in a foreign currency. All of the values that were considered in the analysis were obtained prior to the deduction of any taxes. However, the investment's depreciation was calculated using the straight-line method. Nevertheless, in the cash flow analysis, depreciation is ignored. That is peculiar, as it could provide a more accurate financial picture. The analysis shows that the company uses a nominal return requirement against real figures, which is incorrect. However, insufficient evidence prevents us from concluding that this is the case. Even though the company has shared little information for this portion of the analysis, they have responded to our questionnaire. The company elaborates that they primarily calculate potential investments using the IRR method. Beyond this, they have provided blank responses to the remaining questions. By email, the company's CFO confirms that they have a simple approach to the profitability assessments, without calculations related to tax assessments and inflation, since the investment is primarily carried out on the basis of needs in the production, as well as to manage the firm's competitive position. Thus, there is less focus on the results of the analyzes.

7.1.5 Firm 5

Firm 5 is a corporation's subsidiary that develops and produces freshly processed products in commercial kitchens, groceries, and service trade. The subsidiary employs approximately 55 people and generates about NOK 1 billion in revenue. For our investigation, we were provided with one spreadsheet outlining their model and three product proposals including a project appraisal calculation. The product proposals incorporate the model in the spreadsheet that indicates that the

company is consistent and conducts the analyses equally within the company. Furthermore, the Group CEO answered our questionnaire.

The model is a single-sheet Excel model, which is simple in design.

Unfortunately, we cannot comment on the level of error that may occur using the model, as all numbers presented in Appendix 9 are values. We presume that the submitted model usually has formulas in the cells since the values include more than five decimals. As such, we cannot draw any conclusions from the Excel model outside of what it incorporates in its calculations. We observe that the model uses different signs before each number in its calculations, which increases the complexity of the model. The different signs make the analysis harder to comprehend.

Additionally, there are no presented calculations concerning the discount rate nor the presentation of the discounted rate; however, in the questionnaire, the Group CEO communicated that the company assumes an interest rate based on an estimate of market developments or internal return requirements. The cash flow analysis is performed using the indirect method before tax and with no residual value. In addition to calculating the NPV, the model estimates the PBP and IRR for the investment.

To enhance our analysis, we aimed to reverse-calculate the employed formulas, as the investment was as significant as presented. Firstly, we wished to determine if the project's duration was indeed ten years. Unfortunately, we discovered that the IRR was inaccurate, indicating that the project's duration is longer than the duration presented in the appendix. As a result, we cannot draw any conclusions regarding the model's construction and calculations, as it is incomplete. Overall, the model is hard to comprehend as it utilizes different signs in the input. Consequently, we believe that the model is more prone to human error.

7.1.6 Firm 6

Firm 6 is a subsidiary of a multinational corporation that manufactures industrial coating resins, crosslinkers, and additives. The Norwegian subsidiary employs approximately 80 people and generates about NOK 650 million in revenue. For our investigation, we were given two spreadsheets outlining their model. Each

spreadsheet reflected actual corporate investment. We only examined one of the spreadsheets since the calculations in each were the same. That indicates that the company is consistent and conducts the analyses equally within the company.

The model is a multiple-sheet excel model with explicit instructions for the user; however, the document is unorganized and demanding to comprehend in terms of Excel usage and presentation. There are individual sheets for financial input, such as assumptions and asset depreciation, and a sheet with the output of the model-cash flow calculations (Appendix 10). Several cells are formulated using formulas, making navigating model data manageable. As the sheet is not locked, it is possible to overwrite the formulas, which is an area where the model could be improved. The user of the model must enter positive values of the financial data as the model creator presumably wanted to minimize the sign errors. The model calculates the cash flow using the data input and assumptions. An assumption in the model that is manually input is the discount rate, which in both models is 12 percent. There are no presented calculations concerning the discount rate, as the user is instructed to input the desired discount rate. The NPV is calculated using the NPV formula in Excel with the input discount rate and the project cash flow values. The cash flow calculation considers depreciation, tax, and working capital. The analysis shows that the company uses a nominal return requirement against real figures, which is incorrect. However, insufficient evidence prevents us from concluding that this is the case. Aside from calculating the NPV, the model also allows for estimating the PBP and IRR for the investment. In the model, the PBP is calculated using an IF function that estimates the year the payback turns from negative to positive, indicating which year the project is fully paid back. The IRR is calculated using the IRR function in Excel with the input IRR estimate and the project cash flow values.

Overall, we consider that Firm 6 has an automated model that can reduce the possibility of an error occurring. However, aside from the calculations, the spreadsheet construction and presentation might be overwhelming for the user, and the main spreadsheet could be locked for editing; as such, it has potential for improvement. Further, we suspect that the model does not consider inflation in its calculations.

7.2 Questionnaire

During the data collection, we received a total of 37 responses to our questionnaire. The questionnaire was open for responses for six weeks, from March 15th, 2022, until April 27th, 2022.

The response time for the questionnaire was variable, with some extreme outliers at several hundred minutes. Based on these extreme outliers, the estimated average response time will be exceptionally high. However, a median answer time of 6.88 minutes is a more appropriate measurement. A total of 23 firms did, to some degree, fully complete the questionnaire. Even though the remaining 14 firms did not fully complete the questionnaire, we received a high amount of information from a great proportion of them.

The introductory questions were about the respondent and the company he or she represented. These questions were asked with the goal of 1) identifying which companies contributed to the study and 2) gaining knowledge of the respondent's position in the company. A total of 14 respondents did not wish to elaborate regarding which firm they represented. Most of the respondents had a management position within finance, had been in the company for more than ten years, and had their current position for a minimum of 10 years.

The findings from the questionnaire will be discussed in the following subpoints. The section is divided into one section for each question from the questionnaire.

7.2.1 Capital Budgeting Techniques

Although our literature review confirms that NPV is the most frequently used CBT, we wanted to identify which of the methods the firms in the questionnaire most frequently used. Therefore, the question was formulated in the following way:

“Capital Budgeting Techniques (CBTs) is a set of techniques that can assist any decision maker in determining whether or not an investment is profitable and should be pursued, such as the Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PBP). In our thesis, we assume that NPV is the most

commonly used technique for the firms we want to investigate. When calculating the value and estimating whether your firm should accept an investment or not, which CBT do you mostly use?"

We received 36 answers to this question, which implies that one of the respondents did not answer the question. The questionnaire findings align with findings from the literature review: NPV is the most frequently used technique. 55.56 percent of the respondents exclusively use NPV when estimating the value of an investment. Further, a total of 19.44 percent use PBP, and 11.11 percent use IRR. Three of the respondents used a combination of the three methods, representing 8.33 percent of the responses. The remaining two respondents (5.56%) chose the option "other methods" and stated that their decisions are made based on the firm's needs. The findings are summarized in Table 3 below:

When calculating the value and estimating whether your firm should accept an investment or not, which CBT do you mostly use?	Number of responses	In percent
<i>NPV</i>	20	55,6 %
<i>PBP</i>	7	19,4 %
<i>IRR</i>	4	11,1 %
<i>Several of the techniques</i>	3	8,3 %
<i>Other techniques</i>	2	5,6 %
	36	

Table 3: Responses to question 1

7.2.2 Tax

Further, we wanted to identify whether the respondents' used values before or after taxes in their calculations. We received a total of 20 answers to this question; hence, 17 did not wish to elaborate regarding their practices related to tax. The question was formulated the following way:

"Do you use values before or after tax in your calculations?"

Of the 20 respondents, 14 stated that they use numbers before and six after tax. In addition, they highlighted the preference for using numbers before tax in their model. Regardless, the distribution of numbers before and after tax is relatively

even.

Do you use values before or after tax in your calculations?	Number of responses	In percent
<i>Before tax</i>	14	70,0 %
<i>After tax</i>	6	30,0 %
	20	

Table 4: Responses to question 2

7.2.3 Inflation

Whether a firm takes inflation into account or not affects the outcome of the analysis drastically. If a firm takes inflation into account, they use nominal numbers. On the other hand, if they do not consider inflation, they use real numbers. The question was formulated the following way:

“Do you use nominal or real numbers (with or without inflation) when estimating the cash flows for each of the periods?”

We received a total of 21 responses to this question. While 11 respondents use nominal numbers, eight use real numbers in their cash flow calculations. In addition, two respondents vary between taking inflation into account.

Do you use nominal or real numbers (with or without inflation) when estimating the cash flows for each of the periods?	Number of responses	In percent
<i>Nominal numbers</i>	11	52,4 %
<i>Real numbers</i>	8	38,1 %
<i>Variation in their practices</i>	2	9,5 %
	21	

Table 5: Responses to question 3

7.2.4 Cash Flow to Equity/Firm

Further, we wanted to identify if the firm estimates cash flow to the equity, including debt in the cash flow, or if they estimate cash flow to the firm. Cash flow to the firm implied that they view the cash flow from the firm's perspective and, thus, not invoice financing activities. The question was formulated the following way:

“Do you include debt financing in the cash flow (Cash Flow to the Equity) or do you view it from the firm's perspective (Cash Flow to the Firm)?”.

In response to this question, there was a significant overweight of respondents who estimated cash flow to the firm. Of the 21 respondents, 17 said they estimate cash flow to the firm, while one estimated cash flow to the equity. In addition, two respondents misunderstood the question, and their response was thus excluded. Finally, one respondent uses a variation of both cash flow to the firm and cash flow to the equity.

Do you include debt financing in the cash flow(Cash Flow to the Equity) or do you view it from the firm's perspective(Cash Flow to the Firm)?	Number of responses	In percent
<i>Cash Flow to the Firm</i>	17	81,0 %
<i>Cash Flow to the Equity</i>	1	4,8 %
<i>Misunderstood the question</i>	2	9,5 %
<i>Variation in their practices</i>	1	4,8 %
	21	

Table 6: Responses to question 4

7.2.5 Required Rate of Return

Regarding the respondents' practices related to the estimation of the required rate of return, we asked the following question:

“How do you estimate the required rate of return for the investment?”

A significant overweight of respondents favored the WACC method, with a total of nine responses to this method. A total of 15 respondents answered this question blankly, and two did not want to share such information. The remaining respondents answered that the required rate of return is set by the company's policy rules, estimated by the actual cost/market price, or do not use such rates in their analyses.

How do you estimate the required rate of return for the investment?	Number of responses	In percent
<i>WACC</i>	9	40,9 %
<i>Guidelines within the firm</i>	6	27,3 %
<i>Does not use such rates</i>	1	4,6 %
<i>Actual cost / market price</i>	4	18,2 %
<i>Do not want to share such information</i>	2	9,1 %
	22	

Table 7: Responses to question 5

The latter question lacked multiple-choice options; respondents provided text answers. We assume that several respondents misunderstood the question as the answer "WACC" is erroneous because it estimates the total cost of capital. However, we assume that they believe they use the Capital Asset Pricing Model (CAPM), which estimates the investment capital requirement. To avoid this misunderstanding, we should have provided multiple-choice options to this question.

7.2.6 Residual values, limited lifetime, or an infinite lifetime?

In relation to whether the respondents estimated a residual value, assuming that the investment has a limited or an infinite lifetime, most respondents favored estimating a limited lifetime. The question was formulated the following way: “*Do you use residual values, do you estimate a limited lifetime, or do you assume that the project has an infinite life?*”

A total of 16 respondents favored this method, while one estimated a residual value, and six assumed that the project has an infinite lifetime. The remaining 14 responded blankly to this question. An interesting finding within the field was that most of the respondents that assumed an infinite lifetime worked within the hydropower industry.

