ABSTRACT

Title
Evaluating Business Intelligence Investments - is comparative evaluation enough?

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Five key words
Business Intelligence investment, Ex-ante evaluation, Financial appraisals, Intangible benefits, Multiple case study

Purpose
The purpose of the study is to evaluate and describe how three large companies with Swedish presence have coped with the investment appraisal ex-ante a purchase of a BI system. Further, the paper strives to investigate how the companies evaluated the perceived benefits, which are of intangible nature and hence difficult to quantify.

Methodology
The study consists of qualitative data collected as primary data from semi-structured interviews, which is analysed with an abductive approach.

Theoretical perspectives
The field of ex-ante evaluation in Business Intelligence systems is weakly researched and previous research has identified a gap between practitioners and academia.

Empirical foundation
The data consist of three large companies with operations in Sweden who have within the last year invested in a Business Intelligence system. The empirical data was divided based on the analytical framework, which was operationalized into categories that constitute the fundamental basis of the interview guide.

Conclusions
The thesis concludes that the methods used in the studied cases are of comparative nature and no thorough attempt to financially evaluate the BI investments were done. This was not perceived as an issue amongst the majority of the practitioners. However, as these types of investments will increase going forward alongside digitalization, the understanding for the financial return on capital employed should be of paramount importance to better understand, despite the inherent difficulties of assessing quantitative value to intangible benefits.
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1. Introduction

In the following chapter, a background of the study’s subject is given and further on problematized, which falls into a question formulation and a purpose. The chapter ends with a definition and an outline.

1.1 Background

Already in 1988, Zuboff’s In the Age of The Smart Machine: The Future of Work and Power, clearly stated the upcoming impacts from increased information in the workplace, deriving from investments in information technology (“IT”). Zuboff (1988) elaborated regarding how information is related to reality, and how it creates the reality perceived by organisations. Information can be seen as a mapping of a pre-existing world, hence creating new realities and lifts up factors or processes that have previously gone unnoticed, allowing new decision-making approaches, opportunities and ability to prioritise (Kallinikos, 2011).

Digitalization could at an early stage be seen in production and manufacturing organizations, where information systems (“IS”) systems in production were implemented to streamline and digitize the operations (Kaplan, 1986). The term IT has drastically expanded to include many different systems and is today an important component of the daily operations within almost all companies and its importance will without a doubt continue to grow even further in the coming years (Hawking & Sellitto, 2010). With continuously increasing amounts of data readily obtainable, sorting, storing and retrieving data becomes yet more crucial. This is usually done in Enterprise Resource Planning systems (“ERP”), which has grown to include vast amounts of transactional data in many companies. This data is usually handled via some sort of decision support system (“DSS”) in order to prioritise and present information, eventually laying the ground for operational decisions. The magnitude of companies trying to utilize their data and create a competitive advantage has rapidly increased, which means that investments in systems enabling data handling, storage, and decision making have increased significantly (Hawking & Sellitto, 2010).

During the 1970s and 80s, major IT/IS investments in US companies did not render corresponding productivity growth in relation to expectations, which gave rise to what later became to be called the productivity paradox. This relationship and dynamic became poorly understood, and while the IT revolution was ongoing, it was stated “You can see the computer age everywhere but in the productivity statistics.” (Solow, 1987). One dimension of the productivity paradox is according to Brynjolfsson (1993) the difficulty managers found in justifying their investments in IT. Particularly, the difficulties in
measuring benefits and costs of IT/IS investments created uncertainties and hence restraints. Given the difficulties, evaluation of IT/IS investments is often ignored or carried out inefficiently because of it being too complex (van Grembergen, 2002).

The investments in these systems during 2017 were according to Moore (2017) approximately 18.3 billion USD. This makes the area of modern information technology and decision support systems important to evaluate, given a large amount of shareholders’ capital spent. One of the recent developments within the area of information technology is found within the latest expansion of DSS (Gray, 2003), namely Business Intelligence (“BI”) systems. Just as Zuboff stated in 1988 that IT has major implications arising from the two characteristics, namely automotive and informative, BI systems help organisations to handle both these aspects, i.e. automate the gathering and presentation of information, as well as increase the amount of valuable information readily available for decision makers. Aligned with the purpose of increased information as put forth by Kallinikos (2011), BI strive to bring new realities to organisations, allowing opportunities and prioritisation by seeing processes and data that have precedently gone unnoticed by management.

1.2 Problem discussion

BI systems are intended to support the decision making process within organisations. This is done by retrieving data from usually several operational databases and data warehouses, and thereafter manipulating it into information (Gibson, Arnott and Jagielska, 2005). It was long ago already stated by Zuboff (1988) that investments in computer-based technologies generate benefits classifiable either as automating or informating. Automating refers to the benefits with the potential of simplifying operations, while informating relates to processes producing information to construct new realities in the workplace. Despite being a pioneer in the field of researching benefits within information technology, the findings of Zuboff (1988) still holds true many years later (Kallinikos, 2011). Naturally, these classifications can help distinguish the different benefits companies can receive from investing in new technology, there amongst BI. The associated effects of IT investments described by Zuboff (1988) are hence similar to the intangible or tangible benefits presented by Powell (1992). Given the significant portion of benefits considered being of intangible nature in these systems, evaluating investment opportunities in BI could be challenging with otherwise commonly used appraisal tools. Willcocks (1992) described this situation as a catch 22, referring to the fact that companies must
invest in IT/IS for competitive reasons but the current appraisal tools cannot justify it. This phenomenon has been further strengthened by other researchers (amongst other; Huerta & Sanchez, 1999; Smithson & Hirschheim, 1998; Parker, Benson and Trainor, 1990; Willcocks, 1996).

The investment appraisal procedure usually involves cash flow forecasting techniques and project evaluation. As Ballentine and Stray (1998) present, commonly used appraisal tools include Net Present Value calculations (“NPV”), Internal Rate of Return (“IRR”), payback and Accounting Rate of Return (“ARR”). Just as Arnott and Gibson (2005) state, the body of literature evaluating the intangible benefits of BI is rather limited, and there is an inherent issue when evaluating non-traditional benefits with traditional tools. Despite being a complex matter, investment appraisals in IT/IS and hence also BI, are still needed both to justify the proposed investment, compare it to other opportunities and conduct an ex-post evaluation in order to be a learning organisation (Farbey, Land and Targett, 1992). This becomes a yet more palpable issue, given a large amount of capital spent and thin academic research in the area (Trieu, 2017).

Gibson, Arnott and Jagielska (2005), Kaplan (1986), Stein (2003), Ballentine and Stray (1998) and Christensen, Kaufman and Shih (2008), explain how common investment appraisals are based on direct benefits such as cost reductions and revenue growth. Hence, these evaluation methods do not manage to grasp and take into account the indirect benefits that are hard to quantify, e.g. greater business knowledge, effective relationships and improved work processes. This proven negative aspect of the traditional evaluation techniques makes it hard to justify investments in non-traditional areas. However, just as Kaplan (1986) argues, there is most likely not anything wrong with the theory underlying a DCF when evaluating information technology investments, but the application must be done more appropriately. Evenmore, Christensen, Kaufman and Shih (2008) argue that inappropriate use of old tools hinder investments in innovation, where BI could be an example. Therefore, this paper will contribute to elucidate and map a currently weakly researched area, by dwelling down into three companies with Swedish operations and analyse the potentially special investment appraisal procedures and tools, in order to understand if there has been an adoption or change in the procedures, in contrast to standard routines.

This area is not only important to understand from an academic perspective. As mentioned by Myrtidis and Weerakkody (2008), all practitioners do not currently see the lack of what academia would call suitable investment appraisal methods. One could argue that as long as there is no issue announced or
pinpointed by practitioners, there is perhaps no need for further development of the methods and their usage. However, given that the vast amount of money spent on BI systems will increase rapidly going forward, there is a need understand how to evaluate this type of assets and the expected return on capital employed.

1.3 Research Question

- How do companies conduct ex-ante evaluation in investment appraisals where there are significant intangible benefits?

1.4 Purpose

This paper aims to analyse how three large companies with Swedish presence have coped with the investment appraisal ex-ante a purchase of a BI system. This is needed since the literature has identified several plausible issues concerning appraisals of IT/IS investments. Further, the paper strives to investigate how the companies evaluated the perceived benefits, which are of intangible nature and hence difficult to quantify. The research is undertaken in order to create a deeper understanding for the investment appraisal process, benefitting both companies and vendors when encountering similar investment opportunities in the future, as well as contributing to a weakly researched academic field.

1.5 Delimitation

The study is delimited to examine three multinational companies with operations in Sweden that have within the last two years invested in a BI system.

The paper will examine a limited number of companies in order to enable a deeper understanding of each specific case. Two of the selected companies are listed on the main list of Nasdaq OMX Stockholm, and the other is listed on the London Stock Exchange. The focus on the large multinational companies with operations in Sweden is chosen for two reasons. First, most research within the area is limited to the Anglo-Saxon markets. Secondly, one could expect multinational companies to have better routines for handling these matters in place, and hence be able to identify plausible methods and support normative research in the future.

Finally, the paper is delimitated to investments within BI systems due to the accelerating use of BI systems and the large amount of capital spent, which most likely will continue to grow. Also, these systems’ expected benefits and costs have precedent been proven difficult for companies to assess.
1.6 Outline

The structure of the study will be presented below in combination with an explanation of each chapter’s main focus.

2. Theory

Chapter two narrates the main objects of the thesis and the theoretical framework. The main objects Capital budgeting and Business intelligence systems are described since they constitute the fundamental basis of the study. Furthermore, the theoretical framework presents a literature review where the main arguments within the area are being highlighted and compiled. The chapter discharges to an analytical framework.

3. Data & Method

Chapter three describes how the study approaches the collection of information and realizes the analysis of the data. Finally, the chapter critically discusses the methods and approaches used to collect and analyse the data.

4. Empirical Findings

Chapter four presents the empirical findings of the study. The descriptive findings will initially be presented to enable a cover of the differences that the study has come across. The empirical findings of the study are limited to the relevant aspect that serves the purpose of the study.

5. Data analysis & Discussion

Chapter five presents an analysis of the empirical findings given from the study’s specified framework, where the empirical findings have been put in relation to given theories and earlier studies. The chapter ends with a discussion where the analysis is put in a broader context.

6. Conclusion

Chapter six concludes the analysis of the study and discusses explanation factors regarding the result. Furthermore, the conclusion offers general reflections and gives proposals for further research.

2. Theory

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they constitutes the fundamental basis of the study. Furthermore, the theoretical framework presents a literature review where the main arguments within the area are being highlighted and compiled. The chapter discharges to an analytical framework.

2.1. Capital Budgeting

Capital budgeting is the process within organisations where prospect investments are screened, evaluated and reviewed. Butler et al. (1998) describe the capital budgeting as a process where organizational capital is employed in relation to their future estimated gains. Within many large organisations the capital budgeting process can be seen as ideas stemming from lower levels of the organisations, later to be reviewed by divisional management (Slagmulder, Bruggeman and van Wassenhove, 1995). The process can be portrayed as several joint stages. Anthony, Dearden and Bedford (1984) describe the capital budgeting process as eight steps, starting with the identifying of a project need, and ending with post-implementation audits to assess cost and benefits realisations. One of these steps is individual projects being appraised and revised if necessary, which is the main focus of this paper. In a similar manner, Mukherjee (1987) also classified the capital budgeting process as containing eight steps, starting with strategic planning where defining the strategy and hence deciding how to allocate capital, and the final step being a post-implementation audit and project review. Just as Anthony, Dearden and Bedford (1984), the financial appraisal of screened projects is positioned in the middle of the process. Mintzberg, Raisinghani and Theoret (1976) propose a somewhat simpler four-stage model, where investment appraisal is included in the stage of selecting a project.