Do you use residual values, do you estimate a limited lifetime, or do you assume that the project has an infinite life?	Number of responses	In percent
<i>Residual value</i>	1	4,4 %
<i>Limited lifetime</i>	16	69,6 %
<i>Infinite lifetime</i>	6	26,1 %
	23	

Table 8: Responses to question 6

In retrospect, we see room for improvement concerning this inquiry. Given that a residual value may be employed regardless of whether a finite or infinite lifetime is assumed, one should first inquire whether a finite or infinite lifetime is assumed and then inquire whether a residual value is employed.

7.2.7 Direct or Indirect Method

Further, we wanted to identify whether the respondents used a direct or an indirect method when estimating the cash flow. That is an interesting topic to get insight into, as different methods will give different answers in the analysis. Therefore, the question was formulated the following way:

“Do you estimate your cash flows by subtracting the disbursement from the payments (direct method) or by estimating the cash flow from your operating activities (indirect method)?”

We received a total of 18 responses to the question. The remaining 19 respondents either answered blankly or misunderstood the question. The distribution between direct and indirect methods was divided 50/50; thus, nine favored the indirect method, and nine favored the direct method. That is an intriguing finding, as it indicates significant differences between the companies.

Do you estimate your cash flows by subtracting the disbursement from the payments (direct method) or by estimating the cash flow from your operating activities(indirect method)?	Number of responses	In percent
<i>Direct method</i>	9	50,0 %
<i>Indirect method</i>	9	50,0 %
	18	

Table 9: Responses to question 7

7.2.8 Tools

To get both an impression of how time-consuming the analyzes are, as well as an insight into which tools are used in the analyzes, we asked the following question: “*What tools do you use to carry out the investment analyzes?*”

This question will give us a sense of how effective the calculator of the analyses is and whether there is room for improvement regarding the amount of time spent on the tools. Respondents were provided three multiple-choice options and the option to answer "other" and elaborate. We received 24 responses to this question, suggesting that the remaining 13 respondents chose not to elaborate. Sixteen respondents utilized a pre-made Excel template for their respective analyses, while six created new spreadsheets for each analysis. As preparing new spreadsheets for each analysis is deemed time-consuming, there is significant room for improvement in this area. None of the respondents utilized a standard investment module from an enterprise resource planning (ERP) system, which was the third option. The remaining two respondents answered "other" and elaborated that they do not use such tools because the investment is made in response to a recognized production need.

What tools do you use to carry out the investment analyzes?	Number of responses	In percent
<i>Pre-made Excel template</i>	16	66,7 %
<i>New Excel-sheet for each analysis</i>	6	25,0 %
<i>Other tools</i>	2	8,3 %
	24	

Table 10: Responses to question 8

An interesting finding is that 25 percent of the respondents produce a new spreadsheet for each analysis. In addition to being very time-consuming, this can lead to different practices being used internally in the company - as there is no clear template for how the analyzes should be carried out. Further, according to Powell et al. (2007), the computation of a new spreadsheet increased the likelihood of a computation error occurring.

7.2.9 Presentation of the analysis

Once the analysis has been conducted, there are several ways to present the findings to decision-makers. On this basis, we posed the following question in order to determine the respondents' practices regarding the presentation of analyses:

“How do you present the findings from your analysis?”

To this question, we received 22 responses, and the distribution of those responses across the various methods was even. First, most corporations preferred presenting the findings graphically of the four combinations. Second, corporations preferred presenting the spreadsheet and/or output in detail. Third, a combination of presenting the findings graphically and direct output from the analyses. Lastly, the least utilized method is to present the spreadsheet output alone.

How do you present the findings from your analysis?	Number of responses	In percent
<i>Show them the spreadsheet and/or the output in detail</i>	6	27,3 %
<i>Show them graphically</i>	8	36,4 %
<i>Show them graphically, as well as some output</i>	5	22,7 %
<i>Show them some output from the spreadsheet</i>	3	13,6 %
	22	

Table 11: Responses to question 9

7.2.10 Knowledge of the decision-maker

Generally, the analysis findings must be presented to a decision-maker before selecting an investment. Nevertheless, based on previous research, we are aware that there are concerns regarding the fact that the decision-maker within a company does not fully comprehend the interpretation of the analysis and

therefore lacks the appropriate knowledge to make such decisions (Myers, 1984). Consequently, the following questions were included in the questionnaire.

“Some research indicates that companies do the analysis, but that decision makers do not always fully understand the interpretation. To what extent do you agree with this statement? 0 indicates strong disagreement with this statement (always understands), while 9 indicates strong agreement (does not always understand).”

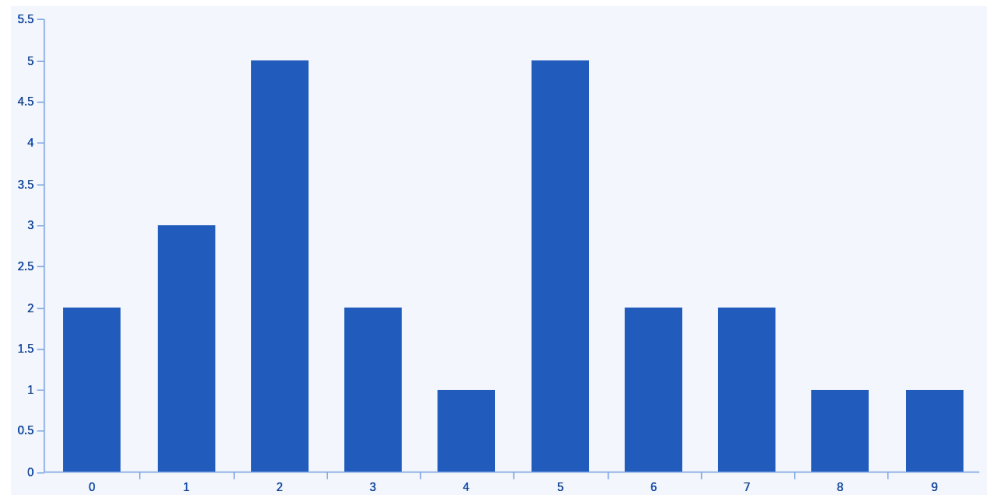


Figure 4: Responses to question 10

Figure 4 displays the responses of 24 corporations. We observe from the illustration that there is considerable disagreement among respondents. Nevertheless, 20.83 percent of respondents neither agree nor disagree with the statement, while the same proportion appears to disagree. Moreover, the remaining answer choices are distributed evenly. However, we see that most of our questionnaire respondents are part of top management and thus also probably are one of the company's decision-makers. Therefore, we do not consider this answer to be representative, as other employees in the company may have different opinions and views regarding this statement.

7.2.11 Other arguments

Furthermore, we wanted to investigate whether there were other arguments or analyses, other than the result from the NPV analysis, that influenced whether an investment should be carried out. Therefore, we asked the following question:

“Are there more arguments or analyzes than the result from the NPV analysis that are used as a basis when you assess whether an investment should be carried out or not? Or are the results from the NPV analysis the only argument you use? Please specify.”

We received a total of 23 descriptive responses to this. Internal needs, Health, Safety, and Environmental (HSE), competitiveness, and liquidity were recurring in the responses. Given that all respondents work in the production sector, it is clear that internal needs play a significant role. For example, if there is a failure in any fixed assets, the companies must invest in new assets that can replace them quickly.

7.2.12 Guidelines from the top management

As a final question, we wanted to identify if the respondents ever make assessments that are not in line with the overall guidelines within the firm.

Therefore, the question was formulated the following way:

“Do you sometimes make assessments that are not in line with guidelines given by the director / CFO / manager regarding how an analysis should be performed? If such, what type of decisions and what are the guidelines given? Please specify.”

This question received a total of 19 responses. Fifteen respondents indicated unequivocally that they always follow the firm or group's internal guidelines. Three of the respondents emphasize that the guidelines are a minimum requirement and that deviations are made if it is considered necessary for a better analysis, as well as if it provides a better basis for decision-making. According to one respondent, there are no clear guidelines; however, it is evident that price, return, and risk is taken into account in the calculation.

Similar to question 10, we see a problem with the generalizability of these results. That is because the question is primarily answered by the corporation's upper management and those who decide what should be executed. We assume that the outcome would have been inferior if only lower-ranking employees had participated in the survey.

7.3 Additional discoveries

An additional discovery from our research is that a surprising number of firms state that they perform no or few official analyses. As shown in Figure 3, the discovery is responsible for 61 percent of the contribution to the research. We further investigated the statement by requesting an elaboration. Six of the 35 respondents delegate the analysis to their mother corporation and do not conduct any official analysis. Further, 29 respondents elaborated that there was no need for official analyses, and therefore, they did not conduct any official analyses. This was an unforeseen elaboration, as all participants in the research have a turnover more significant than NOK 100 million and are in the production sector.

However, we observe from the data that most corporations with no or few official analyses have a turnover between NOK 100 - 650 million, which are considered small corporations compared to other participants in our study. Nevertheless, no corporation is categorized as small in our data collection. Further, when analyzing how many employees the corporations have, it is between 13 and 298, with an average of 118 employees.

We know that 29 firms have investments towards fixed assets in their operation; however, their top management states that the use of a capital budgeting method is lacking. Therefore, we presume that these companies buy the fixed assets the operation requires, i.e., machinery, with top managers doing a profit analysis in a non-official capacity. The presumption is that the corporations have a small group of employees that make investment decisions by operational needs, resulting in no or little need for official analyses.

8.0 Result and discussion

In this section, we are discussing and presenting the findings of the research. In the latter section, we did a comprehensive analysis of our data, including an analysis of multiple cash flow models, questionnaires, and additional discoveries. The most provident findings of our research originate from the questionnaire, reinforced with the analysis of the cash flow models. We aimed to answer our four hypotheses on the subject and constructed the following table:

Hypotheses	Findings
<p>We believe corporations in the same industry base their investment analysis on different numbers.</p> <p style="text-align: center;">True</p>	<p>(1) 50% use the direct method, and 50% use the indirect method,</p> <p>(2) 57% take inflation into account, 33% uses real numbers, and 10% have variation in the practices,</p> <p>(3) 41% use CAPM to estimate the required rate of return, 27% have received guidelines from the firm, 18% uses actual cost/market price, and 5% does not use such rates, and</p> <p>(4) 27% presents the spreadsheet in detail, 36% presents the analysis graphically, 14% presents the output from the spreadsheet, and 23% use a combination of all above.</p>
<p>We believe that, in addition to the results of NPV analyses, other considerations are taken into account when deciding whether an investment should be made.</p> <p style="text-align: center;">True</p>	<p>Common factors that are considered are</p> <p>(1) Internal needs,</p> <p>(2) Health, Safety and Environment (HSE)</p> <p>(3) Competitiveness, and</p> <p>(4) Liquidity</p>
<p>We believe that the majority of corporations' investment analyses contain computational errors.</p> <p style="text-align: center;">True</p>	<p>(1) 50% have mistakes in calculations of the cash flow model</p> <p>(2) 50% have an error in the model's construction, and</p> <p>(3) All firms in the selection are prone to a human error due to their routines</p>
<p>We believe that the firms' Excel calculations contain a number of weaknesses and flaws.</p> <p style="text-align: center;">True</p>	<p>Weaknesses connected to</p> <p>(1) Construction, and</p> <p>(2) Presentation</p>

Table 12: Findings

We have a large number of companies that participated in the study, with an even distribution of location, revenue, and the number of employees, all of which operate in the same sector. As a result, we believe that the findings presented in Table 11 are both representative and generalizable to the Norwegian manufacturing sector. We had a 46 percent answer ratio, with a contribution ratio of 24 percent of all contracted firms. The contribution ratio is better than expected, as we encountered several challenges in the collection process, primarily connected to contact information, the time of contact, and other internal factors. During the data collection process, we became aware of a difficulty associated with the timing of our contacts: we contacted the companies around the time of their Q1 quarterly reports. We believe the response would have been considerably more favorable if we had made contact at an earlier or later period. That is consistent with the responses we received from several companies, who emphasized that they were unable to contribute due to time constraints associated with quarterly reporting. Therefore, if one were to replicate the study, the data collection process should not occur during the quarterly reporting and/or audit period.

In our analysis, several findings were unexpected and educational in relation to the questionnaire. The literature suggests that NPV is the preferred CBT (Berman et al., 2013) in the Nordic countries (Brunzell et al., 2011), which is corroborated by our research. Therefore, we can conclude that NPV is the most commonly employed method for the production sector in Norway. However, some corporations prefer other methods such as IRR and PBP, as well as a combination of the methods.

Further, we investigated which numbers, requirements, estimations, and assumptions the corporations are implementing in their calculations. The level of agreement in the responses to the questionnaire's various questions varied substantially. However, there were significant similarities in whether the companies prefer FCFE or FCFE: most respondents estimate FCFE and thus exclude the financing in their analyses and solely look at the investment from the firm's perspective. Moreover, significant similarities were associated with the tax treatment in the analyses: the majority utilized numbers before tax. In addition,

most respondents assumed a limited investment life, which is natural given their sector. Typically, fixed assets that a company in the production sector invests in often have a limited lifetime as they play a central role in producing the goods and experience significant wear and tear. In addition, there were several parallels between the companies' analytical tools. 92 percent of respondents use Excel to prepare such analyses, with the majority of them employing pre-made templates. The number of respondents who created a new spreadsheet for each analysis was low but still surprisingly high: 25 percent of those who used Excel created new spreadsheets for each analysis. That can quickly lead to both calculation errors and inconsistencies in the analyses. Moreover, there was a near-even distribution between presenting the spreadsheet in detail, presenting the result graphically, presenting some spreadsheet output, and a combination of the above.

Further, as stated, several questionnaire responses showed significant differences. Pertaining to whether respondents use a direct or indirect method, there was an equal distribution between the two approaches, and as many respondents preferred the indirect approach as the direct approach. In the absence of a clear advantage for one of the two methods, significant preferences between them are inevitable. Regarding inflation, there was a significant disparity in how companies incorporate inflation in their analysis. Corporations that account for inflation mainly use nominal values, while corporations that do not account for inflation use real values. However, from our observations, we suspect that corporations mix methods in the computation of the cash flow analysis. Unfortunately, we could not conclude on the presumption, as there was a lack of available information on the spreadsheets. The questionnaire reflects that most firms include inflation; however, a large proportion answered that they do not. That is an intriguing observation, as the future earnings that are the basis for the cash flow are not accurately forecasted.

Further, when calculating the required rate of return, corporations prefer the Capital Asset Pricing Model (CAPM), which estimates the investment capital requirement or, secondly, other calculations stated by company guidelines. The less prevalent method is to use the actual cost/market price, or in some companies, to not use such rates. In such instances, it is probable that the company does not rely heavily on NPV analysis.

From the findings, we can conclude that the corporations in our study use various numbers, requirements, estimations, and assumptions in their calculations. As such, we can accept our first hypothesis: *We believe corporations in the same industry base their investment analysis on different numbers.* As reflected in Table 12, the main takeaways are that (1) 50 percent use the direct method, and 50 percent use the indirect method, (2) 57 percent take inflation into account, 33 percent uses real numbers, and 10 percent have variation in the practices, (3) 41 percent use CAPM to estimate the required rate of return, 27 percent have received guidelines from the firm, 18 percent uses actual cost/market price, and 5 percent does not use such rates, and (4) 27 percent presents the spreadsheet in detail, 36 percent presents the analysis graphically, 14 percent presents the output from the spreadsheet, and 23 percent use a combination of all above.

Furthermore, regarding two questions connected to the knowledge level of the decision-maker (Q10) and guidelines from the top management (Q12), we acknowledge that these findings are not generalizable. That is because the questions were primarily answered by the corporation's upper management and those who decide what should be executed. Therefore, we assume that the results would have been different if only lower-ranking employees had participated in the survey. Previous literature on the subject indicates that the individual in charge of making the final decision regarding an investment does not always have the required knowledge to make such a determination (Myers, 1984). However, in our questionnaire, responses were evenly distributed, with most respondents disagreeing with this statement. Additionally, we asked the corporations if they had ever made assumptions or decisions that violated the company's guidelines. The majority of respondents indicated that they adhered to the company's policies at all times. As such, we are not able to conclude from these findings.

For our second hypothesis, we stated the following: *We believe that, in addition to the results of NPV analysis, other considerations are taken into account when deciding whether an investment should be made.* According to the results of our questionnaire, several companies report that there are, in fact, additional factors that influence their decision in this regard. These factors may include internal

requirements, competitiveness, Health, Safety, and Environmental (HSE), and liquidity. Therefore, we can conclude that the second hypothesis is true, as economic aspects are not the only consideration in the decision-making process.

Further, after analyzing 11 spreadsheets from six different firms, we discovered several errors and miscalculations (Table 2). That is consistent with the findings of numerous studies indicating that such spreadsheets typically contain substantial flaws (Panko & Sprague, 1998; Panko & Aurigemma, 2010; Panko, 2014). We identified that (1) 50 percent have mistakes in their calculations of the cash flow model, (2) 50 percent have an error in the model's construction, and (3) all firms in the selection are prone to human error due to their routines. Further, the overall observation of the Excel routines was that the model presentation is overwhelming for the user, and the construction is prone to human error. For instance, our analysis identified calculation errors associated with factors such as depreciation and working capital. We would consider these miscalculations preventable if the construction and presentation of the model were to improve by automating the model, reducing editing access, and consequently, limiting the risk of human error.

On this basis, we accept our third hypothesis: *We believe that the majority of corporations' investment analyses contain computational errors.* Additionally, we accept our fourth hypothesis: *We believe that the firms' Excel calculations contain a number of weaknesses and flaws.*

Through data collection and analysis, we uncovered unexpected discoveries about the thesis's research topic, hypotheses, and field of study. We discovered that 15 percent of the surveyed corporations state that they perform no or few official analyses. Seventeen percent of respondents delegate the analysis to their mother corporation and do not conduct any official analysis. Furthermore, 83 percent of respondents elaborated that there was no need for official analyses, so they did not conduct any official analyses. In our analysis, we attempted to determine whether these firms were correlated with their size. Each company in our sample that did not conduct such an analysis was categorized as a small business, in relation to the rest of the firms, with an average number of employees of 118 and a turnover

between NOK 100 and 650 million. We assume that these firms make investments for other reasons, as stated in section 7.2.11, such as internal needs, HSE, competitiveness, and liquidity.

9.0 Conclusion

This study investigates how enterprises in the production sector use the Net Present Value method when conducting project appraisals. After a comprehensive literature search on how companies conduct such analyses, it became evident that this was a pertinent and intriguing topic. In addition to examining the application of these analyses, we wish to connect the thesis to the utilization of digital tools such as Excel. We deemed it pertinent since our literature review revealed that such calculations contain significant flaws and errors. Consequently, the following research question was formulated for our thesis: *“How do enterprises in the production sector use the Net Present Value method when conducting project appraisal?”*

We aim to answer our research question by concluding each of the four hypotheses developed for our study. Based on the results of our analysis, all four hypotheses were accepted.

I. We believe corporations in the same industry base their investment analysis on different numbers.

Based on the responses to our survey, it became evident that there are significant differences in how companies conduct their NPV analysis in terms of the numbers they use as a starting point. These distinctions pertain to whether companies account for inflation, how they estimate return requirements, and whether they employ indirect or direct methods in their cash flow analysis. Furthermore, there were minor disagreements regarding the use of numbers before or after taxes, the calculation of FCFF/FCFE, and the assumption of a residual value or a limited/infinite lifetime. However, one can conclude that firms utilize different numbers, therefore, this hypothesis is accepted.

II. We believe that, in addition to the results of NPV analysis, other considerations are taken into account when deciding whether an investment should be made.

The question was posed with the assumption that companies typically conduct NPV analyses but do not rely solely on their results when deciding whether or not to invest. Based on the results of the survey, the hypothesis was accepted by a substantial margin, as several respondents indicated that there were, in fact, other factors that influenced this decision. These may include internal requirements, competitiveness, HSE, and liquidity.

In addition, we made a second discovery that is consistent with this hypothesis. Fifteen percent of the 214 companies we contacted reported conducting no or few official analyses. Seventeen percent of these claim that their mother company conducted such an analysis. The remaining respondents stated there was no need for official analysis. That was an unexpected discovery that indicates that several aspects, other than economic, affect their decision-making process.

III. We believe that the majority of corporations' investment analyses contain computational errors.

We analyzed several spreadsheets containing a firm's cash flow analysis and NPV calculations. We discovered that several computational errors existed in those models. The errors we identified are related to the release of working capital deposits and depreciation calculations. From our analysis in section 7.1, we can conclude on 50 percent of our selection, where we could identify a computational error. Further, the spreadsheet analysis determined that all the firms in the sample were prone to human error due to firm routines. Consequently, we accept the third hypothesis that most corporations have an error in their calculations.

IV. We believe that the firms' Excel calculations contain a number of weaknesses and flaws.

Further, after analyzing the use of Excel by the six different companies, we discovered that the corporations rely heavily on manual input and a low degree of automatization of the model. Therefore, we see great potential for improvement

related to using formulas in Excel, such as locked cells, colors, and presentation of the material. That will both contribute to an increased understanding of the content as well as reduce human error. Consequently, we accept the fourth hypothesis

By accepting our hypotheses, one can assert that there are significant differences in the analysis quality and the numbers used as a foundation. As a result, the companies' cash flow computations and NPV analysis will not be comparable, as their decision regarding the investment will be based on diverse grounds. Inaccuracies in the companies' calculations of such key figures may also cause them to accept investments on the incorrect basis. Additionally, we see significant room for development in the companies' Excel routines. As previously stated, better utilization of digital tools will reduce the possibility of miscalculations and misunderstandings.

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Appendix

Appendix 1: Questions from the questionnaire

1.	What firm do you work for? This question is asked to determine which of the 214 firms we contacted that have completed the questionnaire.	1. Do not wish to answer this 2. Please specify
2.	For how many years have you been working in this firm?	1. < 1 year 2. 3-5 years 3. 5-10 years 4. > 10 years
3.	What is your current position in this firm?	
4.	For how many years have you been working in your current position?	1. < 1 year 2. 3-5 years 3. 5-10 years 4. > 10 years
5.	Capital Budgeting Techniques(CBT) is a set of techniques that can assist any decision maker in determining whether or not an investment is profitable and should be pursued, such as the Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PBP). In our thesis, we assume that NPV is the most commonly used technique for the firms we want to investigate. When calculating the value and estimating whether your firm should accept an investment or not, which CBT do you mostly use?	1. Net Present Value (NPV) 2. Payback Period (PBP) 3. Internal Rate of Return (IRR) 4. Other(Please specify)
When using an NPV/IRR analysis:		
6.	Do you use values before or after tax in your calculations?	
7.	Do you use nominal or real numbers (with or without inflation) when estimating the cash flows for each of the periods?	
8.	Do you include debt financing in the cash flow(Cash Flow to the Equity) or do you view it from the firm's perspective (Cash Flow to the Firm)?	
9.	How do you estimate the required rate of return for the investment?	
10.	Do you use residual values, do you estimate a limited lifetime, or do you assume that the project has an infinite life?	
11.	Do you estimate your cash flows by subtracting the disbursement from the payments (direct method) or by estimating the cash flow from your operating activities(indirect method)?	
12.	What tools do you use to carry out the investment analyzes?	1. Excel-template 2. New Excel-sheet for each project 3. Standard investment modulus from an ERP-system 4. Other(Please specify)
13.	When presenting the information from the analysis to decision makers do you:	1. Show them the spreadsheet/other output in detail 2. Show them this graphically 3. Other(Please Specify)
14.	Some research indicates that companies do the analysis, but that decision makers do not always fully understand the interpretation. To what extent do you agree with this statement? Where 0 indicates strong disagreement in this statement (always understands), while 10 indicates strong agreement (does not always understand)	
15.	Are there more arguments or analyzes than the result from the NPV analysis that are used as a basis when you assess whether an investment should be carried out or not? Or are the results from the NPV analysis the only argument you use? Please specify.	
16.	Do you sometimes make assessments that are not in line with guidelines given by the director / CFO / manager regarding how an analysis should be performed? If such, what type of decisions and what are the guidelines given? Please specify.	