The investment appraisal can be seen as similar to ex-ante evaluation or as a part of the same (Ababneh, Zeglat and Shrafat, 2017), in contrast to ex-post evaluation which could be seen as the final review of the project, post-implementation. The investment appraisals’ purpose in the capital budgeting process is declared by both Irani and Love (2002) as well as Farbey, Land and Targett (1992). Reasons include the need to compare projects, rank projects, act as a control mechanism of the following costs, benefits and implementation as well as creating a framework for organizational learning (Irani and Love, 2002). Farbey, Land and Targett (1992) use similar reasons for why the investment appraisal is needed, but however adds one reason, namely the ability to justify the investment. Investment appraisal can be seen as a process conducted prior to the beginning of each project in order to support the approval of the business case, while the ex-post evaluation occurs at project closure in order to identify project success or failure (Zwikael and Smyrk, 2012). Ex-ante evaluation of IT
investments is mostly dependent on financial estimates. It is normally performed using financial criteria such as NPV, payback and IRR. Its purpose is to support the justification of the investment (Ababneh, Zeglat and Shrafat, 2017). However, Christensen, Kaufman and Shih (2008) criticized these financial estimates by coining the DCF trap expression. The DCF trap refers to the miss guiding comparison of cash flows from innovation against the default scenario of doing nothing. Christensen, Kaufman and Shih (2008) argue that it is incorrect to assume that the present health of the company will persist indefinitely if the investment is not carried through. However, the standard scenario should according to Christensen, Kaufman and Shih (2008) be declining sales and cash flows, given the changing environment, since technology advances and competitors most likely will advance.

Finally, despite not being all available methods within the area, Irani and Love (2002) compiled a framework of investment appraisals techniques used within the IT/IS investment area, which it considered relevant. This model is presented in a simplified form in figure 1.0 below.

*Figure 1.0, Appraisal techniques*

<table>
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<th>Analytical Portfolio Appraisal</th>
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<td>Integrated Appraisal</td>
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Ticked area covers what in this thesis is denoted as financially oriented appraisal methods.
2.2 Business Intelligence systems

Luhn (1958) coined one of the first definitions of BI systems accordingly, “a comprehensive system may be assembled to accommodate all information problems of an organization. We call this a Business Intelligence System”. Chee et al. (2009) reviewed existing definitions of BI and made a distinction between the technological aspect, the process perspective and the product. The technological aspect refers to the BI system, the process is the implementation of the system and finally, the product is the result of implementation and outcome generated by the system.

Negash (2004) explains how BI systems support decision makers by offering actionable information in the correct format at the right time. It argues that the most important aspect is that the information is delivered quicker than by a standard DSS, which enables decision makers to act proactively. Dedić and Stanier (2017) describe BI as systems that enable companies to extract and present data from internal and external sources by running queries, which results in beneficial reports helpful to streamline the daily work within operations and decision making. Olszak and Ziemb (2007) highlight following components and argue that they constitute the fundamental basis of BI systems:

- **Extracting tools** – Tools to extract and load data i.e. Extract Transform Load (ETL), mainly concentrating on transforming data from transaction systems and Internet to data warehouses.

- **Data warehouses** – Offers room for storing aggregated and analysed data.

- **Analytics tools** – Enables users to access, analyse and model business problems, to be able to distribute information that is stored in the data warehouses, e.g. OLAP.

- **Data mining tools** – Makes it possible to discover patterns, generalizations, regularities and rules in data resources.
Tools for reporting and ad hoc inquiring – Creates and utilities synthetic reports.

Presentation layer – Includes graphics and multimedia interfaces, which offer users information in a comfortable and manageable form.

BI systems were initially mostly used by the IT departments, given the low amount of expertise within the area among other departments. However, the usage among different departments increased as technology and user-friendlier programs were being developed. BI is today used by many different departments and the number of users will increase even further, which implies large volumes of future investments (Moore, 2017; Hawking and Sellitto, 2010). Hawking and Sellitto (2010) and Negash (2004) argue that BI has significant impacts on companies' performance and is consequently perceived as a high priority amongst managers. However, Hawking and Sellito (2010) highlight the challenges with BI investments, which are foremost related to computing the anticipated return on the investment. It is difficult due to the large costs up front and the fact that the efficiency savings are only a small portion of the payoff, coupled with many intangible benefits. Also, Negash (2004) state that it is uncommon for a BI system to pay off itself strictly through cost reductions.

Negash (2004) made a definition of a BI system as “... a system that combines data gathering, data storage, and knowledge management with analytical tools to present complex and competitive information to planners and decision-makers.”, which is an appropriate classification for this paper and shall, therefore, be the basis going forward. The definition by Negash (2004) is well suited for this paper, given that it contains several of the notions discussed as key factors during the literature review and problem definition.
2.3 Theoretical framework

Following section cover the specific and relevant theories and literature given the research question and purpose of the study.

2.3.1 Literature review approach

The literature review was conducted with a narrative approach. Trieu (2017) acknowledged that the area of precedent literature within BI systems was thin, especially regarding ex-ante evaluation, which implied a need to extend the review to include articles regarding ex-ante IT/IS evaluations. Appendix. 3 displays how the literature review was conducted, it highlights what search engines and keywords that were used in order to find relevant journals and articles.

2.3.2 Literature review

It has since long been acknowledged that IT/IS investment appraisals are difficult given the significant amount of intangible benefits provided. Kaplan (1986) discusses an early example of investments in computer integrated manufacturing (CIM), where it is clarified that there is a conflict between the financial justification (i.e. appraisal in our meaning) and strategic justification. It argues that it necessarily must not be the case, given that there is no underlying issue with the DCF, and hence conclude that practitioners must learn to apply the DCF more appropriately, and adjust it to be more “sensitive to the realities and special attributes of CIM.” (Kaplan, 1986). Though, Kaplan (1986) endorses the fact that some intangibles are very difficult to assess a cash flow value to, but nevertheless argue that practitioners may be too conservative not giving these benefits a value at all and therefore leaving the investment to faith alone. However, as will be presented in the following literature review, many researchers argue that new appraisal methods are needed to perform the ex-ante evaluation (Willcocks, 1992; Hochstrasser, 1990; Gibson, Arnott and Jagielska, 2005).

Klein and Beck (1987) discuss a similar issue as Kaplan (1986) presents, namely that the current evaluation methodologies used when considering a IS ignore the need to choose between qualitative factors or require a numerical value to be attached to the qualitative attributes. Qualitative factors should be included in assessing investment appropriateness since they in these types of assets are important, but the lack of ability to assess a quantifiable value to it hinder their value to be shown in current decision-making models (Klein and Beck, 1987). Drawing on preference theory, Klein and Beck (1987) discuss a method based on the decision maker choosing between presented attributes, however, the model
does not present much aid in evaluating a single alternative and is hence limited in appraisals concerning a single investment opportunity.

Similarly as many of the articles presented in the literature review, Parker, Benson and Trainor (1990) and Maskell (1991) explore the issue of companies using traditional evaluation methods to justify IT/IS investments. Parker, Benson and Trainor (1990) argue that most managers feel responsible for making appraisals when investing in IT/IS, despite traditional investment appraisals not being sufficient to capture the many intangible benefits.

Hochstrasser (1990) refers to the Kobler Unit study and highlights the result, which is that most practitioners tend to use methods that emphasise the contribution to the bottom line. These methods may result in the quantification of benefits easy to measure rather than evaluating what is important, which is in line with Kaplan (1986) claiming that IT/IS investments should not be left to faith alone. However, the arguments behind this claim are in contrast to those of Kaplan (1986). It argues that there is a need for methods focusing on intangible benefits. Finally, Hochstrasser (1990) argues that IT/IS investments cannot be justified by one single appraisal procedure due to the dynamic factors inherent in IT/IS investments.

Thereafter, Farbey, Land and Targett (1992) set out to understand how organisations actually do while appraising whether or not to go ahead with an IT/IS investment or not and also what role the appraisal itself plays. The research is undertaken since evaluating the potential benefits of these investments are considered a major issue amongst managers in general. In line with Hochstrasser (1990) they argue that the previous dominance of a few appraisal techniques has led to the search for a single optimal appraisal technique for IT/IS investments, which most likely will not be successful (Farbey, Land and Targett, 1992). In order to understand how organisation appraise investments, Farbey, Land and Targett (1992) presents the foundational reasons to why they do appraisals, namely (1) justification of the investment, (2) compare investments, (3) allow benchmarking to project performance, and lastly (4) compare actual outcome for organisational learning. Looking at 16 large IT investments, Farbey, Land and Targett (1992) found a mixture of approaches, ranging from standard procedures, ad-hoc justification or even no justification at all. The article concludes that very few of the available, by academia presented methods, were used in practice, and as a response draws on a framework for matching appraisal techniques with IT/IS investments, depending on several variables.
In line with the above-presented uncertainties regarding what methods are deemed usable, Powell (1992) highlights the issues regarding IT/IS investment appraisals and reviews existing as well as new methods to be able to consider if IT/IS investments differ from other investments. Powell (1992) cannot decide whether IT/IS investments differs from other investments but concludes that scholars should focus on improving existing methodologies rather than creating new ones since the field is already crowded. However, the findings suggest that the major technique at the time were NPV and IRR. This consequently led to many non-quantifiable benefits being left out, making the justification of IT/IS investment difficult. These difficulties resulted in many organizations not making ex-ante evaluations at all.

Willcocks (1992) defines the problems within the IT/IS investments as a Catch 22, referring to the situation where companies need to invest in IT/IS for competitive reasons but the appraisals do not justify it. Also, it argues that the current evaluation techniques are not suitable. Furthermore, Willcocks (1992) describes how most of the current techniques have been developed and pushed forward by experts, vendors and consultant instead of the profit center managers, which entails biased and inappropriate techniques. Finally, Willcocks (1992) concludes in line with Powell (1992) that traditional techniques cannot be relied upon and highlights the large range of modern techniques, which means that organizations need to shape the process of conducting evaluations.

Similarly as Parker, Benson and Trainor (1990), Hirschheim and Smithson (1998) argue that IT/IS appraisal is a “necessary evil”, which is demanding and complex but still very important to enable a justification to senior management. Hirschheim and Smithson (1988) analyzed the methods at the time by dint of an old framework and were able to draw the conclusion that the development of both business and IT/IS itself has made the evaluation process more complex, mainly due to the shift in the nature of benefits related to the investments.

Just as Farbey, Land and Targett (1992) and Hochstrasser (1990), Ballantine and Stray (1998) evaluate the use of appraisal methods used by organisations when assessing IT/IS investments. It proposes that there are arguments both against and for using standard investment appraisal techniques, there amongst the issue that they are not capturing all the inherent benefits and are too financially oriented, but on the other hand this could be argued as logical from a shareholders’ maximisation perspective. What Ballentine and Stray (1998) found was that a smaller portion of the respondents used more sophisticated appraisal techniques such as NPV and IRR, which may be due to the fact they are not seen as easily adapted to the nature of IT/IS investments. It was also found that the
quantification of benefits was more difficult for practitioners, rather than the identification of them.

Irani (2002) states that there is a general difficulty discussed in the normative literature regarding IT/IS evaluations and that there is a difficulty assessing the full impact of such investments. Looking at an IS investment in a manufacturing company, Irani (2002) focus on the limitations of traditional appraisal techniques, and how the financial and conceptual justification was carried through. The manufacturing company lacked experience since precedent investments could be evaluated by standard investment appraisal techniques. Even though benefits were identified, no estimated financial values were attached. Irani (2002) concludes that many social and technical factors make the search for a generic evaluation method impossible. Irani and Love (2002) set out to present a framework for the ex-ante evaluation of IT/IS investments by looking at the appraisal stage of the capital budgeting process, and sorting the different appraisal methods into subgroups. Irani and Love (2002) further discuss the issues of using traditional appraisal techniques when assessing IT/IS investments and argue that more strategic, analytical and integrated appraisal methods should be used. Though, these are not well established amongst practitioners, probably due to the complexity and subjectivity and the fact that focus on expected financial returns in many capital budgeting processes still plays a key role.

Just as Irani and Love (2002) argue that there is a need for new methods to be adopted, Walter and Spitta (2004) look at both the academic contribution as well as practitioners and thereafter presents a framework for classifying appraisal techniques. It goes on to discuss their limitations, and finally reviews findings regarding how well the techniques are established in practice. The appraisal techniques can roughly be divided into either effect- assessing or effect-locating, where effect-assessing are more financially oriented, while effect-locating are more of interpretative nature. Walter and Spitta (2004) presents that there are certain financially oriented methods which try to apply quantitative measures to qualitative benefits. It is also argued that no single method is universally applicable (which is in line with Farbey, Land and Targett (1992)). Similarly to earlier studies Walter and Spitta (2004) found that financially oriented methods are more widely established, which most often leave the intangible values disregarded. The main problems experienced were related to identification, quantification and estimation of benefits when assessing IT/IS investments.

Looking at BI more specifically, Gibson, Arnott and Jagielska (2005) state that there is a limited body of knowledge regarding the intangible benefits of BI, and
that these benefits just as other IT/IS investments are difficult to quantify. However, given the lack of research in the area, it is not yet known whether or not BI investments are appraised in the same manner as other IT/IS investments, and if there is a need amongst practitioners to use new methods. Gibson, Arnott and Jagielska (2005) state that this area is of importance to further explore, given that there is a need to justify BI investments, and also a need amongst BI vendors to understand how techniques are used to evaluate their products.

Myrtidis and Weerakkody (2008) go on to discuss the difficulties emphasized in earlier literature (e.g., Powell, 1992; Farbey, Land and Targett, 1992; Hirschheim and Smithson, 1998; and Irani and Love, 2002) and highlights the problem even further, arguing that digitalization has led to escalating costs within the IT/IS investment area. Myrtidis and Weerakkody (2008) build further on Symons (1991)'s arguments concerning IT/IS investments and the political problems within organizations. It concludes that different goals and agendas behind the investment will have an impact on the evaluation. Myrtidis and Weerakkody (2008) highlight the importance and limitations regarding IT/IS appraisal methods used in practice and argues that the appraisals and justifications focus on short-term benefits. Finally, it calls for further research within the area, to create a deeper understanding of the organizational processes.

Song and Letch (2012) reflects on the last twenty-five years body of literature related to IT/IS investments, and highlights where research has been focused, what are the main issues and finally where future research is needed. Song and Letchs (2012) reflection discover that most of the examined articles ignore the purpose of evaluation, described by Farbey, Land and Targett (1992), and most of the articles focus on the ex-post evaluation even though ex-ante evaluation is found to be more prevalent in practice. Finally, Song and Letch (2012) concluded that the methods presented by academia are many which make the field crowded, however few of these methods are used in practice, which is in line with earlier findings from Powell (1992) and Farbey, Land and Targett (1992).

Royer (2013) presents an overview of relevant ex-ante evaluation methods related to IT/IS investments. These methods are further evaluated and examined from the perspective of practitioners. Royer (2013) finds that financial methods e.g. NPV, payback, return on investment (“ROI”) and IRR seems to be most relevant in practice. However, the Balanced IT Decision Card (“BITDC”) scored highest on the evaluation since this method takes most of the effects and benefits into account. Finally, Royer (2013) highlights the limits with BITDC in practice, which is mainly related to the limitation of data and quality.
Looking at decision making in the context of BI investments Frisk et al. (2014) argue for the need of a more interactive, creative and adaptive model for explaining decision making (cf. rational decision making under known circumstances). According to Frisk, Lindgren and Mathiassen (2014), this could enable a better understanding of both structured and unstructured data. Further, it argues that this approach could make investments in BI more easily adopted and analyzed, mainly because it allows managers to measure the tangible benefits while sensing the intangibles.

Ababneh, Zeglat and Shrafat (2017) and Trieu (2017) are both recent literature reviews, which summarize literature dating back to 1988. Despite having been systematically addressed throughout the years, researchers yet have contradictory views regarding what models ought to be used when appraising IT/IS investments. At the same time, many different methods have been suggested, but given the many different situations and contexts in which IT/IS is being evaluated, there is likely no best methodology readily available to suit the different situations (Ababneh, Zeglat and Shrafat, 2017). There is a widespread concern regarding the use of evaluation and justification techniques in organisations, and this issue becomes yet more palpable given the intensive use of IT/IS/BI and the large investments that have been made (Ababneh, Zeglat and Shrafat, 2017; Trieu, 2017), and there has not been much progress in the field (Ababneh, Zeglat and Shrafat, 2017).

2.3.2.1 Summary of literature review

As presented in several of the articles above, there is clearly a recurring elucidated issue where the investment appraisal techniques in use are not appropriate for the task. There are inherent issues with the use of the methods, and it results in intangible benefits not being sufficiently accounted for. Further, the literature review shows that there are plenty of by academics presented methods for evaluation, though these are not yet used by practitioners. Some researchers argue that there is a need for new methods in order to better fit the needs of practitioners, while others argue that there need to be a better adoption and application of the already available methods. Finally, the issue which has been discussed with regards to IT/IS investments are yet more palpable in the situation of BI investments, given the nature of the systems’ benefits. This area is according to researchers in need to be further explored, and there is a need to understand how practitioners are handling these issues. As a summary, there is inherent criticism amongst the researchers whether certain methods are
deemed appropriate or not. Other disagreements between researchers in the area include the discrepancy of whether or not there should be a focus on developing new methods or further development of a large number of already existing methods of which very few are used in practice. For a summary of precedent research, see table 2.0.

2.2.1.2 Criticism to precedent literature

Consensus exists among the presented literature regarding the inadequacies of methods used by practitioners. However, there is no evidence of a call or need from practitioners concerning improvements of these methods, which Myrtidis and Weerakkody (2008) also mentions when discussing the relevance of further research within the area. Further, the literature presents several different methods to evaluate these investments (e.g. Irani and Love (2002); Farbey, Land and Targett (1992); Ballentine and Stray (1998); Royer (2013)), but details regarding how to carry through an evaluation with these methods and capture the intangible benefits are limited, with exception for the suggestions presented by Klein and Beck (1987). Furthermore, except for Myrtidis and Weerakkody (2008) a majority of the case studies and the literature that focus on describing what methods that are mostly used among the practitioners (e.g. Ballentine and Stray (1998)) are limited to the Anglo-Saxon markets. This could, of course, limit the possibilities to draw conclusions regarding what extent the evaluated cases in this studies are aligned or not with other companies in their own geographical jurisdiction. Finally, the literature presented consists of several literature reviews, repeating each other to a large extent, and there is also few of the articles discussing BI investments specifically and rather investigate IT/IS investments more generally.

Table 2.0, summary of articles included in the literature review

<table>
<thead>
<tr>
<th>Article</th>
<th>Focus</th>
<th>Issue</th>
<th>Method</th>
<th>Conclusion and arguments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaplan (1986)</td>
<td>Investments in CIM systems</td>
<td>Practitioners not adopting financially</td>
<td>Illustration of two practical examples</td>
<td>There is no inherent issue with standard techniques such as DCF models, but practitioners need to use them in an appropriate manner</td>
</tr>
<tr>
<td></td>
<td></td>
<td>oriented evaluation methods well enough</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Klein and Beck (1987)</td>
<td>Present useful methods to evaluate IT/IS</td>
<td>Current evaluation methods ignore qualitative attributes or require numerical estimates of these</td>
<td>Reviewing existing methods</td>
<td>Propose a simplistic method of choosing between already known alternatives, based on preference theory</td>
</tr>
<tr>
<td>Hochstrasser (1990)</td>
<td>Present parts of the Kobler Unit study and tries to identify best</td>
<td>Evaluation processes entirely centred on standard accounting methods simply do not</td>
<td>Case study of 34 British companies within different industries</td>
<td>Companies lack relevant evaluation processes, which leads to loss of control of IT investments. IT investments are an act of faith</td>
</tr>
<tr>
<td>Author(s)</td>
<td>IT/IS investment appraisal methods</td>
<td>Methodology</td>
<td>Evaluation focus</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>------------------------------------</td>
<td>-------------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td>Farbey, Land and Targett (1992)</td>
<td>IT/IS investment appraisals, their roles, how practitioners do and what can be done</td>
<td>Evaluating IT/IS is a major problem area for practitioners. There is a matching problem between available methods and the use of them</td>
<td>Case study, interviews and review of documentation from 16 organisations</td>
<td>Different problems at various organisational levels. Few available methods are used. Propose a “matching technique” for using the appropriate method</td>
</tr>
<tr>
<td>Ballentine and Stray (1998)</td>
<td>IT/IS investment appraisal techniques.</td>
<td>Capital investment appraisals are inherent when investing in IT/IS according to IS literature.</td>
<td>Survey investigating methods used by practitioners</td>
<td>The result shows that financial techniques are widely used by organizations when appraising IS/IT investments. Further, the article states that problems related to the appraisal methods still remains.</td>
</tr>
<tr>
<td>Irani (2002)</td>
<td>Normative literature of IT/IS evaluation</td>
<td>Issues assessing the full impact of IS investments, mainly intangible and indirect benefits</td>
<td>Case study of a manufacturing company</td>
<td>Many social and technical factors make the search for a generic evaluation method impossible. Indirect costs tend to spiral out of control. Some socio-technical variables cannot always be quantified into financial terms</td>
</tr>
<tr>
<td>Irani and Love (2002)</td>
<td>IT/IS appraisal methods</td>
<td>Lack of understanding how to use the extensive amount of methods available</td>
<td>Literature review</td>
<td>Present a frame of reference for mapping the available methods. The framework divides the different available methods into different categories depending on the focus, where Economic Ratio and Economic Discounting Appraisal categories include many of the commonly used methods according to the literature review. Accounting literature still holds the traditional methods valuable</td>
</tr>
<tr>
<td>Gibson, Arnott and Jagielska (2005)</td>
<td>Intangible benefits of BI</td>
<td>Limited body of research available. Benefits of BI are hard to assess with traditional evaluation techniques</td>
<td>Review of available techniques</td>
<td>Due to the many different intangible benefits, BI is difficult to evaluate. Propose a research agenda and initial draft of a framework to since there is too little academic literature in the area concerning BI as a specific field. The widespread interest for BI justify the need for research into the area</td>
</tr>
<tr>
<td>Myrtidis and Weerakkody (2008)</td>
<td>IT/IS investment evaluation approaches</td>
<td>Evaluation of complex IT/IS investments often tends to take only quantifiable costs and benefits into account and ignore many of the</td>
<td>Case study of the 6 Greek banks</td>
<td>Highlights the importance of appraising IT/IS investments and demonstrates the limitations of methods currently used. Further, the study provides insights of the challenges senior managers</td>
</tr>
<tr>
<td>Study</td>
<td>Focus</td>
<td>Methods</td>
<td>Research Design</td>
<td>Findings</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>--------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>--------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Song and Letch (2012)</td>
<td>IT/IS evaluation literature</td>
<td>A mismatch between outcome and promised benefits also know as Productivity paradox. Further, research has put in extensive effort in order to improve approaches, which needs to be reviewed and reflected</td>
<td>Literature review and analysis</td>
<td>Argues that most focus has been put on ex-post evaluation even though ex-ante is found more prevalent in practice. The paper purpose that the classification of IT/IS evaluation should be respecified and that people are the core of the evaluation process since they decide what and how the evaluation is carried out. Finally, the mismatch between research and practice indicates a long distance from developing methods to be put to use</td>
</tr>
<tr>
<td>Royer (2013)</td>
<td>Overview and categorization of relevant ex-ante evaluation methods for IT/IS investments</td>
<td>Several methods and frameworks have been presented but which are actually used by practitioners</td>
<td>Literature review and analysis</td>
<td>Looking at methods being used by practitioners, financial methods seem to be most relevant. However, the study concludes that BITDC scores highest on the analysis. Finally, the study highlights the shortcomings of the BITDC</td>
</tr>
<tr>
<td>Frisk, Lindgren and Mathiassen (2014)</td>
<td>Decision making process when making BI investments</td>
<td>Previously used models to explain the choices done in decision making are not suited to explain the situation</td>
<td>Case study/Action research</td>
<td>Propose a new design approach to decision making, emphasising the iterative process of making decisions, specifically in an IT investment context</td>
</tr>
<tr>
<td>Ababneh, Zeglat and Shrafat (2017)</td>
<td>IT/IS investment literature</td>
<td>Fragmented body of literature in the area of IT/IS investments</td>
<td>Literature review</td>
<td>Contradicting views of what methods ought to be used when evaluating investments. Many different stakeholders involved, making a single method for evaluation deemed difficult. Not much progress has been done in the field if IT/IS evaluation, an immense amount of capital spent justifies more research</td>
</tr>
<tr>
<td>Trieu (2017)</td>
<td>BI value literature</td>
<td>Fragmented body of literature in the area of BI, and researchers and practitioners questions the value of BI</td>
<td>Literature review</td>
<td>Lack of overarching framework to guide further research in the field of BI value, ranging from BI investments, BI assets and the impacts from BI. Propose a draft of a framework which ought to help understand the value organisations gain from BI</td>
</tr>
</tbody>
</table>