Appendix 2: Identified firms

Status	Organizational number	Company	Municipality	County	Number of Employees	Organization form
Active	917537534	HYDRO ALUMINIUM AS	Oslo	OSLO	2726	AS
Active	938752648	NORTURA SA	Oslo	OSLO	4976	SA
Active	947942638	TINE SA	Oslo	OSLO	4637	SA
Active	987059729	STATKRAFT ENERGI AS	Oslo	OSLO	1021	AS
Active	930187240	HYDRO ENERGI AS	Oslo	OSLO	252	AS
Active	986051678	FMC KONGSBERG SUBSEA AS	Kongsberg	VIKEN	2152	AS
Active	984015666	YARA NORGE AS	Oslo	OSLO	779	AS
Active	914829674	GE HEALTHCARE AS	Oslo	OSLO	907	AS
Active	978614582	KONGSBERG DEFENCE & AEROSPACE AS	Kongsberg	VIKEN	2756	AS
Active	981122607	NEXANS NORWAY AS	Oslo	OSLO	1564	AS
Active	916170858	ORKLA FOODS NORGE AS	Oslo	OSLO	1094	AS
Active	913536770	VEIDEKKE INDUSTRI AS	Oslo	OSLO	1145	AS
Active	895623032	BORREGAARD AS	Sarpsborg	VIKEN	843	AS
Active	985958246	WÄRTSILÄ MOSS AS	Moss	VIKEN	155	AS
Active	980347257	TAKEDA AS	Asker	VIKEN	244	AS
Active	976388097	COCA-COLA EUROPACIFIC PARTNERS NORGE AS	Lørenskog	VIKEN	560	AS
Active	911161230	ORKLA HOME & PERSONAL CARE AS	Oslo	OSLO	290	AS
Active	916987110	MILLS AS	Oslo	OSLO	372	AS
Active	985958165	WÄRTSILÄ GAS SOLUTIONS NORWAY AS	Asker	VIKEN	205	AS
Active	987643935	DENOFA AS	Fredrikstad	VIKEN	79	AS
Active	980250008	FRESENIUS KABI NORGE AS	Halden	VIKEN	604	AS
Active	984884176	NCC INDUSTRY AS	Oslo	OSLO	520	AS
Active	997754123	NORFERSK AS	Indre Østfold	VIKEN	184	AS
Active	976894677	HAFSLUND ECO VANNKRAFT AS	Oslo	OSLO	442	AS
Active	996732703	NORSKE SKOG SAUGBRUGS AS	Halden	VIKEN	485	AS
Active	983590600	PROTAN AS	Lier	VIKEN	187	AS
Active	914183332	BAKHUSET AS	Oslo	OSLO	1024	AS
Active	934049145	NORCEM AS	Oslo	OSLO	362	AS
Active	941218555	LIFE TECHNOLOGIES AS	Oslo	OSLO	271	AS
Active	934863909	LINDE GAS AS	Oslo	OSLO	207	AS
Active	994628577	PEAB ASFALT NORGE AS	Oslo	OSLO	326	AS
Active	943771030	GKN AEROSPACE NORWAY AS	Kongsberg	VIKEN	331	AS
Active	914183987	BASF AS	Oslo	OSLO	196	AS
Active	980859525	DUPONT NUTRITION NORGE AS	Bærum	VIKEN	139	AS
Active	912008754	GLAVA AS	Indre Østfold	VIKEN	364	AS
Active	875778722	SYNNØVE FINDEN AS	Oslo	OSLO	220	AS
Active	990666466	RINGNES SUPPLY COMPANY AS	Nittedal	VIKEN	570	AS

Status	Organizational number	Company	Municipality	County	Number of Employees	Organization form
Active	814780422	PRYSMIAN GROUP NORGE AS	Drammen	VIKEN	159 AS	
Active	948616491	KRONOS TITAN AS	Fredrikstad	VIKEN	180 AS	
Active	979473672	KONGSBERG AUTOMOTIVE AS	Kongsberg	VIKEN	509 AS	
Active	971507837	CONTIGA AS	Moss	VIKEN	527 AS	
Active	981279980	FINDUS NORGE AS	Oslo	OSLO	223 AS	
Active	912555739	DYNEA AS	Lillestrøm	VIKEN	192 AS	
Active	976565967	BAMA INDUSTRI AS	Lier	VIKEN	326 AS	
Active	914720958	NORDOX AS	Oslo	OSLO	88 AS	
Active	937107323	DRESSER-RAND AS	Kongsberg	VIKEN	174 AS	
Active	984460198	DIPLOM-IS AS	Nittedal	VIKEN	550 AS	
Active	940198178	SAINT-GOBAIN BYGGEVARER AS	Oslo	OSLO	206 AS	
Active	942822979	UNICON AS	Oslo	OSLO	160 AS	
Active	934097238	FURUSETH AS	Ullensaker	VIKEN	188 AS	
Active	920404499	BRAV NORWAY AS	Lørenskog	VIKEN	187 AS	
Active	986821058	MESTERBAKEREN AS	Oslo	OSLO	633 AS	
Active	915209750	HUSQVARNA NORGE AS	Sarpsborg	VIKEN	110 AS	
Active	863948592	GOMAN AS	Oslo	OSLO	381 AS	
Active	986519904	ORKLA HEALTH AS	Oslo	OSLO	122 AS	
Active	913283805	JOH. JOHANNSSON KAFFE AS	Vestby	VIKEN	49 AS	
Active	934469801	FATLAND OSLO AS	Oslo	OSLO	66 AS	
Active	945772042	NIPPON GASES NORGE AS	Oslo	OSLO	190 AS	
Active	910629085	LANTMANNEN CEREALIA AS	Oslo	OSLO	142 AS	
Active	981363019	ABBOTT DIAGNOSTICS TECHNOLOGIES AS	Oslo	OSLO	223 AS	
Active	911382563	ELKO AS	Oslo	OSLO	106 AS	
Active	923828583	AS Rockwool	Oslo	OSLO	231 AS	
Active	990566038	ELKEM CARBON AS	Oslo	OSLO	126 AS	
Active	971190744	SJØMATHUSET AS	Oslo	OSLO	155 AS	
Active	928902749	FLOKK AS	Oslo	OSLO	319 AS	
Active	975381722	ARCUS NORWAY AS	Nittedal	VIKEN	113 AS	
Active	980345106	CELSA STEEL SERVICE AS	Oslo	OSLO	190 AS	
Active	934468470	NORBETONG AS	Oslo	OSLO	78 AS	
Active	992034912	BRYNILD AS	Fredrikstad	VIKEN	201 AS	
Active	917099839	NOBIA NORWAY AS	Nordre Follo	VIKEN	227 AS	
Active	844558082	SPENNCON AS	Ringerike	VIKEN	406 AS	
Active	983633080	NORDIC PAPER AS	Sarpsborg	VIKEN	103 AS	
Active	977069904	AXEL ANDERSEN AS	Drammen	VIKEN	42 AS	
Active	959231591	IDUN INDUSTRI AS	Lillestrøm	VIKEN	149 AS	

Status	Organizational number	Company	Municipality	County	Number of Employees	Organization form
Active	986034757	NORGIPS NORGE AS	Drammen	VIKEN	151 AS	
Active	992102403	FLIR UNMANNED AERIAL SYSTEMS AS	Asker	VIKEN	175 AS	
Active	989135082	LANTMÄNNEN UNIBAKE NORWAY AS	Nordre Follo	VIKEN	146 AS	
Active	917016011	UNGER FABRIKKER AS	Fredrikstad	VIKEN	123 AS	
Active	917274975	VPK PACKAGING AS	Halden	VIKEN	248 AS	
Active	952784536	ANDRITZ HYDRO AS	Jevnaker	VIKEN	172 AS	
Active	999177565	ALLNEX NORWAY AS	Lillestrøm	VIKEN	77 AS	
Active	913019334	JACKON AS	Fredrikstad	VIKEN	214 AS	
Active	989519247	JØTUL AS	Fredrikstad	VIKEN	145 AS	
Active	966618019	AASHEIM KJØTT AS	Drammen	VIKEN	21 AS	
Active	982793017	MOELVEN SOKNABRUKET AS	Ringerike	VIKEN	110 AS	
Active	960622944	NORRØNA SPORT AS	Bærum	VIKEN	99 AS	
Active	960400917	BERGANS FRITID AS	Asker	VIKEN	54 AS	
Active	919522461	HALLINGPLAST AS	Hol	VIKEN	87 AS	
Active	912014177	Glomma Papp AS	Sarpsborg	VIKEN	211 AS	
Active	994925954	METACON AS	Sarpsborg	VIKEN	69 AS	
Active	986173617	OSO HOTWATER AS	Øvre Eiker	VIKEN	167 AS	
Active	951194913	LOE BETONGELEMENTER AS	Drammen	VIKEN	210 AS	
Active	980869814	SMURFIT KAPPA NORGE AS	Ringerike	VIKEN	181 AS	
Active	945692758	DEFA AS	Nes i Buskerud	VIKEN	185 AS	
Active	914785200	INDRA NAVIA AS	Asker	VIKEN	189 AS	
Active	979487223	GLITRE ENERGI PRODUKSJON AS	Drammen	VIKEN	72 AS	
Active	976623991	NORSK STÅL TYNPLATER AS	Fredrikstad	VIKEN	34 AS	
Active	998058996	FG KJØTTSENER AS	Oslo	OSLO	44 AS	
Active	932455463	SLEIPNER MOTOR AS	Fredrikstad	VIKEN	150 AS	
Active	951269778	MOELVEN MODUS AS	Ullensaker	VIKEN	298 AS	
Active	951898139	HILDING ANDERS NORWAY AS	Drammen	VIKEN	141 AS	
Active	995643316	NORILIA AS	Oslo	OSLO	58 AS	
Active	989186493	NORSUN AS	Oslo	OSLO	288 AS	
Active	980319652	TOMRA PRODUCTION AS	Lier	VIKEN	91 AS	
Active	82335092	NORSK WAVIN AS	Oslo	OSLO	66 AS	
Active	936612741	KLINGER WESTAD AS	Modum	VIKEN	88 AS	
Active	939378103	REICHHOLD AS	Fredrikstad	VIKEN	56 AS	
Active	911770636	VAJDA-PAPIR SCANDINAVIA AS	Drammen	VIKEN	108 AS	
Active	977194105	HTS BESAFE AS	Krødsherad	VIKEN	36 AS	
Active	935708745	CERTEX NORGE AS	Asker	VIKEN	135 AS	
Active	876597152	ETAC AS	Moss	VIKEN	39 AS	