### 2.3.3 Shareholder theory and decision making

Discussing the institutional framework and the proposed problem, there are several theories useable for understanding the phenomena. As discussed by Ballentine and Stray (1998), the accounting and finance literature have focused
to a large extent on developing financial appraisal techniques which are aligned with the theory of shareholder maximization. Just as Farbey, Land and Targett (1992) states, one of the main reasons of investment appraisals is to justify the investment, which could be interpreted to justify the spending of shareholder capital. Shareholder maximisation implies that the primary goal of the company ought to be increasing the wealth of its shareholders, and hence the investment appraisal as a tool of justification should aim to rationalize the use of shareholders’ funds. However, there is widespread criticism and discussions regarding shareholder maximisation as a sole goal of businesses (Strand and Freeman, 2013). The discussion whether or not it is more appropriate to use a broader stakeholder approach has been ongoing for long, and is reflected in some researchers reasoning presented in the literature review (e.g. Irani (2002); Irani and Love(2002); Royer (2013)), mainly in a proposed need for methods capturing more than financial benefits. As Strand and Freeman (2013) states, long-term profitability is a by-product of effective stakeholder management, which could be seen as aligned reasoning to the more non-financial investment appraisal methods.

The theory of shareholder maximization in relation to investment appraisal is closely related to the different theories of decision making (Schniederjans, Hamaker and Schniederjans, 2010). The rational model of choice views decision makers as having a known objective when making decisions. This is done in conjunction with appropriate information sources, and hence an optimal choice can be made. Bounded rationality, however, assumes that decision makers rather can strive for rationality by obtaining more information. This is described by Dean and Sharfman (1996) as the process of using several information sources to create a better holistic picture and by that striving for a rational decision. Other literature views the decision-making process as heavily influenced by politics and power, in contrast to the rational model of choice, were a single objective is assumed (Frisk, Lindgren and Mathiassen, 2014). As a response to the above, Cohen, March and Olsen (1972) introduced the garbage can decision making model. The model is in contrast to the above more oriented toward the reasoning that decision-makers do not understand their goals in advance and that the process is influenced by many random events.

2.4 Analytical framework

As presented throughout chapter two, there are recurring issues highlighted, and different theoretical standpoints which must be considered when analysing the empirical findings. The way the interviewed companies work with investment appraisals will be mapped by variables derived from the literature review and
Theoretical framework. These variables were operationalized into questions which guided the semi-structured interviews and will be further described in the method section.

The variables extracted in order to conduct a mapping of the procedures will include the general capital budgeting process. This is of course of background character and not the main focus of the analysis. However, it can provide valuable insight in terms of how or if the companies deviate from their standard procedures in order to better approach capital expenditures within IT/IS investments. Next set of variables will be related to how the decision-making process was carried through, and from where the need of a BI system was identified. These variables are also connected to the other theoretical parts, namely if the companies’ processes can be differentiated by different approaches in terms of a shareholder or stakeholder orientation.

The main variables used to describe the procedures will be related to the choice of investment appraisal methods or tools. This set of variables will also include in what way the companies try to either adapt current methods to match the situation of intangible benefits or if they use non-standard methods. Also, a more high-level variable will be whether or not the companies even bother to justify the investment, which was found to be a rather common case by Farbey, Land and Targett (1992). These variables will also help capture whether or not the voluminous number of methods presented by academics are used by practitioners, or if more classical methods still are in use despite their shortcomings. Please see a mapping of the analytical framework below.

*Figure 2.0 Analytical framework*
3. Method

Chapter three describes how the study approaches the collection of information and realizes the analysis of the data. Finally, the chapter critically discusses the methods and approaches used to collect and analyse the data.

3.1 Research Methodology

This study was formed by qualitative characteristics with a basis in primary data, specifically collected with the purpose to serve this study (Bryman and Bell, 2015). A multiple case study was the most appropriate design given the research question and purpose, and it aims to generate a deep and detailed analysis of a particular situation within a few numbers of organizations (Bryman and Bell, 2015). This qualitative research with a multiple case study design takes an abductive approach, implying a synthesis of the inductive and deductive approach.

3.2 Selection

The process was aimed to select large publicly listed companies which have within the last two years invested in a BI system and operates within industries where investments usually generate tangible benefits. Large was defined in line with the size criteria to be a part of the Nasdaq list of Large cap, which requires a market capitalization of one billion euro. Large publicly listed companies were chosen since it was expected that this group would have had developed procedures for handling IT/IS investments carefully.

Nasdaq list of Large cap was initially screened in order to find companies who recently had carried through an investment in a BI system. Several companies were contacted, which resulted in two cases, a manufacturing and a construction company. Further, engagement with a trade company was given by contacts from one of the authors. The trade company was carefully investigated in order to match the criteria above before being contacted, where both size and operations were considered. The operations were deemed to be fully oriented towards trade of consumables, and no logistics or IT services were provided according to the annual report, and hence it could be classified as the other two companies. Four of the respondents were found directly by being contacted by the authors and one of the respondents was indirectly contacted through the Human Resource (“HR”) department.
In addition to the reason mentioned above, namely that the sheer size of the companies would hopefully imply well-established investment procedures, the selection was done in order to make the companies representative of potential peers. Also, the manufacturing company, in particular, is promoting its competitive edge and product offering within digitalisation, which of course implies that there will be a need for organisation wide investments in IT/IS also going forward. This makes the reasoning around and investment appraisal procedures of IT/IS investments interesting, given that there will be a significant amount of capital spent within the area and hence the evaluation of such should be considered more and more going forward since digitalisation most likely will not stop. Further, the trade company and its peers are facing more challenges when it comes to efficiency in logistics, something large international players have prevailed within and also started to develop as services (e.g. Amazon). This will likely put increased pressure on further investments in IT/IS, and hence it is of high interest to understand how these companies work with evaluation of the same.

3.3 Data sample and respondents

All of the three companies are active on a global scale, and two of them are considered leaders or close to it, in their respective industries in Sweden. Looking at the at the manufacturing company, it operates in a couple of subdivisions, where the facility which has been subject to the case study belongs to one of the most profitable ones. The facility belongs to one of the company's premium brands and is also an active promoter of digital services within its area. The three employees interviewed were involved to different degrees in the BI investment. First, the project manager working with the evaluation and implementation was interviewed, providing first-hand experience of the entire process. Secondly, the production unit manager who had initiated and promoted the need for a BI system was interviewed. This interview gave a holistic view of both the capital budgeting process and also the specific reasons for investing in a BI system. Finally, the facility's finance manager was interviewed, who provided the thesis with a lot of insight regarding the standard procedures and also possible ways to reason about investments in IT/IS more generally. In addition to the interviews, it was provided a thorough business case, where arguments and reasoning, as well as calculations and benchmarking, were included.

The construction company is working within a broad range of different areas, ranging from properties, industrial solutions to infrastructure projects. The person interviewed was working as a business controller at the company's headquarters. He was responsible for the project management and hence had the first-hand experience of the entire process. Also, he was in close contact with the
engaged management and IT consultants supporting the project evaluation and implementation, hence he was considered having a good holistic view of many parts of the project. The person was the highest possible within the finance department being hands-on involved in the project, according to the business controller.

At the trade company, which have operations in large parts of the world, the head of controlling for the Danish and Swedish operations was interviewed. He had been the initiator of the project and also the one conducting the entire investment evaluation, hence being the most suitable person to interview. In addition to the interview, the authors received the investment memorandum which contained a summary of the reasons, arguments and cost structure of the proposed investment. It also included a benchmarking between alternatives. Found below is a table summarizing the data sample and respondents, providing an overview of how the interviews were conducted and what material was received.

*Table 3.1, overview of data collection*

<table>
<thead>
<tr>
<th>Company</th>
<th>Respondent</th>
<th>BI system</th>
<th>Interview</th>
<th>Written material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade company, Global operations. Subsidiary located in southern Sweden</td>
<td>Head of Business Control</td>
<td>Qlik Used for sales, purchasing and trade</td>
<td>Telephone interview, 50 minutes. Transcribed by one author</td>
<td>Investment memorandum sent to owners. Four pages.</td>
</tr>
<tr>
<td>Construction. World wide operations. Publicly listed.</td>
<td>Business Controller</td>
<td>Power BI Used for project management and reporting</td>
<td>Telephone interview, 60 minutes. Transcribed by one author</td>
<td>None</td>
</tr>
<tr>
<td>Manufacturing. Worldwide operations. Publicly listed.</td>
<td>Project Manager, responsible for digitalization of production.</td>
<td>Qlik Used for production environment</td>
<td>Face to face, one to one, 50 minutes. Transcribed by two authors</td>
<td>Business case. 56 pages</td>
</tr>
<tr>
<td></td>
<td>Finance Manager</td>
<td></td>
<td>Telephone 20 minutes, transcribed by two authors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Acting production Manager</td>
<td></td>
<td>Telephone 20 minutes, transcribed by two authors</td>
<td></td>
</tr>
</tbody>
</table>
3.3 Data Collection

Qualitative interviewing was used to collect the primary data. Qualitative interviewing tend to be less structured than quantitative interviewing in order to understand the interviewees’ own perspectives (Bryman and Bell, 2015). Bryman and Bell (2015) describe qualitative interviews as flexible and argue that they often go off schedule as new questions may arise during the interview, rambling or going off tangent is appreciated since it enables interesting details that may be beneficial for the study. This qualitative interview was semi-structured, a list of fairly specific topics that needed to be covered was used in order to guide the interview in the right direction. The questions were not exactly the same for each interview but rather shaped by the answers during the interviews. The authors used the interview guide in combination with their own knowledge and experiences from appraisal procedures in order to guide the interviews and collect the data needed. Further, the companies were asked to share all material of relevance used in the appraisal process.

3.3.1 Interview method

The interviews were conducted with employees within finance, management, as well as project management. The length of each interview was approximately 20 to 50 minutes and formed on a two-to-one basis. The authors acted on a neutral level whilst questions and answers were recorded and later transcribed, in order to erase data bias. The language used during the interviews was accessible and adjusted in relation to each situation. Leading and loaded questions were avoided to the extent possible, the interviews were instead focused on open questions where the interviewee was able to speak freely, with the intention to create a deeper understanding of the case (Bryman and Bell, 2015). The interview guide can be found in appendix.1.

3.3.2 Operationalization

The analytical framework constitutes the fundamental basis of the thesis and the interview guide was outset based on this. The operationalization is presented in order to create links between the interview and already proposed issues and theories presented in the analytical framework.

The questions in the first category were foremost build on the foundations of the shareholder and stakeholder theory and the decision-making theory, the category aims to describe the background and intentions of the investment. These questions were raised to understand the underlying motivations and processes of the BI investment. These questions emphasised what expected benefits the BI investment would generate.
The second category intended to create an understanding of the standard capital budgeting process within the organization. These questions were aimed to create a deeper understanding of how the standard capital budgeting processes are carried through in investments generating a majority of tangible benefits. The questions from this category were important since they enabled a comparison to the outcome of the third category and also the deviations from standard procedures.

The third category narrowed down the interview to the appraisal procedure for the specific BI investment. The category intended to pinpoint how the organisation treated the perceived difficulties since the area is poorly researched and methods available are not well used by practitioners. The outcome of the third category was used as support when analysing practitioner’s methods in relation to academia, and the practitioner’s standard capital budgeting processes in relation to the methods used for the specific BI investment.

Finally, the fourth category was designed to highlight the current gap among practitioners’ awareness for the IT/IS appraisal methods presented by the academia.

Table 3.2, overview of operationalization

<table>
<thead>
<tr>
<th>Analytical framework</th>
<th>Category</th>
<th>Example questions:</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shareholder and Stakeholder Theory</td>
<td>Background and intentions</td>
<td>When and how did the question regarding looking into a potential BI system arise in the organisation? From where in the organisation was the need identified/proposed?</td>
<td>(Ballentine and Stray, 1998), (Farbey, Land and Targett, 1992), (Irani, 2002), (Irani and Love, 2002), Royer (2013) and (Stand and Freeman 2015)</td>
</tr>
<tr>
<td>Decision Making Theory</td>
<td>General capital budgeting process</td>
<td>How does a standard capital budgeting procedure look like, and did this procedure differ in anyway?</td>
<td>(Butler et al. 1998), (Slagmulder, Bruggeman and van Wassenhove, 1995), (Anthony, Dearden and Bedford, 1984), (Mukherjee, 1987), (Mintzberg, Raisinghani and Theoret, 1976), (Ababneh, Zeglat and Shrafat, 2017) and (Christensen, Kaufman and Shih, 2008)</td>
</tr>
<tr>
<td>Capital budgeting</td>
<td>BI investments and evaluation</td>
<td>What benefits did you expect to receive from the investment in this BI</td>
<td>(Kaplan 1986), (Hochstrasser 1990), (Irani, 2002), (Gibson, Arnott and Jagielska, 2005), (Myrtidis and</td>
</tr>
</tbody>
</table>
Gap in current research: understanding the discrepancy between practitioners and academia

<table>
<thead>
<tr>
<th>Methods of investment appraisal</th>
<th>System?</th>
</tr>
</thead>
<tbody>
<tr>
<td>What investment appraisal methods do you usually use when evaluating investments, and did this situation differ in terms of methods used?</td>
<td></td>
</tr>
<tr>
<td>If you used financial methods, how did you justify the benefits of intangible nature in financial terms?</td>
<td></td>
</tr>
</tbody>
</table>

Weerakkody (2008) and (Trieu 2017)

Gap in current research: understanding the discrepancy between practitioners and academia

<table>
<thead>
<tr>
<th>Gap between research and practitioners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Looking at the process of evaluation, where did you find it easy and difficult?</td>
</tr>
<tr>
<td>What methods are you aware of, which could have been used and accepted by the organisation in evaluating this type of investment?</td>
</tr>
</tbody>
</table>

(Klein and Beck, 1987), (Farbey, Land and Targett, 1992), (Irani and Love, 2002), (Song and Letch, 2012), (Royer, 2013) and (Ababneh, Zeglat and Shrafat, 2017)

3.3.3 Documentation received

In addition to the interviews conducted, two of the companies agreed to share written material. First, a written investment memorandum of five pages was given by the trade company. It summarized the reasons and main reasons for purchasing the BI system. Further, it specified the costs and a high-level comparison of two systems. Secondly, the manufacturing company provided a 56 pages long business case regarding the investment decision. It was a thorough investigation and comparison of two investment alternatives, as well as estimated costs and expected benefits.

3.4 Data analysis

The data analysis was conducted through two stages. First, a thematic coding of the transcribed interviews was conducted, and secondly, a review of all received material was done. The review of all material intended to match the schematic coding of the transcribed material, either to support or contrast the information received in the interviews.

The approach to thematic coding was to use colours for the different sections or information to different categories. These categories were first and foremost intended to be linked to the categories of questions presented in the
operationalization and their corresponding role set forth in the analytical framework. To be able to identify the main themes the authors summarized, apart from each other, their main takes from each interview before discussing the interview together. Further, in order to find other common themes amongst the different interviews, the colour coding of the transcriptions was postponed until the first two interviews had been conducted. Apart from that, the colour coding was done as soon as possible after the interviews in order not to be overwhelmed by data after many interviews. Also, it provided time to go back to the company and ask for complementary information if needed. In order not to lose the context of the whole interview or material received, and get too stuck in thinking of themes rather than the holistic picture, each company's contribution to the empirical findings were summarized and presented as a part of the material in the data description. After all the material had been coded, the different groups of data could be compared cross companies and to the analytical framework.

3.5 Method discussion

Following part of the chapter emphasises a critical discussion regarding the methods used in the study. The chapter ends with a discussion concerning the study's reliability, replication and validity.

3.5.1 Criticism of research design and method

Given the nature of the research design and following research method, there is relevant criticism to take into account. First and foremost, the purpose of the study is to cover a weakly researched area by extracting and explaining certain variables, chosen through the analytical framework. However, this positivistic endeavour, of course, holds its limitation with the limited number of companies and width. There are inherent limitations with generalizability and external validity when using this sort of design, coupled with a limited number of companies. Consequently, deeper and thick descriptions will better contribute to an understanding of the specific cases described.

Issues with the chosen method could include interviewees, despite being aware of anonymity, want to portray the organisation’s procedures as good as possible. Given that only one to three persons of each organisation were interviewed, there is also the risk that the perception of the organisation’s procedures or actions are biased, and cannot be triangulated with several sources of information. By receiving investment memorandums from two companies, this could to some extent be mitigated. Another issue relevant to interviews is that
interviewer bias results from the use of probes, follow-up questions, that are used to get respondents to elaborate on an ambiguous, or incomplete answer (Shaughnessy, Zechmeister and Zechmeister, 2000). This was partly mitigated by limiting the follow-up questions when it was noticed that the interviewee had limited knowledge to answer the question.

3.5.1.1 Trustworthiness

As always when conducting semi-structured interviews with employees of an organisation, and relying on this as your primary source of data, there needs to be an awareness that it may be the respondents own opinion or otherwise distorted information. The first step towards assurance of as much reliable data as possible, was as mentioned above the identification of employees in the organisation who had the closest experience of the ongoing investments. That is the highest ranked person who had been hands-on with the process. The second step was to triangulate what had been said during the interviews with the written received material.

In the case of the manufacturing company, three thorough interviews with different employees were conducted, and hence the authors could quickly understand that the employees described the process and other circumstances very much alike, despite the finance manager who admitted that he had not been thoroughly involved. However, the information of a more general character which he provided matched with the descriptions of the others. Further, the technical aspects of the evaluation process were triangulated by the received written material. Of course, some things mentioned in the interviews were not covered by the business case, but there were no contradictions between the written material and process description verbally received.

At the trade company, the investment memorandum received was not as long and thorough as the business case received by the manufacturing company. However, in general, it covered both the arguments and technical reasons to why the company should invest, and these were perfectly aligned with what was received during the interview. Though the respondent described the decision-making process and other related issues to the investment procedures, which was not included in such a short memorandum, and hence this could not be verified. Albeit, given that the technical aspects and such were fully aligned with the written material, the authors see no reason to why the other information should be distrusted. Lastly, the construction company was the only company not providing written material, and hence triangulation is harder. The authors made sure that the interviewee was the closest person to the project available.
This does of course not tell whether the interviewee had reasons for distorting the data or not (e.g. make the evaluation procedure seem more thorough or successful than it actually was). Should one be thoroughly critical, there has been no way to triangulate the data, however, the authors noted no immediate signs during the interview which should raise concerns regarding the trustworthiness of the employee.

### 3.5.1.2 Ethical considerations

Looking at potential ethical considerations, the authors took the main points from the framework of Bryman and Bell (2015) into account. This consist of four areas, namely if there is (1) potential harm to participants, (2) lack of informed consent, (3) invasion of privacy, and (4) whether or not there is deception involved.

In terms of potential harm, the paper is using anonymity both in terms of company names as well as interviewees. Given the location of certain companies and their area of operations, their characteristics and description have been generalized as much as considered possible, but still, keep the description detailed enough to give the reader an understanding of the context. However, the anonymity has been kept throughout the thesis even though it has been difficult in some situations, for example when making the other interviews. Further, some of the respondents that were contacted abstained to participate even though they were informed that the thesis was using anonymity since they were anxious about how the thesis could harm their career. This elucidates the importance of anonymity for the respondents of this thesis. Pseudonyms were therefore used in order to easily refer to the companies without revealing their true identity, which is in line with the description from Bryman and Bell (2015) how to decrease the potential harm.

With regards to informed consent, given that all data was extracted through interviews and granted material, there were no covert observations involved. Further, all participants knew that there was recording ongoing and that their data would be anonymized. However, worth noting is that some participants were only given a brief and general description of the intention of the study, e.g. that it would be regarding investments in BI and not the more specific purpose of investment evaluation. This aspect was difficult to deal with given that revealing too much of the intention with the study could affect the answers of the interviewee since it could enable the interviewee to exaggerate the difficulties of evaluating intangible benefits in order to defend their own actions. Informed
consent is closely related to invasion of privacy, and was handled in the same way.

Whether there is deception involved or not, should be put in the context of the authors, not in a detailed way described the purpose of the study. However, given that it was desirable to have as unbiased answers and not create behaviour of focusing on specific parts of the interview, this had to be weighted against each other. Also, worth mentioning is that one interviewee was told that the call was recorded first after the interview was completed.

Relating to several of the points above, there was the issue where one the interviewees was a colleague to one of the authors. In order to disturb the interview or create inherent bias, the other author handled the interview and majority of the analysis of this company.

3.5.1.3 Reliability, Replicable & Validity

Reliability stresses the possibilities to repeat the study, which is particularly difficult in quantitative studies (Bryman and Bell, 2015). By having this in mind the authors tried to describe the methods used to collect the data as truthfully as possible and by describing all relevant material from the interviews. Further, a high level of internal reliability was reached by having both authors as interviewers in as many of the interviews as possible, which enabled two observers to agree about what they saw and heard.

Bryman and Bell (2015) describe replication as the possibility to replicate the study, which is not common in business research. The study allied with this aspect by critically examine the approach used, observably scan for complements to the methods used and finally analyze how these could affect the outcome. A complement could, for example, be focus groups instead of semi-structured interviews, which probably would have had other outcomes.

Validity address the issues regarding the study’s conclusion and its truthfulness (Bryman and Bell, 2015). Bryman and Bell (2015) question how the findings from a few cases can be generalized and representative for other cases and argue that external validity and possibilities to generalize the conclusion from a case study is low. When understanding the limits of a case study, Yin (2003) argues that it is useful to make a distinction between different case studies in order to increase the validity, which in this study is a unique case within the examined companies.
4.0 Empirical findings

Chapter four presents the empirical findings of the study. The descriptive findings will initially be presented to enable a cover of the differences that the study has come across. The empirical findings of the study are limited to the relevant aspect that serves the purpose of the study.