Status	Organizational		Municipality	County	Number of Employees	Organization
	number	Company				form
Active	948936402	SALATMESTERN AS	Fredrikstad	VIKEN	159	AS
Active	914786827	VILOMIX NORWAY AS	Ringerike	VIKEN	26	AS
Active	965160922	FOODMAN AS	Aurskog-Høland	VIKEN	66	AS
Active	979657919	HEY DI AS	Lillestrøm	VIKEN	55	AS
Active	996386805	TEKNOTHERM MARINE AS	Halden	VIKEN	106	AS
Active	912696553	AASS BRYGGERI AS	Drammen	VIKEN	107	AS
Active	987223200	HAFSLUND PRODUKSJON AS	Indre Østfold	VIKEN		AS
Active	811651532	FISKCENTRALEN AS	Oslo	OSLO	69	AS
Active	879904412	ØSTFOLD ENERGI AS	Sarpsborg	VIKEN	55	AS
Active	914531616	WESTEND BAKERI AS	Oslo	OSLO	47	AS
Active	871200092	HANSEN PROTECTION AS	Moss	VIKEN	122	AS
Active	979479875	EUREKA LOGISTICS AS	Bærum	VIKEN	13	AS
Active	941730566	VIPO AS	Drammen	VIKEN	172	AS
Active	996707415	NORTEK AS	Bærum	VIKEN	89	AS
Active	991191984	CHEMRING NOBEL AS	Asker	VIKEN	150	AS
Active	984374135	PHARMATECH AS	Fredrikstad	VIKEN	153	AS
Active	933309827	ÅKRENE MEK VERKSTED AS	Lillestrøm	VIKEN	53	AS
Active	994341189	H - VINDUET FJERDINGSTAD AS	Øvre Eiker	VIKEN	70	AS
Active	990476357	KAPPA BIOSCIENCE AS	Oslo	OSLO	23	AS
Active	852671432	TRONRUD ENGINEERING AS	Ringerike	VIKEN	156	AS
Active	980488683	CARBOLINE NORGE AS	Lier	VIKEN	61	AS
Active	958272383	NORDIC LUNCH AS	Oslo	OSLO	153	AS
Active	979708076	FINSBRÅTEN AS	Oslo	OSLO	23	AS
Active	986942033	APPEAR AS	Oslo	OSLO	140	AS
Active	982722039	TOMRA SORTING AS	Asker	VIKEN	3	AS
Active	977028442	VARDAR AS	Drammen	VIKEN	4	AS
Active	938109753	STENQVIST AS	Drammen	VIKEN	67	AS
Active	918799141	LECA NORGE AS	Rælingen	VIKEN	75	AS
Active	846170642	ØSTFOLDKORN SA	Halden	VIKEN	16	SA
Active	936030327	HØIAX AS	Fredrikstad	VIKEN	106	AS
Active	813120232	VISTIN PHARMA AS	Oslo	OSLO	68	AS
Active	987634723	ØSTMØLLENE AS	Marker	VIKEN	57	AS
Active	950509910	EKORNS BEDS AS	Lillestrøm	VIKEN	73	AS
Active	987985240	BECTON DICKINSON NORWAY AS	Oslo	OSLO	26	AS
Active	995806797	SPLITKON AS	Modum	VIKEN	61	AS
Active	977293022	LOE RØRPRODUKTER AS	Øvre Eiker	VIKEN	81	AS
Active	998608511	SATEBA NORWAY AS	Ringerike	VIKEN	79	AS

Status	Organizational		Municipality	County	Number of Employees	Organization
	number	Company				form
Active	911655160	HELLEFOSS PAPER AS	Øvre Eiker	VIKEN	92	AS
Active	958204434	FRYDENBØ BOATS AS	Sarpsborg	VIKEN	22	AS
Active	915101739	AS PALS	Asker	VIKEN	85	AS
Active	917524297	ÅKEBERG SKOGLUNN PØLSEMAKERI AS	Oslo	OSLO	54	AS
Active	988921521	LEIV VIDAR AS	Ringerike	VIKEN	121	AS
Active	930614785	ORTOPEDITEKNIKK AS	Oslo	OSLO	151	AS
Active	984979193	ALNA AS	Vestby	VIKEN	69	AS
Active	957338690	NKT AS	Drammen	VIKEN	9	AS
Active	965395830	HANDICARE AS	Moss	VIKEN	97	AS
Active	936010229	FOSS AS FIBEROPTISK SYSTEMSALG	Drammen	VIKEN	63	AS
Active	991365427	FERSKVAREHUSET AS	Ullensaker	VIKEN	138	AS
Active	982792991	MOELVEN NUMEDAL AS	Flesberg	VIKEN	40	AS
Active	979975732	MJØRUD AS	Rakkestad	VIKEN	89	AS
Active	938106916	BUSKERUD BETONGVAREFABRIKK AS	Asker	VIKEN	66	AS
Active	886282842	FEIRING ASFALT AS	Lørenskog	VIKEN	11	AS
Active	963580207	NAGRAVISION AS	Oslo	OSLO	64	AS
Active	937948212	AS HADELAND GLASSVERK	Jevnaker	VIKEN	222	AS
Active	999065465	ETAC BIL AS	Lillestrøm	VIKEN	110	AS
Active	912792307	H-FASADER GLASSTEAM AS	Fredrikstad	VIKEN	96	AS
Active	912399095	BAKER HANSEN AS	Bærum	VIKEN	94	AS
Active	986375589	ARE TREINDUSTRIER ASKIM AS	Indre Østfold	VIKEN	111	AS
Active	916350678	VITUX AS	Oslo	OSLO	72	AS
Active	976876385	PRESENS AS	Oslo	OSLO	24	AS
Active	993191728	MONDELEZ NORGE PRODUCTION AS	Oslo	OSLO	144	AS
Active	947753967	HONNINGCENTRALEN SA	Ullensaker	VIKEN	19	SA
Active	931200348	HTS DYNAMICS AS	Drammen	VIKEN	80	AS
Active	987719818	SKEDSMO BETONG AS	Lillestrøm	VIKEN	21	AS
Active	986116710	SOPHIES MINDE ORTOPEDI AS	Oslo	OSLO	133	AS
Active	936787819	OCH ORTOPEDI AS	Oslo	OSLO	144	AS
Active	921075197	SMARTPANEL AS	Fredrikstad	VIKEN	46	AS
Active	997039297	IPOA AS	Råde	VIKEN	119	AS
Active	986351620	T & G ELEKTRO AS	Bærum	VIKEN	88	AS
Active	984684215	MASKINPAKKING AS	Asker	VIKEN	46	AS
Active	986076832	NEO MONITORS AS	Lillestrøm	VIKEN	48	AS
Active	933112993	ALF STRØM-LARSEN AS	Oslo	OSLO	84	AS
Active	985215294	NORVIGROUP NORWAY AS	Indre Østfold	VIKEN	45	AS
Active	981381394	MAUR BILPÅBYGG AS	Drammen	VIKEN	45	AS

Status	Organizational number	Company	Municipality	County	Number of Employees	Organization form
Active	915647774	W B SAMSON AS	Oslo	OSLO		262 AS
Active	984011202	AK MEKANISKE AS	Fredrikstad	VIKEN		93 AS
Active	810547472	BRØDR BERTTSEN AS	Ringerike	VIKEN		35 AS
Active	883370112	FAUN PHARMA AS	Vestby	VIKEN		43 AS
Active	950461470	KONECRANES AS	Oslo	OSLO		63 AS
Active	922693714	HOLTET PUKK & BETONG AS	Krødsherad	VIKEN		48 AS
Active	836874412	NEN-PRODUKTER AS	Fredrikstad	VIKEN		22 AS
Active	851970452	MYSEN KORNSILO OG MØLLE SA	Indre Østfold	VIKEN		17 SA
Active	980380122	GOLDFISH BOAT AS	Vestby	VIKEN		14 AS
Active	981982452	NÆRBAKST ØST AS	Lier	VIKEN		106 AS
Active	917031711	SLÅTTLAND MEK INDUSTRI AS	Rakkestad	VIKEN		41 AS
Active	897869462	FORCIT NORWAY AS	Lier	VIKEN		39 AS
Active	984783892	BRØDRENE RINGSTAD AS	Rakkestad	VIKEN		70 AS
Active	996330990	BAKERMESTER KLAUSEN AS	Drammen	VIKEN		97 AS
Active	951278017	MOELVEN EIDSVOLL AS	Eidsvoll	VIKEN		45 AS
Active	915613713	AS RÅDE MØLLE OG KORNSILO	Råde	VIKEN		15 AS
Active	924801026	BENESTAD SOLUTIONS AS	Lier	VIKEN		50 AS
Active	918167013	GUMMISERVICE PRODUKSJON AS	Råde	VIKEN		89 AS
Active	961592097	ASAK AS	Ringerike	VIKEN		42 AS
Active	912228738	SERO AS	Asker	VIKEN		64 AS
Active	980334511	BRATTÅS AS	Oslo	OSLO		86 AS
Active	921853181	AUTO-MASKIN AS	Lillestrøm	VIKEN		43 AS
Active	815062892	THERMO KING NORGE AS	Oslo	OSLO		44 AS
Active	989889389	FOODS AS	Drammen	VIKEN		3 AS
Active	920480322	NORILIA NORDIC AS	Oslo	OSLO		AS
Active	925836702	SHERWIN-WILLIAMS NORWAY AS	Lillestrøm	VIKEN		23 AS
Active	916079966	SOLBERG & HANSEN AS	Oslo	OSLO		50 AS
Active	835322632	METTLER-TOLEDO CARGOSCAN AS	Oslo	OSLO		51 AS
Active	997059565	TELEMARKHYTTER AS	Oslo	OSLO		6 AS
Active	916098804	SOLE AS	Sigdal	VIKEN		69 AS
Active	915034691	NITTEDAL TORVINDUSTRI AS	Nittedal	VIKEN		21 AS
Active	917871949	VEMA INTERIØR AS	Indre Østfold	VIKEN		25 AS
Active	983521908	BARCO FREDRIKSTAD AS	Fredrikstad	VIKEN		60 AS
Active	884344662	GLASOPOR AS	Oslo	OSLO		36 AS
Active	942652968	UVDAL MASKINFABRIKK AS	Nore og Uvdal	VIKEN		55 AS
Active	959079420	RINGERIKES KORNSILO SA	Ringerike	VIKEN		5 SA
Active	887308462	BRYNSLØKKEN AS	Vestby	VIKEN		16 AS

Status	Organizational number	Company	Municipality	County	Number of Employees	Organization form
Active	918435018	SOLBERG INDUSTRI AS	Fredrikstad	VIKEN		17 AS
Active	918278338	PETPACK DRIKKER AS	Aurskog-Høland	VIKEN		37 AS
Active	990374031	CIPAX AS	Aurskog-Høland	VIKEN		55 AS
Active	964878080	SKJELFOSS KORN AS	Indre Østfold	VIKEN		9 AS
Active	919595930	ITO PALLPACK AS	Oslo	OSLO		42 AS
Active	985974799	NORWEGIAN SPECIAL MISSION AS	Nannestad	VIKEN		56 AS
Active	915912850	NORXE AS	Fredrikstad	VIKEN		33 AS
Active	917780595	NRS AS	Oslo	OSLO		25 AS
Active	974887754	PROTEKET AS	Oslo	OSLO		96 AS
Active	987287608	GLOMMA KRAFTPRODUKSJON AS	Nes i Akershus	VIKEN		16 AS
Active	917939527	ÅLHYTTA AS	Ål	VIKEN		46 AS
Active	931683616	BJERTNÆS SAG AS	Jevnaker	VIKEN		46 AS
Active	944420649	TRONRUD ENGINEERING MOSS AS	Moss	VIKEN		69 AS
Active	917571929	SMEDSTUEN AS	Eidsvoll	VIKEN		32 AS
Active	919207965	TP-PRODUCTS AS	Drammen	VIKEN		53 AS
Active	959738769	MARITIM FOOD AS	Fredrikstad	VIKEN		50 AS

Appendix 3: Inquiries to the companies

Hello **Name of CEO**,

We would really appreciate help from **Name of firm** in connection with our master thesis

We are two students at BI Norwegian Business School who this spring will complete our master's degree. We are studying a *Master of Science in Business with a major in Accounting and Business Control*. For our master thesis, we have chosen to investigate how companies carry out profitability analysis (cash flow analyzes) using different profitability methods. We know that such methods are frequently utilized, based on research, but we know very little about how they are actually used in practice - this is what we now want to identify. The issue for our master's thesis is formulated as follows:

“How do enterprises in the production sector use the Net Present Value method when conducting project appraisal?”