4.1 Findings

4.1.1 Case 1 (“Trading company”)

Background and intentions
The first company interviewed was a trading company who distributes products to grocery stores. The need for a new BI system was identified when the company decided to replace the existing ERP system and the old BI system was not technically compatible with the new ERP system. This need was identified by the finance and IT department, and the system’s primary area would cover trade, sales operations and purchasing. The company had already had an older version of a BI system in place, which the company had used for similar tasks and the new implementation hence had to be done in alignment to the new ERP system. The company is in a highly stable business and the system would be used for daily routines and cover operational performance, as well as better understand the company’s daily transactions. The program chosen in the end was QlikView. The new BI system was currently being implemented at the company and would cover its Swedish and Danish operations, and is hence not covering the global operations.

General capital budgeting process
Usually, the company’s capital budgeting process differ somewhat depending on the size of the investment. Investments exceeding certain amounts have to be approved by higher authorities from headquarters, whereas below a certain level can be approved by the individual subsidiaries. Investments are usually motivated by appraisal methods such as DCF and payback calculations. This is accompanied by an estimated full profit and loss statement ("P&L"), balance sheet and cash flow analysis for the coming five or ten years. If the investment is above a certain limit, this is summarized in an investment memorandum and presented to the headquarters. There is no specific financial hurdle in terms of required return for a proposed investment, but this is rather evaluated from time to time. Further, investments can be classified as strategic, meaning it is considered critical for future competitive performance. In these situations, the justification needed is lowered in terms of financial return, but rather of qualitative nature.

**BI investments and difficulties**

This specific BI investment had to be justified with a written memo to the owners since the investment exceeded the threshold. No DCF, payback or equivalent was used for this investment, with the main reason being that it is too hard to assess quantitative values to the perceived benefits. It was possible to calculate the costs and following depreciation which was summarized and presented. The focus of the justification was therefore related to the qualitative benefits rather than the quantitative. Variables used in the qualitative justification were foremost focused on costs, user-friendliness, interface, experiences from similar implementations and finally the comfortability and trust to the vendors. All these aspects were compared between a number of systems and vendors before making a decision. The head of controlling was very keen to involve all relevant stakeholders in the decision process since they were the ones that were going to use the system.

The costs were analysed by comparing the one-time costs, implementation and license fees. The user-friendliness and interface concerned the possibilities to work as easy as possible within in the system. To be able to work within the old system you had to be very well known with the functions, and this needed to change, given that more people would use the new system. Given that the old system would go out of function when the new ERP was implemented, the change was necessary, despite being difficult to justify financially.

“So if we wanted to have control of our business we had to do this investment but of course we also had to argue to our owner, how much is the investment, what is the gain from this kind of system and how is this compared to other BI systems?”
It was by the head of business control perceived as a must do to justify the investment to the headquarters, given the standard capital budgeting procedures.

The experiences from similar implementations were important since this type of implementations tend to be difficult, which made experiences of connecting and implementing similar systems valuable. Finally, a lot of different vendors and suppliers made sales presentation during the process and the trust towards the salesmen had a big impact on the final decision.

*Gap between research and practitioners*

The knowledge regarding possible methods to evaluate the investment was insignificant. Further, the interviewee was satisfied with the process and would form a similar process if making an analogous investment.

**4.1.2 Case 2 (“Construction company”)**

*Background and intentions*

The second company was a large international construction company, where the BI system was currently being implemented. The identified need came directly from the finance department. Using the BI, the finance team expected and intended to gain better control of project management and evaluation. Its main purpose would be twofold, firstly, help analyse the profitability and events during the construction and divestment process of projects, and secondly to assist in assuring reporting quality of the above. This need was identified by the finance department, which also steered the project of investing and implementing.

The company has operations worldwide in a variety of areas, and this BI system would only be used by this department for consolidation and analysis. When the company evaluated the potential systems and benchmarked them against each other, one of the last remaining systems, Power BI, had the benefit of being easily integrated with many of the other Microsoft products that the company was using.

*General capital budgeting process*

The methods used differ according to the size of the investment, the size of the investment also affects the level of attestation needed. Larger investments
require different use of appraisal methods. Usually, when investing in capital expenditure or projects of none IT/IS character, the company uses investment appraisal methods such as NPV, and an IRR. Further, it is usually a modified ROI used as well. The entire organisation is in turn benchmarked on operating profit and return on capital employed.

**BI investments and difficulties**

Before starting the project of investing in a BI system, the construction company engaged a management consulting firm specialised towards IT, and also later on an IT consultant for implementation once the investment had been done. Together with the consultants, the business controller who was interviewed created a list of requirements for the BI systems, which were to be evaluated. Put straight, according to the business controller, they lacked the competency in-house, or at least at the department, to evaluate all the technical benefits of the proposed system.

The evaluation process started by a broad comparison of available BI systems, which resulted in a few systems that met the company’s requirements. Thereafter, the remaining systems were benchmarked on their ability to meet the company’s needs and the costs associated with the system. No financial evaluation except for cost analysis was conducted. The company used a comparative evaluation method, where they benchmarked systems against each other. The comparative evaluation is described in section 4.2.4 before the data analysis.

*“Since this system won’t generate profit ... which meant that the only thing we actually looked at was the matching against our needs and costs.”*

- Business Controller, Construction Company

The organisation has a good overview of time spent on different tasks within the finance department, and could hence by estimations quantify potential time savings the system could provide within the department. Other benefits expected were better follow up on project outcomes and budget performance. Further, it would allow better consolidation of the project portfolio and also better quality of the reported data. However, the time savings were considered hard to quantify, and also not entirely sure, given that the time savings would lead to work on other tasks. This is aligned with other IT/IS investment in the company, where focus usually is on the costs rather than estimated benefits.
Other difficulties, apart from adopting the standard appraisal methods, was the fact that it was hard to really understand the benefits proposed by the salesmen of the BI systems. In order to handle this, the company hired a consultancy firm to help negotiate and act as a support, in order to better understand the specifications of each system, as mentioned above.

*Gap between research and practitioners*
There were no appraisal methods to the business controller’s knowledge which could have been used in addition to the typical financial methods. When being asked, the business controller was of the perception that the process had gone well, and would not make further efforts to change, should a similar investment be conducted.

4.1.3 Case 3 (“Manufacturing company”)

*Background and intentions*
At the third company, a multinational manufacturing company, three interviews were conducted, one with the project manager, working with the BI implementation, and also the finance as well as production unit manager. The investment and implementation of the BI system were done at one of the company’s largest manufacturing facilities, where it was intended to work towards the production process. At the same time as the interviews were conducted, the system was being implemented. The system chosen in the end was Qlik Sense. The main expected benefits and area of use within the production process were related to productivity improvements, cost reduction and improvement of handling of rejections.

“They need a tool in order to start analysing their data, the demand is directly from production […] Number one, improve production, increase efficiency, reduce costs and improve quality. That is number one. Number two, increase knowledge about data and processes in production.”

- Project Manager, Manufacturing Company

Since there would be users across the facility, the project manager was interested to involve many stakeholders during the implementation process.

The BI system would be used at the production facility, as mentioned above, however, worth noting is the fact that large parts of the organisation apart from this production facility have engaged in implementing another system. Both the project manager and production unit manager were pleased with the process so
far and impressed by the speed which the team had managed to roll out the implementation process.

**General capital budgeting process**

Given that the company is dependent on large capital expenditures, there is a thorough capital budgeting process in place. Depending on the size of the investment, there are several approval levels, ranging from production line manager, all the way to the board of director of the holding company. Further, investments are divided into several categories where different requirements regarding appraisal methods are required. The typical investment is evaluated by a NPV, payback and IRR, where specific hurdles are set as a guideline with regards to what should be approved or not. Further, just as in the first case above, investments can be approved as strategic, where they are considered specifically important for future success, and hence the requirements of expected returns in terms of financial evaluations are either lowered or removed.

**BI investments and difficulties**

The need for BI system was identified from the production facility, however, there had been BI systems implemented in other parts of the organisation before. The evaluation process started by identifying the largest providers of systems, and thereafter two systems that matched the outlined criteria were chosen for further evaluation. The comparison between these two systems became severely thorough, given that there were internal contradictions between the IT department and the production facility regarding what system should be purchased. The systems were benchmarked by the project manager, which resulted in a 56-page long business case. According to the interviewee, it was critical that the sales people did not influence his choice, whereby it became very important for him to evaluate the two systems by himself.

Variables considered when benchmarking the systems were compatibility with existing systems, possibilities to connect to existing databases, user-friendliness and interface as well as costs. The costs were analysed by a total cost of ownership method ("TCO"), and thereafter a NPV calculation. In addition, there were expected benefits in terms of increased information to the production managers. It was reasoned as such that it would take significantly less time to retrieve and analyse the same information in comparison to today, and that this would allow more time spent on finding new information, previously not known or available. However, no estimations in terms of quantification of these benefits were used in the NPV, and hence only the cost side of the calculation was used.
The financial manager of the company was of slightly different opinion regarding how this could have been approached. According to him, who was not involved in the evaluation, there is almost always a possibility to attach values to expected benefits, despite being highly arbitrary. Further, he advocated the use of assessing probabilities of achieving these explicit benefits, in order to start a discussion amongst involved decision makers whether or not the expected value is reasonable. Also, just as had been done by the project manager, it was suggested that all intangible benefits should be listed and discussed, even though there is not a quantified value. On the other hand, the facility's production manager argued that it is difficult to put quantitative values on the expected benefits and that as long as there is a discussion regarding the expected outcomes it is possible to make an informed decision.

**Gap between research and practitioners**

The total cost of ownership method was not used in the standard capital procedure and was considered as suitable for this investment. Except for that addition, there was limited knowledge about other suitable appraisal methods, and the approach would have been the same, should another investment be made, according to the project manager. However, the finance manager was of another opinion, and would have given more traditional approaches such as NPV a larger influence of the decision, should he be involved in the next similar investment.

**4.2.4 Comparative evaluation conducted**

Since all companies conducted a comparative evaluation as their main method when appraising the potential investments, an own section below is dedicated to describing how the comparisons were done at the specific companies. This is hence an elucidation of the main findings with regards to what investment appraisal method was used at the companies.

The evaluation process proceeded by the trade company started off by discussing the experiences among different BI systems internally. All systems discussed were then screened in order to get a broad overview of their functions and if their features met the needs of the company. During the screening, services focused on ranking and discussing the BI market were used (e.g. Gartner), in order to get a understanding of the systems and their possibilities. Combining the internal experiences from other systems with the screening of the market, the process narrowed down to QlikView. After QlikView was found to be the most suitable system, consultants were hired to conduct a proof of concept
and also clarify the possibilities with QlikView system. The QlikView system was then in a memorandum compared to the organization’s current BI system, named Infosuite. In the memorandum, the trade company started off by describing the current situation within the organization and the importance of changing system. Further on, the memorandum introduces QlikView by giving an overall explanation of the company and the features enabled by the system. A comparison with focus on costs and the main needs was then conducted. Finally, the memorandum recommended to implement QlikView given the small difference in costs compared to Infosuite, and also QlikView better met the requirements and needs. The process described in the memorandum was in line with the description given by the chief controller during the interview.

The construction company’s comparative evaluation started at a much broader level than the other companies. Looking at ten different providers of systems. The comparison quickly narrowed the selection down to only two companies which provided solutions matching their specific needs. From there, a more thorough comparison was done. However, in contrast to the other companies, the second stage of screening was strongly influenced by costs rather than other attributes. In the end, it was a major advantage for Power BI to be of the same manufacturer as many other software systems in use.

Looking at the manufacturing company’s comparative evaluation, the project manager clearly stated that he tried to rely on own first-hand experience by testing the two final systems himself. The first round of comparative evaluation, deriving to only two systems, was done by looking at technical specifications. Thereafter, the two final systems were benchmarked on variables such as their ability to easily drill down into detailed levels of data. This was important since the main task would be a better understanding of production processes, and users of the systems would include personnel not usually accustomed to new and modern IT tools. Further, the two alternatives were benchmarked on their ability to integrate operational databases. This was the main aspect given that the facility was running over 14 different databases, many of which are classified as legacy systems. Closely related to the easiness to drill down into data, was the user interface which also was a key evaluation variable. The project manager emphasised the importance of being neutral in the evaluation, and hence not base the decision on sales information provided by the vendors. The description of variables described by the project manager was clearly aligned with the final justification of benefits in the business case received in written form. Also, the production unit manager emphasised the importance of being unbiased in the
decision-making process. However, he also admitted that he had been working with Qlik at his previous positions at another division within the company.

Table 4.0, overview of comparative evaluation

<table>
<thead>
<tr>
<th>Case</th>
<th>Number of BI vendors within first round of screening</th>
<th>Variable</th>
<th>Number of BI vendors within second round of screening</th>
<th>Definitive variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1 - Trade company</td>
<td>“Few major companies”</td>
<td>n.a</td>
<td>One</td>
<td>User friendliness, Graphical interface, Costs, Implementation/Integration, Annual license fee, Support option/supplier, Size of organization behind it</td>
</tr>
<tr>
<td>Case 2 - Construction company</td>
<td>Ten companies</td>
<td>Meeting the criteria</td>
<td>Two</td>
<td>Costs, Match with other IT infrastructure</td>
</tr>
<tr>
<td>Case 3 - Manufacturing company</td>
<td>“Several companies”</td>
<td>n.a</td>
<td>Two</td>
<td>Costs, Ability to drill down into data, Implementation, Interface</td>
</tr>
</tbody>
</table>

5. Data analysis & Discussion

Chapter five presents an analysis of the empirical findings given from the study’s specified framework, where the empirical findings have been put in relation to given theories and earlier studies. The chapter ends with a discussion where the analysis is put in a broader context.

5.1 Data analysis

5.1.1 Background and intentions

The idea and identified need to invest in a BI system came from different parts of the organisation in the different cases. This clearly shaped the decision-making process of each case. As put forward by Frisk, Lindgren and Mathiassen (2014) there are several approaches to making choices. Just as found in Frisk, Lindgren and Mathiassen (2014), which proposed a model of interaction back and forth between the decision maker and the different alternatives, continuously gathering more information. This is fully aligned with the trade company, where the company’s financial department continuously interacted not only with the different vendors to gain more information and trust, but also with different internal stakeholders. Creating a stakeholder understanding was of paramount importance according to the financial department, since it, in the end, was
intended to be used by them to gain more information about the daily operations. In contrast, the evaluation process at the manufacturing company was portrayed more as choosing between two clearly presented alternatives, which is more aligned with what Dean and Sharfman (1996) denotes as striving for rationality. Also, similar to the trading company, the manufacturing company's project manager strived to create stakeholder understanding. The construction company's process was somewhat more influenced by uncertainty, given lack of experience in the area, and hence a separate consulting firm was engaged to better understand the different alternatives. Worth noting is that the trading company also used a consultant company, however not to the same extent in the evaluation process, it was merely hired to provide a proof of concept. The production manager at the manufacturing company confirmed what the project manager stated, namely that there was a thorough investigation of available alternatives.

Simultaneously as there were many stakeholders involved in the trade and manufacturing company, the identified needs and benefits, despite not in the end being quantified, were of shareholder-oriented nature. The manufacturing company's reason for investing was to increase productivity and cost efficiency while also improving work on rejections. The trading company's expected benefits are harder to attribute to either being stakeholder or shareholder oriented, whereas the construction company's benefits were mostly focused on internal and reporting efficiency, attributable to both stake- and shareholders.

5.1.2 General capital budgeting process

Despite referring to research conducted a couple of years ago, Ballentine and Stray (1998) list commonly used appraisal methods for standard investments. The most common methods in use were payback, NPV, IRR and ARR. Further, Farbey, Land and Targett (1992) mention ROI as a prevailing method in use, and also highlights the inherent problems, namely that some investments where cash flow estimations are hard may be overlooked. What is mentioned by the literature is to a large extent reflected by the different companies. The trade company usually used NPV and payback calculations when assessing proposed investments, while the construction company used NPV, IRR and a modified ROI. Similarly, the manufacturing company used NPV, IRR and payback in their standard investment appraisal setting.

Also, it was mentioned by two of the companies that there were different levels of approval authority before justification had to be done towards parties outside of the local organisation. Further, one difference worth noting between the trade and manufacturing company was the financial hurdles required for approval of
standard investments, where the trade company had a floating level of acceptance while the manufacturing company had a more strict level in terms of payback time. However, given the different size of the investment, the manufacturing company and the construction company could make the decision within the division, whereas the trade company had to justify the investment to headquarters. This could, of course, affect the level of ambition in the evaluation.

Looking at the standard capital budgeting process of the companies, which all use rather standard appraisal methods according to research in the area, it could be expected that these deeply rooted methods also become used for investments in IT/IS and hence also BI investments (Schniederjans, Hamaker and Schniederjans, 2010). Simultaneously, as presented in the framework of Irani and Love (2002), there are several methods suggested to be used when evaluating IT/IS investments, and hence there are possibilities to deviate from the standard capital budgeting process.

5.1.3 BI investments and evaluation

Despite the above, there has been no thorough attempt in any of the companies to use neither specifically adapted or standard investment appraisal methods. All of the involved companies have to some extent performed a comparative analysis of available alternatives. The manufacturing company was the only one to take initiative in terms of adopting established and by the literature suggested methods (Royer, 2013). Further, the manufacturing company also approached the investment appraisal by using a NPV, however only with the cost base of the investment. This resulted in a TCO, which was not in the company's standard toolbox of investment appraisal methods.

Neither the trade company nor the construction company made any attempt to financially justify the investment. However, the trade company justified the investment to its owners with supporting arguments, almost exclusively of qualitative nature, with cost specification being the only variable of quantitative nature. In a similar manner, the construction company's focus was almost exclusively on costs when comparing the different alternatives.

Both the manufacturing and trade company were in the same situation as described by Parker, Benson and Trainor (1990), which argue that many managers feel responsible for justifying investments despite the used investment appraisal methods are not deemed appropriate. Both the manufacturing and trade company argued in the business case and investment memorandum respectively, why the investment should be carried through. However, with an
exception for the TCO used by the manufacturing company, the presented costs did not itself bring much in terms of financial justification. The need for justification at the construction company was not as clear, given that the need was identified and the project was initiated by the financial department itself.

Further, just as described by Willcocks (1992), there can be a catch 22 identified at the trade company, where the finance department had the perception that there was an inevitable need to have this sort of system in place when there was a replacement of the old ERP system. This was by the trade company seen as a necessity in order to have sufficient control of the business and hence needed despite lack of financial justification. Also, it was reasoned as such that it was such a small investment in proportion to the newly implemented ERP system, which made the justification of lesser importance.

Just as the definition of BI used in this paper, put forward by Negash (2004): “... a system that combines data gathering, data storage, and knowledge management with analytical tools to present complex and competitive information to planners and decision-makers.” all companies mentioned expected benefits of what Zuboff (1988) would denote as informative character. This included from the manufacturing company’s point of view the expectation that users of the systems would retrieve the same amount of information in significantly reduced time. Further on, it was expected that this would create excess time where more information potentially could be retrieved. The construction company had the expectation of better information regarding project follow up, and the trade company expected the system to provide information to employees at almost all levels of the information. This leads to the inherent problem with the information in investment appraisals:

“The degree to which it is possible to predict the impact of a new system is an important factor in determining how to do an evaluation. [...] a system designed to provide a manager with 'better' information in order to improve decision making depends on the capability of the manager to use the better information to deliver the expected benefits. The impact is indirect.” (Farbey, Land and Targett, 1992).

This problem is present in all the evaluation processes investigated, however at different levels. The trade company acknowledged that there are expected benefits with informative character but clearly had the perception that it not possible to assess cash flows to this sort of benefits. Similarly, the construction company was of the perception that the investment would not generate profit, but merely information and time savings which would enable work at other tasks.
Given the nature of the expected benefits mentioned, this situation is very similar to the issues companies are having in general when it comes to financially justifying IT/IS investments and also BI investments specifically (e.g. Hochstrasser, 1990; Parker, Benson and Trainor, 1990; Hirschheim and Smithson, 1998; Gibson, Arnott and Jagielska, 2005; Irani, 2002 and Ababneh, Zeglat and Shrafat, 2017) However, worth emphasising is the fact that none of the interviewees saw this as problematic, and none would have changed their justification or appraisal methods, should a similar investment be conducted.

Turning to the manufacturing company on the other hand, despite deriving from increased information for more employees, the sequent expected benefits were more tangible, e.g. better productivity and better handling of rejections. Even though, there was no thorough attempt to quantify these benefits and hence be able to use these in any financially oriented investment appraisal method. This led to the use of a NPV with only the cost base present, which both the project manager and production unit manager deemed sufficient. Since the financial manager was of another opinion regarding how it should have been justified, there could be signs of internal political forces at play.

Even though specifically pinpointing areas of expected benefits there were no clear goals set with regards to what was expected to achieve. Consequently, there were no estimations of quantitative nature for these benefits. Here, according to the finance manager of the facility, this could, and perhaps should, have been differently approached. Working more thoroughly to assess quantitative values to these types of benefits does bring value to the evaluation process by creating a better understanding. Despite being arbitrary, it is of importance to at least understand potential effects in terms of monetary value, also for the project managers of IT/IS investments. Another suggested approach by the finance manager was more similar to the approach of the project manager, namely, list all potential benefits and thereafter discuss if the proposed investment is worthwhile pursuing given the potential benefits.

A common area in all the investigated cases was the approach of evaluating the potential investment in a comparative manner. Given the nature of intangible benefits and IT/IS investments, Klein and Beck (1987) proposed a framework for comparing investments, based on preference theory. In a similar manner, all interviewees had conducted a thorough comparison of available alternatives, where a present group of variables was to be benchmarked.
The trade company benchmarked the available alternatives on variables such as user interface and user friendliness as well as the costs of the system. Further, there was an emphasis on the relationship and connection to the different salespeople as well as other employees at the vendors, with whom the company eventually would work with, there amongst the implementation team. Similarly, the construction company hired a consulting firm to help evaluate if the systems met their present needs. Thereafter, the variables were down to cost comparison and match with other IT infrastructure. The manufacturing company benchmarked the two alternatives mainly on their ability to drill down into data, their ability to connect the company’s existing databases, given that there were many legacy systems in place. In addition, the user interface was an important variable, given that there would be a broad user base at the manufacturing facility. Hence, there is a large difference between how the comparative evaluation has been approached. The trade and construction company relied a lot more on external support from both vendors and consultants, whereas the manufacturing company emphasised the need to do the evaluation as unbiased as possible.

The evaluation process can hence be seen as following the framework of Klein and Beck (1987), i.e. instead of evaluating an investment opportunity on a stand-alone basis, a thorough comparison, in order to choose the best alternative with regards to available information, is conducted. As Klein and Beck (1987) argue, this is a workaround to present methodologies which require an assignment of numerical values to a qualitative (i.e. intangible) variables. However, as also mentioned by Klein and Beck (1987), this approach is only suitable for a set of known alternatives. These known alternatives can be achieved by the iterative and interactive process described by Frisk, Lindgren and Mathiassen (2014), i.e. continuously gathering more information as the process develops, or by having all information available up front. The process of retrieving information for the decision-making process was somewhat different between the companies, where the manufacturing company handled it separately, the construction company hired a consultancy firm, while the trade company was in close contact to the vendors. However, this approach may have suited the given situation but is only adoptable when there are alternatives presented.