For our master thesis, we are working together with our supervisor Pål Berthling-Hansen. He is an associate professor at the Department of Accounting, Auditing and Business Administration.

What do we want from you?

We want to receive as many NPV calculations as possible, and preferably in an Excel format if this is available. Project names can be removed and the calculation may be a couple of years old. These can be projects that have been invested in, or not invested in - depending on the result of the analysis.

Furthermore, we want you to conduct an online questionnaire. You are welcome to share the link to the questionnaire internally at your firm to relevant persons. This is to collect qualitative data on how companies carry out their analyzes. If it could be relevant to you, it is of high interest to us to have an interview with the company's CEO / CFO / CFO / controller.

You can find the questionnaire [HERE](https://bino.qualtrics.com/jfe/form/SV_dpayaAQknRBVqBw) (https://bino.qualtrics.com/jfe/form/SV_dpayaAQknRBVqBw)

The form takes around 10 minutes to complete. As a thank you for your help, after completing the questionnaire, you will receive access to a summary of a thesis where students have performed an analysis of how project appraisal is carried out in the real estate industry.

What can you get out of contributing to this task?

- You will receive the result of the assignment, which will give you an understanding of how your analyzes are carried out, compared to other firms' analyzes.
- You will be fully anonymous in the assignment.
- It is considered very positive to contribute to research in connection with a master's thesis.

Feel free to contact Emina Meschan (eminamesan@hotmail.com) or Martine Saur (martine.saur@live.no) for further information regarding our study. If there are other questions and want to get in touch with our supervisor, he can be reached by email pal.berthling-hansen@bi.no.

Best regards

Emina Meschan and Martine Saur

Inquiry 2:

Dear **Name of CEO**,

We refer to the inquiry below **Date of the first inquiry** in connection with our master's thesis.

As mentioned, we are two students at BI Norwegian Business School who, on the occasion of our master's study, want to study to follow the research question: "How do enterprises in the production sector use the Net Present Value method when conducting project appraisal?"

Based on this, we want help from **Name of firm** by receiving insight to as many NPV calculations as possible, as well as we want you to answer the questionnaire below. The NPV calculations can be fully anonymised and up to several years old. The questionnaire takes a maximum of 10 minutes to answer and is based on various questions regarding your practice around NPV analyzes. The survey can be found here:

https://bino.qualtrics.com/jfe/form/SV_dpayaAQknRBVqBw

As a thank you for your help, after completing the questionnaire, you will receive access to a summary from a similar assignment where students have carried out an analysis of how investment analysis is carried out in the real estate industry.

Feel free to contact Emina Meschan (eminamesan@hotmail.com) or Martine Saur (martine.saur@live.no) for further information about the study.

If you have other questions and want to get in touch with our supervisor, he can be reached by e-mail pal.berthling-hansen@bi.no.

Sincerely,

Emina Meschan and Martine Saur

Inquiry 3:

Dear **Name of CEO** - Are you fed up with our inquiries? Fear not, this is the last time we will contact you.

However, we would like to remind you of our inquiries dated **Date of the first inquiry** and **Date of the second inquiry**, and hope you have the opportunity to contribute to us in connection with our master's thesis.

Sincerely

Emina Meschan and Martine Saur

Appendix 4: Classification overview

Overall classification	General classification	Detailed classification
Contributed	Answered survey	Has answered the survey
	Answered survey and shared spreadsheet	Has answered survey and shared spreadsheets
	No/few official analyzes	No/few official analyzes in the company
	No/few official analyzes	No/few official analyzes in the company as it is a subsidiary
	Shared spreadsheets	Shared spreadsheets
Not contributed	No reply	No reply
	Not able to participate	Not able to contribute due to Policy rules
	Not able to participate	Not able to participate due to capacity
	Were not able to contact	Email not delivered
	Were not able to contact	Were not able to contact

Appendix 5: Spreadsheet from firm 1

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Investment	-150,000	0	0	0	0	0	0	0	0	0	0	0	0	0
EBITDA, plant	0	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Working capital, plant	0	-2,500	0	0	0	0	0	0	0	0	0	0	0	0
EBIT Paving 1	0	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
Working capital, Paving 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net cashflow	-150,000	51,000	53,500	53,500	53,500	53,500	53,500	53,500	53,500	53,500	53,500	53,500	53,500	53,500
Positiva nettoflöden	0	51,000	53,500	53,500	53,500	53,500	53,500	53,500	53,500	53,500	53,500	53,500	53,500	53,500
Negativa nettoflöden	-150,000	0	0	0	0	0	0	0	0	0	0	0	0	0
Payback	-150,000	-99,000	-45,500	8,000	61,500	115,000	168,500	222,000	275,500	329,000	382,500	436,000	489,500	543,000
	3.85	0.00	0.00	3.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Payback (year)		3.9												
Current value cashflow	-150,000	44,348	40,454	35,177	30,589	26,599	23,130	20,113	17,489	15,208	13,224	11,499	10,000	8,454
Net Present Value		213,460												
Reinvestment rate														
Return on investment, including reinvestment														
Return on investment, excluding reinvestment														

Appendix 6: Spreadsheet from firm 2

Year	Year											Comments	
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031		
Investment	-8 417												
Reduced manning	4 500	4 500	4 500	4 500	4 500	4 500	4 500	4 500	4 500	4 500	4 500	4 500	
Reduced use of vehicles	1 800	1 800	1 800	1 800	1 800	1 800	1 800	1 800	1 800	1 800	1 800	1 800	
Improved quality (red. need of cleaning)	400	400	400	400	400	400	400	400	400	400	400	400	
Net cash-flow before tax	-8 417	6 700	6 700	6 700	6 700	6 700	6 700	6 700	6 700	6 700	6 700	6 700	
Tax	22%	-1 289	-1 307	-1 324	-1 339	-1 353	-1 365	-1 376	-1 385	-1 394	-1 402	-1 402	
Net cash-flow after tax	-8 417	5 411	5 393	5 376	5 361	5 347	5 335	5 324	5 315	5 306	5 298	5 298	
Depreciation	10%	842	758	682	614	552	497	447	403	362	326	292	
Net booked value investment		7 575	6 818	6 136	5 522	4 970	4 473	4 026	3 623	3 261	2 935	2 643	
Hurdle rate:													10%
Pay-back:													2,00 years
Internal rate of return:													63,5 %
Net present value:													1000 NOK 22 269

Appendix 7: Spreadsheet from firm 3

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Sold units											
Total units sold	360 000	380 218	390 483	350 935	350 935	350 935	350 935	350 935	350 935	350 935	350 935
Production											
Produced units	480 000	463 600	476 198	404 769	404 769	404 769	404 769	404 769	404 769	404 769	404 769
Cost per unit produced (excl. Depreciation)	61	61	61	50,6	52	53	54	55	56	57	58
Produced goods	288 000	278 208	285 720	242 862	242 862	242 862	242 862	242 862	242 862	242 862	242 862
% change cost per unit produced (excl. depreciation)		1,0 %	3,0 %	4,0 %	4,0 %	5,0 %					
Cost per unit produced (excl. Depreciation)				76,5	78	79	80	81	82	84	85
Cost per unit produced											
Yield requirements		15 %									
Investments / sales / depreciation											
Investments				- 53 500 000							
Sale of equipment											
Depreciation				5 354 762	5 354 762	5 354 762	5 354 762	5 354 762	5 354 762	5 354 762	4 783 333
Total depreciation				5 354 762	5 354 762	5 354 762	5 354 762	5 354 762	5 354 762	5 354 762	4 783 333
Investment											
Investments / sales				- 53 500 000							
Payments											
Payments	- 20 483 478			- 20 903 347	- 21 321 414	- 21 747 842	- 22 182 799	- 22 628 455	- 23 078 984	- 23 540 564	
Cash flow	- 73 993 478			- 20 903 347	- 21 321 414	- 21 747 842	- 22 182 799	- 22 628 455	- 23 078 984	- 23 540 564	
Today's situation / baseline											
Payments				- 30 964 863	- 31 429 336	- 31 900 776	- 32 379 288	- 32 864 977	- 33 357 952	- 33 858 321	- 34 366 196
Payments				- 30 964 863	- 31 429 336	- 31 900 776	- 32 379 288	- 32 864 977	- 33 357 952	- 33 858 321	- 34 366 196
Cash flow				- 43 028 614	- 43 028 614	- 43 028 614	- 43 028 614	- 43 028 614	- 43 028 614	- 43 028 614	- 43 028 614
Net cash flow				- 43 028 614	- 43 028 614	- 43 028 614	- 43 028 614	- 43 028 614	- 43 028 614	- 43 028 614	- 43 028 614
Accumulated cash flow				- 43 028 614	- 86 057 228	- 129 085 842	- 172 114 456	- 215 143 070	- 258 171 684	- 301 200 298	- 344 228 912
Present value 15 years				12 126 755							
Payback				6 years							
IR 15 years				24 %							

	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Sold units														
Total units sold	350 935	350 935	350 935	350 935	350 935	350 935	350 935	350 935	350 935	350 935	350 935	350 935	350 935	350 935
Production														
Produced units	404 769	404 769	404 769	404 769	404 769	404 769	404 769	404 769	404 769	404 769	404 769	404 769	404 769	404 769
Cost per unit produced (excl. Depreciation)	59	61	62	63	64	65	67	68	70	71	72	74	75	77
Produced goods	242 862	242 862	242 862	242 862	242 862	242 862	242 862	242 862	242 862	242 862	242 862	242 862	242 862	242 862
% change cost per unit produced (excl. depreciation)														
Cost per unit produced (excl. Depreciation)	86	87	89	90	91	93	94	96	97	99	100	102	103	105
Yield requirements														
Investments / sales / depreciation														
Investments														
Sale of equipment														
Depreciation	- 4 783 333	- 4 783 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333
Total depreciation	- 4 783 333	- 4 783 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333	- 333 333
Investment														
Investments / sales														
Payments														
Payments	- 24 011 375	- 24 491 603	- 24 981 435	- 25 481 063	- 25 990 685	- 26 510 488	- 27 040 708	- 27 581 523	- 28 133 153	- 28 695 816	- 29 269 732	- 29 855 127	- 30 452 230	- 31 061 274
Cash flow	- 24 011 375	- 24 491 603	- 24 981 435	- 25 481 063	- 25 990 685	- 26 510 488	- 27 040 708	- 27 581 523	- 28 133 153	- 28 695 816	- 29 269 732	- 29 855 127	- 30 452 230	- 31 061 274
Ecdf's situation / baseline														
Payments	- 34 881 689	- 35 404 914	- 35 935 988	- 36 475 028	- 37 022 153	- 37 577 486	- 38 141 148	- 38 713 285	- 39 293 964	- 39 883 374	- 40 481 624	- 41 088 849	- 41 705 181	- 42 330 759
Cash flow	- 34 881 689	- 35 404 914	- 35 935 988	- 36 475 028	- 37 022 153	- 37 577 486	- 38 141 148	- 38 713 285	- 39 293 964	- 39 883 374	- 40 481 624	- 41 088 849	- 41 705 181	- 42 330 759
Net cash flow	10 870 314	10 813 312	10 954 553	10 993 864	11 031 468	11 068 987	11 106 440	11 143 743	11 180 911	11 218 057	11 255 189	11 292 307	11 329 411	11 366 502
Accumulated cash flow	42 597 141	53 510 453	64 465 006	75 458 970	86 490 439	97 557 426	108 657 866	119 789 608	130 950 419	142 137 977	153 349 889	164 583 596	175 838 542	187 106 027