5.1.4 Gap between research and practitioners

The awareness of methods disposable for evaluating these types of investments can be perceived as rather low within all of the examined cases, even though the manufacturing company deviated from their standard appraisal method. There is from academia plenty of suggested methods for solving the ex-ante evaluation of
IT/IS investments (e.g. Irani and Love, 2002; Royer, 2013), yet there is amongst the practitioners neither an awareness nor attempt to investigate this area. Another discrepancy between precedent research and the interviewed cases is the perception of what actually is a problem in the investment appraisal procedure. Farbey, Land and Targett (1992), Ballentine and Stray (1998) and Irani (2002) point out that there are inherent issues with using standard appraisal methods for IT/IS investments, and looking at the interviewed cases, none used the standard appraisal methods, except for the manufacturing company which only used the cost base in an NPV model. Further, the literature highlights the lack of appropriate appraisal methods as an issue. However, this has not been seen as problematic amongst the interviewed companies. The reasons for doing an investment appraisal according to Farbey, Land and Targett (1992) are only somewhat covered, given that all evaluations were of comparative nature.

5.2 Discussion

There are several points worth highlighting in the data analysis. First and foremost, the evaluation and investment appraisal process in all interviewed companies were of comparative nature rather than ‘stand-alone’ evaluation. It was from all companies a clear need identified and a decision to invest had already been made. The evaluation in terms of financial justification could perhaps be seen as unnecessary, given that already had been decided that a BI system should be purchased. Nevertheless, as presented by Farbey, Land and Targett (1992) and Irani (2002) there are many reasons for doing investment appraisals which consequently may be overlooked when not trying to financially justify the investment, even though the decision itself to invest already has been made.

It was clearly apparent in two of the cases that the intangible benefits would either not directly bring profit, or that it was too difficult to assess a cash flow value. This is aligned with the issues highlighted in the precedent literature, however, the attitude of not expecting the system at all to contribute to profitability, or completely disregard the possibilities to assess a cash flow value is questionable from a shareholder point of view. Of course, one cannot expect a detailed and thorough backing of all expected benefits, but as Kaplan (1986) reasons about the issue, it could perhaps be better to be vaguely right than completely wrong. The manufacturing company's BI system was implemented to bring benefits such as cost and rejection reductions. Given that there should be other investments, not within IT/IS, with similar expected benefits one could have expected a possibility to assess a value to these benefits. Further, the vendors of BI systems are able to assist with precedent case examples of such
benefits, however, it is of course not without risk to use a biased party in the evaluation.

It is possible that these findings are the result of several factors. First, it could be that the environmental circumstances and context affect the evaluation procedures. All investments were done at local levels within the companies, and the BI systems would not be used company-wide. Should the investments per se be larger both implementation and capital wise, there may have been a different result. Secondly, the fact that only one of the companies had to report outside of its division or facility may, of course, lower the ambition to justify the investment. Thirdly, the selection process could have affected the outcome, it may be the case that many other companies are approaching this an entirely different way.

The lack of attempt could eventually be found in the initiators of the project, who at the manufacturing company was of the opinion that the investment’s size in comparison to the company’s profit was negligible. The same mentality was present at the trade company, which stated that the sum to be invested was of lesser importance given that it was attached to a much more expensive ERP system. The manufacturing and trade company in their respective standard capital budgeting process have the opportunity to request approval for investments considered as strategic. One can draw similarities to the investments done in BI systems and strategic investments, despite the fact they are not classified as such from the companies’ perspective. Should there be a fading tendency to classify investments as regular, but evaluate them in the same framework as strategic, there could be a dilution in its meaning and usage. From a shareholder point of view this is of course questionable, given that all invested sums add up to a total of capital expenditures in large multinational companies.

The above could render problems for all different organisations going forward. As mentioned in the problematization, the increased expenditures of investments with these types of benefits are not likely to slow down. Consequently, large sums of capital could potentially be allocated without the thorough justification of the expected returns from shareholder capital spent. A comparative evaluation of available alternatives does not stand alone justify the need for a system, and the qualitative arguments as to why the system is needed are of course difficult to follow up or even benchmark to other potential investments where capital could have been evaluated.

Another issue worth highlighting is the decision making process which in the end can affect the investment appraisal procedures. The project manager at the
manufacturing company clearly stated that the evaluation should be done with as little involvement from the salespeople as possible. At the same time, the trade company hired a consultancy firm to provide a proof of concept, and the construction company used consultants both in the evaluation as well as the implementation process. This could, of course, affect the findings. The lack of in-house experience at the construction company could have opened up for the consultancy firms as stakeholders to affect the process. For example, the comparative evaluation’s first stage of screening potential systems included significantly more vendors than that of the trade and manufacturing company. Also, the consultancy firms could potentially also have preferences regarding what system they would rather implement, which hence could affect the comparison process.

Just as the issue of not performing financial justification, the dependency on consultants can of course lead to escalate dependency going forward when in-house competency is missing. As more and more capital is spent on these types of assets, unbiased evaluation becomes yet more desirable.

Thirdly, there is a clear void between the interviewed companies and literature regarding whether the lack of suitable investment appraisal methods is a problem. As put forward by Myrtidis and Weerakkody (2008), there was no immediate interest in solving this issue amongst its investigated companies. Similarly, there was no expression amongst the three cases in this thesis that there was a need for change. From this standpoint, if there is no need or willingness to improve within the area amongst practitioners, there is perhaps an exaggerated problematization in literature. Though, from a shareholder perspective, it is of course not as easily disregarded. Further, should the case studies have involved more stakeholders in the organisation, perhaps from top management, there could perchance be other opinions regarding the “problem”. However, should it amongst top managers be seen as a problem, the investment appraisal methods and capital budgeting process regarding IT/IS investments would most likely have required more thorough or financial approaches. This could imply two things. Either a need to further strengthen the knowledge amongst practitioners that there are available methods or an acceptance amongst shareholders and academia that practitioners do not see this as an issue.

Clearly, the comparative evaluation is not enough to financially justify the money spent, since it is difficult to benchmark outcomes where there are no pre-set estimations of expected benefits. This could, of course, reduce the long-term development of competencies within the area. However, the perceived difficulty
amongst the practitioners must be put in the light to the tedious and complex task to actually assess values to the benefits, and perhaps it is too much effort to conduct a thorough financially oriented investment appraisal. Though, it may be worth being vaguely right than completely wrong, which definitely is the case when companies state that there is no expected profit deriving from the systems.

This issue could potentially be resolved by gaining more knowledge of how to quantify the expected benefits. Unfortunately, there is a biased party holding this information, namely the vendors of the BI systems. With their previous experience in terms of customer cases and sales material, there may be a possibility to bridge the current gap. Vendors can provide, despite biased, information regarding precedent outcomes of improved performance in many different areas. This can of course, with a critical mindset, be used as a basis to start assessing values to what at the beginning of an evaluation process may be perceived as impossible.

6. Conclusion

Chapter six concludes the analysis of the study and discusses explanation factors regarding the result. Furthermore, the conclusion offers general reflections and gives proposals for further research.

This thesis has with the support of three case studies investigated how companies evaluate and justify investments in one of the latest trends within IT/IS investments, i.e. BI systems. It has by precedent literature been stated that there are many inherent problems in evaluating investments with significant intangible benefits, especially such as increased information, which is one of the main purposes of many BI systems. Previous research has identified a lack of use of suitable investment appraisal methods in the capital budgeting process when ex-ante evaluating IT/IS investments, and also to some extent a lack of knowledge and immediate interest amongst practitioners to improve within the area. The findings of our research show much alignment with precedent research, but also some glimpse of hope for shareholders to have a solid justification for how their capital is spent, should there be a willingness in the organisations to adopt a new mindset.

None of the companies used a thorough financially oriented investment appraisal method when evaluating the investment. None of the companies assessed quantitative values to the expected intangible benefits. Further, the investments were perceived as important for the companies, and it is likely that the investment decision itself already had been made in at least two of the
organisations already before the end of the evaluation process, showing little interest for deciding whether the stand-alone investment generates any tangible return for shareholders. However, it was by one of the companies’ finance manager argued that it would have been better to try harder to assess quantitative values to the benefits, hence being a little closer to somewhat right, rather than completely wrong. All evaluations were comparisons between different BI systems, rather than assessing the issue whether to invest or not, hence supporting the fact that the investments likely would have been carried through regardless of stand-alone return of the investment.

The findings of this thesis can, of course, have implications looking ahead. Investments of this nature will doubtlessly increase going forward, implying more and more of allocated capital being employed without a thorough justification, hindering benchmarking and follow up on actual outcomes. Ex-post evaluation of goal achievement in relation to quantified targets can of course in an iterative process enhance the evaluation process’ accuracy. Should this not be the case, long-term competence in evaluating investment opportunities is reduced. There are potential solutions, for example, to engage vendors who have experience of other customers’ outcomes, as well as plenty of information. This of course is not without problems, given the inherent bias of the information source.

Finally, given the lack of interest and knowledge shown with regards to financial justification of this sort of capital expenditure, it would be of utter interest to understand top management’s view of how these large sums of money are being allocated to investments, which are considered a must, but with little understanding of actual financial returns.
References:


Appendix
Appendix.1, Interview guide
The interview starts with asking whether it is fine with the interviewee to have a follow up interview, should there be a need for complementing further. Also, it will early on be asked if we can take part of the formal decision material used in the evaluation of the project/investment.

1. When and how did the question regarding looking into a potential BI system arise in the organisation?
2. From where in the organisation was the need identified/proposed?
3. After the recognition of a potential need, how did the early project evaluation proceed?
4. Where there professionals from the finance/economy department involved in the project, and in that case, how early/late did they become involved?
5. How does a standard capital budgeting procedure look like, and did this procedure differ in anyway?
6. What benefits did you expect to receive from the investment in this BI system?
7. Looking at these benefits, at the later stages of the investment appraisal, which one were used as an argument for purchasing the BI system?
8. What investment appraisal methods do you usually use when evaluating investments, and did this situation differ in terms of methods used?
9. How did you cope with using these methods in conjunction to the benefits mentioned above?
10. What methods are you aware of, which could have been used and accepted by the organisation in evaluating this type of investment?
11. If you used financial methods, how did you justify the benefits of intangible nature in financial terms?
12. Looking at the process of evaluation, where did you find it easy and difficult?
13. Should you invest in a similar system once again, how would you justify the benefits and is there anything you would have done differently?
## Appendix.2, Definitions of BI

<table>
<thead>
<tr>
<th>BI Vendor/Author</th>
<th>Definition BI</th>
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<tr>
<td>Luhn (1958)</td>
<td>&quot;... a comprehensive system may be assembled to accommodate all information problems of an organization. We call this a Business Intelligence System.&quot;</td>
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<tr>
<td>Moss and Atre (2003)</td>
<td>“BI is an architecture and a collection of integrated operational as well as decision-support Applications and databases that provide the business community easy access to business data.”</td>
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<tr>
<td>Negash (2004)</td>
<td>&quot;... a system that combines data gathering, data storage, and knowledge management with analytical tools to present complex and competitive information to planners and decision makers.”</td>
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<tr>
<td>Microsoft (2007)</td>
<td>“Business intelligence (BI) simplifies information discovery and analysis, making it possible for decision-makers at all levels of an organization to more easily access, understand, analyse, collaborate, and act on information, anytime and anywhere.”</td>
</tr>
<tr>
<td>Papadopoulos and Kanellis (2010)</td>
<td>“BI can be generally defined as an enterprise architecture for operational and decision support applications.”</td>
</tr>
<tr>
<td>Gartner (n.d.)</td>
<td>“Business intelligence (BI) is an umbrella term that includes the applications, infrastructure and tools, and best practices that enable access to and analysis of information to improve and optimize decisions and performance.”</td>
</tr>
<tr>
<td>Cognos (n.d.)</td>
<td>“Business Intelligence is an integrated system that provides a wide range of functionality to help you understand your organization’s data. BI is used to view or create business reports, analyse data, and monitor events and metrics so that effective business decisions can be made.”</td>
</tr>
<tr>
<td>OLAP (n.d.)</td>
<td>“The term Business Intelligence (BI) refers to technologies, applications and practices for the collection, integration, analysis, and presentation of business information. The purpose of Business Intelligence is to support better business decision making”</td>
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Appendix.3, Overview of search process for the literature review

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<th>Keywords</th>
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