Appendix 8: Spreadsheet from firm 4

Kontantstrømsanalyse og lønnsomhetsberegning:										
Alle beløp i TNOK										
Kostnadsendringer	År 0	År 1	År 2	År 3	År 4	År 5	År 6	År 7	År 8	År 9
Endret bruttofortjeneste		2 700	2 700	2 700	2 700	2 700	2 700	2 700	2 700	2 700
Endrede lønnskostnader		-400	-400	-400	-400	-400	-400	-400	-400	-400
Endrede driftskostnader										
Offentlige bidrag/støtte										
Annen tilgang av midler										
Sum besparelser	0	2 300	2 300	2 300	2 300	2 300	2 300	2 300	2 300	2 300
Investeringsbeløp (Totalbeløp)	6 300									
Årlig kontantstrøm	-6 300	2 300	2 300	2 300	2 300	2 300	2 300	2 300	2 300	2 300
Akkumulert kontantstrøm	-6 300	-4 000	-1 700	600	2 900	5 200	7 500	9 800	12 100	14 400
Internrente	34 %					Avkastningskrav	15,0 %			
Nåverdi (15%)	4 675					Årlig avskrivning	900,00			
Pay back tid (år / mnd)	2,7	31,869565					Avskrivningstid	7		
Verbal kommentar m.h.p. lønnsomhet (sensitivitetsanalyse)					Kursforutsetninger:	Euro 10,25				

Appendix 9: Spreadsheet from firm 5

STRUCTURE X												
Savings / Cost reductions												
	år 0	år 1	år 2	år 3	år 4	år 5	år 6	år 7	år 8	år 9	år 10	
Direct variable Costs												
Direct salary		4 125 036	4 249 787	4 376 250	4 507 538	4 642 764	4 782 047	4 925 508	5 073 274	5 225 472	5 382 236	
Raw materials-incoming shipping		0	0	0	0	0	0	0	0	0	0	
Commodity price		0	0	0	0	0	0	0	0	0	0	
Raw materials - receipt and handling		1282 425	1282 425	1282 425	1282 425	1282 425	1282 425	1282 425	1282 425	1282 425	1282 425	
Packaging		0	0	0	0	0	0	0	0	0	0	
Operating costs												
Wash		0	0	0	0	0	0	0	0	0	0	
Technical and Maintenance		0	0	0	0	0	0	0	0	0	0	
Logistics, Warehousing, Distribution, Picking		0	0	0	0	0	0	0	0	0	0	
Shipping and Terminal cost Finished goods		-1967 179	-1967 179	-1967 179	-1967 179	-1967 179	-1967 179	-1967 179	-1967 179	-1967 179	-1967 179	
Depreciation												
Rent Construction and Land		0	0	0	0	0	0	0	0	0	0	
Energy		180 779	180 779	180 779	180 779	180 779	180 779	180 779	180 779	180 779	180 779	
Water and wastewater		0	0	0	0	0	0	0	0	0	0	
Management / Administration		0	0	0	0	0	0	0	0	0	0	
Increased CM from 50% of annual sales growth		0	2 500 000	2 500 000	2 500 000	1 250 000	625 000	0	0	0	0	
Cost increases												
Direct variable Costs												
Direct salary		0	0	0	0	0	0	0	0	0	0	
Raw materials-incoming shipping		-810 000	-810 000	-810 000	-810 000	-810 000	-810 000	-810 000	-810 000	-810 000	-810 000	
Commodity price		0	0	0	0	0	0	0	0	0	0	
Raw materials - receipt and handling		0	0	0	0	0	0	0	0	0	0	
Packaging		0	0	0	0	0	0	0	0	0	0	
Operating costs												
Wash		0	0	0	0	0	0	0	0	0	0	
Technical and Maintenance		0	0	0	0	0	0	0	0	0	0	
Logistics, Warehousing, Distribution, Picking		0	0	0	0	0	0	0	0	0	0	
Shipping and Terminal cost Finished goods		0	0	0	0	0	0	0	0	0	0	
Depreciation												
Rent Construction and Land		-2 439 911	-2 439 911	-2 439 911	-2 439 911	-2 439 911	-2 439 911	-2 439 911	-2 439 911	-2 439 911	-2 439 911	
Energy		0	0	0	0	0	0	0	0	0	0	
Water and wastewater		0	0	0	0	0	0	0	0	0	0	
Management / Administration		0	0	0	0	0	0	0	0	0	0	
Cash flow effect (EBITDA effect)		371 150	2 994 901	3 122 365	3 253 652	2 138 878	1 653 161	1 171 623	1 319 388	1 471 586	1 628 350	
EBDIT improvement		371 150	2 994 901	3 122 365	3 253 652	2 138 878	1 653 161	1 171 623	1 319 388	1 471 586	1 628 350	
One-time costs												
Investments build rental basis		-21 250 000										
Investment Cold, Steam, construction		-9 000 000										
Costs of downsizing		-2 300 000										
Disassembly - Transport - Reassembly Machines		-5 000 000										
Cleaning up buildings / premises		-6 000 000										
Unforeseen (10%)		-2 190 000										
		-24 090 000	371 150	2 994 901	3 122 365	3 253 652	2 138 878	1 653 161	1 171 623	1 319 388	1 471 586	1 628 350
Present value 10 years		-11 979 429										
Present value 5 years		-15 381 224										
Present value 3 years		-18 931 587										
Payback		10,1										
IRR		-19 %										

Appendix 10: Spreadsheet from firm 6

Product 1 to Product 2	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
Product 1 Avoided	200	640	490	240	240	240	200	200	200	100	0	2 750
Product 2	-360	-2 085	0	0	0	0	0	0	0	0	0	-2 445
Product 1 Demolition	0	0	-100	0	0	-100	-100	-100	-100	-100	0	-600
Severance	0	-683	0	0	0	0	0	0	0	0	0	-683
Total Product and One-Time Charges	-160	-2 128	390	240	240	140	100	100	100	100	0	-978
Setamines: Lower Price to retain Customers	-40	-160	-186	-196	-201	-201	-201	-201	-201	-201	-201	-1 988
Setamines: Raw Material Costs	109	436	507	535	547	547	547	547	547	547	547	5 419
Setamines: Freight	-37	-129	-153	-162	-166	-166	-166	-166	-166	-166	-166	-1 646
Setamines: Period Costs	154	617	771	771	771	771	771	771	771	771	771	7 710
Incremental Methylated: Contribution Margin	0	103	240	343	343	343	343	343	343	343	343	3 090
Incremental Methylated: Maintenance	0	0	-65	-65	-65	-65	-65	-65	-65	-65	-65	-582
EBITDA Impact (Other incremental cashflows)	186	867	1 115	1 226	1 230	1 230	1 230	1 230	1 230	1 230	1 230	12 003
Book Depreciation	-16	-321	49	-88	-64	-40	-20	1	21	31	42	-405
Asset Write off	0	0	-160	0	0	0	0	0	0	0	0	-160
CashFlow												
Product	-160	-2 128	390	240	240	140	100	100	100	100	0	-978
EBITDA (Other incremental Cashflows)	186	867	1 115	1 226	1 230	1 230	1 230	1 230	1 230	1 230	1 230	12 003
Taxes on incremental earnings	13	83	-176	-229	-234	-215	-220	-225	-230	-233	-259	-1 925
Working Capital Inflow (outflow)	0	276	-99	-74	0	0	0	0	0	0	0	-103
Net Cash Inflow (Outflow)	39	-901	1 230	1 163	1 236	1 155	1 110	1 105	1 100	997	867	9 100
K Euro NPV @ 12,00 %												4 628
IRR												150 %
Payback (post closeout)												1,1

Appendix 11: Preliminary Thesis Report

1.0 Introduction

The first section of our paper will go over the context and motivation for our research question.

1.1 Background

The production sector, also referred to as the secondary or manufacturing sector, includes all human activities that convert raw materials into finished goods. In this paper, we will look at capital investments conducted by Norwegian small and medium-sized enterprises (SMEs) in the production sector, which includes a variety of industries. Even though investments are not the primary activity of these corporations, there are comprehensive investment activities in, e.g., acquisitions, property, machinery. Furthermore, the Covid-19 pandemic has highlighted the fragility of globally dispersed manufacturing supply chains and the significance of a mature production sector as the sector contributes to economic growth globally (CDC Group, 2020). Thus, we are intrigued by the sector's decision-making process of capital investment activities.

1.2 Area of study

A fundamental concept in financial economics describes how companies should make capital investment decisions. Specifically, the decision process focuses on net present value (NPV), cash flows (CF), and assessing the project risk (Pinches & Lander, 1997). In economic theory, projects with a positive net present value are profitable, while projects with a negative net present value are unprofitable. Thus, the investment analyses assist in mapping the project value and risk prior to a company determining to invest in a project. Most businesses benefit from understanding investment theory and methods. That is the case as most businesses make investments of some kind, whether small or large. However, despite the fact that a large amount of research has been conducted on various investing methods, we have identified that a low degree of research has been carried out regarding how the NPV analysis is carried out in practice.

This literature gap became evident as we dug deeper into previous research and publications and discovered that there is very little information about how the

company conducts its investment analyses. We thus want to take this to our advantage and (1) investigate how companies conduct their investment analyses and (2) identify whether there are any differences or errors in their methods, and (3) examine if there are any other elements, apart from findings from the investment analysis, that influence whether or not an investment should be conducted. For example, based on knowledge from previous subjects, we know that they use a discounting of future cash flows. That is standard practice in investment analysis; however, we know little about what numbers they use.

2.0 Literature Review

For the second part of this thesis, we will provide an overview of present knowledge on investment analyses and investigate whether there are any knowledge gaps regarding this subject. In addition, we will discuss how our research paper intends to fill the identified literature gap.

2.1 Capital Budgeting Technique

During our five years as business students, it has become clear that Net Present Value (NPV) is the preferred Capital Budgeting Technique (CBT) to use when estimating the value of a project or an investment. That is underlined in several studies, articles, and books.

Berman et al. (2013) state in their book that NPV always is the preferred method when analyzing capital expenditures. This is related to the method's capacity to account for the time value of money. Additionally, the method's capacity to account for the cost of capital, as well as present the conclusion in today's money value, are highlighted as essential aspects. In their conclusion, they discuss how the Payback Period (PBP) and Internal Rate of Return (IRR) normally are used for discussions and presentations (Berman et al., 2013).

On the other hand, Alles et al. (2021) state that the PBP is the preferred method for newly established SMEs, but that the usage of NPV increases as the company's age increases. In their conclusion, they state that PBP is the most commonly used CBT due to time, cost, and knowledge related to it. As a result, it's easy to see why the use of NPV rises as the company gets older: their understanding, as well

as their access to capital and highly qualified employees, has most likely improved. This is emphasized by Brijlal & Quesada (2009), who argue that financial analysts with a master's degree in Business Administration utilize more advanced approaches, such as NPV, whereas analysts with no or a low degree employ simpler methods, such as PBP.

Further literature supports the significance of how ratios, rates of change, and considerations are used in the cash flow components of the modeling. The different ratios, rates, and considerations can drastically change a cash flow model (González Jiménez & Blanco Pascual, 2008). González Jiménez and Blanco Pascual (2008) investigated the significance of capital budgeting decision support using NPV models for project risk, return, and value analysis. Their findings emphasized the importance of modeling generality, simplicity, and flexibility to avoid unnecessary complexity in large projects. Furthermore, each assumption we take into account complicates the model; as a byproduct, only the project's integral assumptions should be included.

In 2011, Brunzell et al. studied which CBT is most frequently used across the five Nordic countries. The results were clear; NPV is the most commonly used CBT, with a total of 41.29 percent using it as their main method. Based on this, we can be sure that NPV is the most used method in the area we are going to investigate, namely Norway.

2.2 Net Present Value

As stated in section 2.1, we identify NPV as the most frequently used method when estimating the value of an investment. Further, we want to investigate present knowledge regarding how these analyses are carried out in practice.

After searching through various databases on relevant keywords, such as "the use of NPV" and "survey of NPV," we have not found any relevant research on how the NPV analysis is carried out in practice. We only found articles with information about what an NPV analysis is or how it should be conducted in theory by conducting these searches. As a result, the search for information helped us identify a possible knowledge gap.

2.3 Knowledge Gap in Prior Research

Based on our literature review, we have identified the most frequently used CBT; NPV. The NPV approach is the most commonly used CBT in the Nordic countries, according to Brunzell et al. (2011), which includes the country we want to study; Norway. That is also underlined by Berman et al. (2013), which state that NPV is the preferred method when analyzing capital expenditures. As our review confirms that NPV is the most used CBT in practice, we do not want to investigate which investment techniques are most used, based on the fact that we assume that NPV is the preferred technique.

After searching back and forth in various databases, we have clearly identified a literature gap regarding the NPV analysis: There is no information on how companies conduct these analyses. By this, we mean that we do not find any information on whether they use values before or after-tax, whether they take inflation into account or not, whether they use the total or equity method when estimating the cash flow, how they estimate their required rate of return, whether they assume that the project has an infinite life or uses a residual value for the cash flow, and whether they use the direct or indirect method when estimating the cash flow. We want to cover this literature gap by examining how companies in a given sector carry out their analyses.

In addition to the fact that we do not find any information on how the analyzes are carried out in practice, we also find little research done on what the analyzes are used as an assessment basis for. That is an important question because the NPV analysis can be complex and, therefore, difficult to use as a basis for discussion. Based on this, we suspect that several factors can be used as an assessment basis regarding a potential investment. This suspicion was reinforced by a statement from Berman et al. (2013), who emphasized that a weakness of the NPV analysis is that they can be difficult to explain and further hard to use in discussions and presentations. Based on this statement, they emphasize that the PBP and IRR method is more frequently used for discussion and presentation. This substantiates that there may be other decisions that may be the basis for decision-making regarding an investment.

3.0 Research Question and Hypotheses

In the third section of our paper we will identify our research question and our hypothesis.

3.1 Problem definition

As our literature review confirms, there are several CBTs that are widely used when it comes to decision-making regarding an investment. The literature review did confirm our thought about the most used investment CBT; Net Present Value. However, the literature review did not help us identify how these analyses are conducted in practice.

The purpose of this research paper is thus to analyze how small and midsize companies in the Norwegian production sector use NPV analysis. We know from previous research that these investment methods are often used in practice to calculate an investment's present value. However, there is a low degree of knowledge on how it is implemented in practice. Therefore, the goal is to identify differences in how small and midsize enterprises (SMEs) carry out these analyzes.

3.1.1 Research Question

“How do small and midsize enterprises in the production sector use the Net Present Value analysis when calculating the present value of a future investment object?”

3.1.2 Keywords

- Net Present Value
- Cash Flow
- Investment Analysis
- Investment Method
- Investment Appraisal
- Capital Budgeting Techniques
- Cost of Capital
- Project valuation

3.2 Hypothesis

Since there is little to no research on the numbers to the calculations of the investments analysis, we are interested in identifying which numbers, methods, requirements, estimations, and assumptions the corporations are implementing

in their calculations; (1) numbers before or after-tax, (2) nominal or real numbers, (3) total capital or the equity method, (4) which return requirement, (5) how they estimate their required rate of return, (6) assumption: project with infinite life or use of residual value, (7) direct or indirect cash flow method. Of course, a corporation can in the composition of an investments analysis differ in its numerous prerequisites; as such, we have three hypotheses that we want to test in this paper:

1. *We believe that corporations in the same industry use different numbers as the basis for their investment analysis.*
2. *We believe that the investment analysis of most corporations has an error in their calculations.*
3. *We believe that there are other factors that contribute to making decisions regarding whether an investment should be carried out, apart from the results of the NPV analyzes.*

4.0 Research Methodology

The fourth section of the study aims to discuss the chosen methodology for our study. The methodology is a structure that delivers the essential data to support our research question's conclusion. We will discuss our choice of research method and design used in our paper, how it relates to our research topic, and assess its validity and novelty. In addition, we will also present the delimitation for our research.

4.1 Research Method

Saunders (2015) defines research methods as “*techniques and procedures used to obtain and analyze data*” (Saunders, 2015, p.4) We acknowledge that secondary data is more easily obtained, however, there is no recent data that could be used for our purposes. This became clear to us after conducting our literature review. To investigate calculations in the investment analysis for SMEs, in order to fill the identified literature gap, we need to obtain the investment analysis from the corporations and preferably conduct surveys. For that reason, we are aiming to do primary data collection. Primary data is defined as “*original data collected for a specific research goal*” (Hox & Boeije, 2005, p. 593). Since we are aiming to answer how NPV is carried out

in practice, we need to consider the methods in obtaining and analyzing the data. We will, in this subsection, consider the quantitative and qualitative methods.

4.1.1 Quantitative method

Quantitative research methods are based on quantifying and generalizing the results of a sample from a larger population through surveys. The information is gathered using a questionnaire, for example, with either fixed options or a combination of options and open-ended questions. Data can be gathered by participants filling out a form, calling in, or conducting an interview. The main difference is that respondents have less freedom to answer questions openly because they are looking for directions or trends in the sample to answer the research questions. The advantage of such a survey is that the responses are easier to analyze and quantify than in a qualitative survey. The goal is to compare, which is accomplished by asking similar questions to all respondents. A quantitative survey makes it much easier to collect large amounts of data more efficiently, increasing the significance of the results. The disadvantage of the quantitative method is that the measurements may be interpreted as qualitative data that has been "forced" into numerical form, thereby questioning the validity (Bell et al., 2019).

4.1.2 Qualitative method

Qualitative research is a research strategy that favors words over numbers in data collection and analysis. It is an inductive, constructionist, and imperative research design in general. Qualitative data is typically collected through interviews and, unlike quantitative data, is not quantifiable to the same extent. The qualitative survey results and the analyses that follow are thus distinct from quantitative data analyses. According to the literature, qualitative data is typically collected through observations, in-depth interviews, or group interviews. In comparison to a quantitative survey, the sample size is relatively small in order to obtain a diverse and descriptive database. This could be a disadvantage of the method because the small sample size will make quantifying certain aspects of the research difficult (Bell et al., 2019).

4.2 Research Design

Research design is a “*plan of how you will go about answering your research question*” (Saunders, 2015, p.163). In this research paper, we will collect data using the qualitative research method. We recognize our research design as qualitative as our surveys will consist of in-depth answers where the respondents are able to express their opinions and thoughts. The choice for the method is based on the aftermath of the collection process; the analysis. The data used for the purpose of this paper is easier to analyze with the identified method, in addition to increasing the validity of our findings. Our objective is to collect data through both questionnaires, as well as by gaining insight into the company's own spreadsheets. A questionnaire is a data collection method where a large number of people respond to the same set of questions in a prearranged order (Saunders, 2015). This is a time-saving primary data collection method that ensures a large number of responses in a short period of time. Even though some people argue that questionnaires have several drawbacks (DeFranzo, 2012), such as misunderstandings and a lack of control over the number of responses received, we have only found benefits to using them for our thesis: it ensures that more people within a company are able to answer. As a result, we avoid that one person responds on behalf of an entire company, as there can be large differences internally between the companies. We will collect our responses through a self-composed questionnaire sent out to the respondents by email.

4.2.1 Basis for selecting the method

We presume that a qualitative survey is the right approach based on our topic area. By distributing questionnaires with open-ended questions to key players in the sector and analyzing their models, we will have a good enough database to answer our research question. We chose the production sector because we believe the diversity of industries will provide us with a database that is generalizable to the sector as a whole.

We presume that the collected spreadsheets and the generated questionnaire will further our understanding of their investment activities. It is essential and

critical that we are professionally updated and possess good knowledge of the subject to generate an appropriate questionnaire and interpret the results. The research will build on existing studies, teaching materials, work experience, and literature reviews. As the sector includes several industries, we presume that the answers we receive will give us a solid foundation for analyzing the methods used by market participants and, to some extent, generalizing the results.

Finally, we acknowledge that there are time constraints in primary data collection due to the master thesis given deadline, and it is natural that we do not reach as many participants as we would prefer. As a result, the responses are not as generalizable as those obtained in a quantitative survey.

4.3 Validity of the Research

When it comes to questionnaires, internal validity refers to whether the findings from the questionnaire is able to answer our research question and hence measure what we want it to measure (Saunders, 2015). Based on this, we want to discuss whether our chosen research method can answer our research question. The qualitative survey allows for greater depth and, as a result, a better understanding of the research area. That improves the result's internal validity, and it is considered very good if the correct questions are asked in the distributed questionnaire. Furthermore, the qualitative survey provides observations in the form of words, enriching and clarifying the analysis.

4.3.1 Description of the data

We believe that questionnaires, rather than in-depth interviews, are a better way to answer our research question because they allow us to get feedback from a large number of employees. Since an in-depth interview had probably only been done on one person in the company, and we had therefore received one answer on behalf of an entire company, we consider this a poor research method for our thesis. Additionally, in-depth interviews are more time-consuming. By using questionnaires, we may identify how a firm performs as a whole, whether there are differences within the company, and whether employees are following their superior's instructions or not. In addition, we

also want access to any spreadsheets that have been used to estimate the NPV of any future investment objects. We realize that getting this information from companies might be difficult, but we believe it is a valuable source of information if they are willing to share it with us.

4.4 Novelty of the Research

The novelty of the research refers to whether the research is novel, that is, whether the research will lead to new knowledge and hence fill a knowledge gap (Research Synergi Institute, 2019). Therefore, we can most definitely say that our research will contribute to more excellent knowledge in this field. There is a clear knowledge gap regarding how the NPV analysis is carried out in practice.

4.5 Delimitations

The selection of companies we want to analyze is limited to companies in the production sector. That includes all companies that develop products, such as equipment and machines. The justification for this is that we know multiple significant investments are being made in this field, and minimal research has been done regarding their investment analyses. After segmenting for the production sector, we received a spreadsheet from Proff Forvalt of a total of 10 001 companies. As a result, we had to impose a number of delimitations. For simplicity, we will limit our analysis to include Norwegian companies located in Oslo and nearby municipalities such as Asker, Bærum, Lørenskog, and Lillestrøm.

First and foremost, we want to set a limit by looking exclusively at limited companies, and thus excluding company forms such as public listed companies and sole proprietorships. Further, we only want to investigate SMEs; this implies that we will only look at businesses with a workforce of 1 to 100 employees (NHO, n.d.). Additionally, we specified that the companies must be operational as of 2021. As a final criterion for the companies we want to look into, we set a delimitation that the operating revenues must be greater than NOK 50 million.

Based on the stated delimitations, we have identified a total of 75 firms that we would like to approach in order to gain insight into their investment analysis. We identified these companies through the Norwegian information provider Proff Forvalt. The identified firms are presented in Table 1 in the Appendix.

5.0 Plan to Completion

We will begin collecting data for our thesis as soon as we receive feedback on our Preliminary Thesis Report. We assume that the questionnaire responses will take some time; thus, we plan to collect and process the data by the end of March 2022. See the Appendix for the questionnaire. We also hope to have obtained spreadsheets from some of the companies by this time. We have identified 74 companies in the production sector that we will contact to ensure that we have enough data to answer the identified research question. Because we anticipate a long response time, we intend to send reminders to companies on a regular basis in the hopes of minimizing the response time. Furthermore, we plan to begin analyzing the findings in April and estimate to use around two months on this work. Both the writing of the introductions, methodology, and theory must be completed before we begin the analysis. As a result, we plan to finish the writing by the beginning of June, allowing us to use the final month before the deadline to read through the thesis and polish our work.

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