Are Swedish Firms Ready For Real Options?

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Abstract

This study deals with Real Option Analysis. This is a powerful method of capital budgeting which also encompasses strategic planning. The method is praised and hailed by the scientific community but however is not well used in practice. There have been many potential reasons aired as to why Real Option Analysis has not gained more wide spread acceptance in practice. The authors have chosen to, through a qualitative study; look into the potential mismatch between Swedish firms' organizational systems and structures and what may be required to successfully implement Real Option Analysis. A broad literature study has been conducted to acquaint the reader with potential problems encountered when using Real Options Analysis. Specifically, what Real Option Analysis demands from a firm in terms of organizational systems, structures as well as other soft values in order to be implemented successfully is comprehensively examined. This is then compared and contrasted to how the five interviewed Swedish firms were described. The study has lead the authors to the conclusion that for Real Option Analysis to function fully and correctly, many firms need to amend their organizational structures to make sure the options present in the company are exercised in a correct and timely fashion. Equally, the authors have identified a factor regarding an options mindset that entails that for a firm to even see the need for applying ROA, they first have to start viewing their business as containing options and flexibility.

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1 INTRODUCTION

In financial markets, purchasing an option on a stock gives an investor the right, but not the obligation, to buy or sell the stock at a fixed price within a fixed period. In the "real" market, in much the same way a firm may buy an option on real assets. This option can then be exercised or not depending on how both exogenous and endogenous factors for the firm develop. This analogy between financial and real options takes root in the model of financial options developed by Fischer Black and Myron Scholes in 1973. This knowledge was subsequently complemented by the insight that options methodology could be used to value investment opportunities as well as ongoing projects in the markets for products and services. This extension of application field was still being based on the underlying option philosophy of procuring the right but not the obligation to act (Leslie and Michaels [1]).

An investment project (hereafter project) valued using real option analysis (here after ROA) is systematically assigned a greater value than by using traditional valuation methods as it includes the flexibility to act on new information and thus affect the outcome of an investment (see Myers [2];Copeland and Antikarov [3]). ROA thus accounts for the value of managerial flexibility inherent in projects. The flexibility envisioned with ROA can be in form of expanding when conditions are favorable, abandoning projects when conditions are less favorable, change the strategic direction of the firm depending on competitors' actions and other types of flexibilities inherent in different kind of projects (Trigeorgis [4]). Furthermore, not only does the use of ROA include the value of flexibility and thus reflect the true value of a project, but it is also seen as the link between financial planning and strategic planning. ROA represents a structure with which to view strategic planning from a financial mathematical vantage point. Hence it gives continuous directions to managers as to which paths to choose based on profitability calculations and environmental changes (Mun [5]). By not applying ROA one might not be aware of the strategic flexibility available to adjust the direction of the project. By not acting on all the sequentially revealed information, one will not only undervalue projects but also fail to reap the full benefits as one may ignore the available flexibility along the way. ROA is thus just as much a strategic tool as it is a way of valuation (Myers [2]).

1.1 RESEARCH BACKGROUND

Following the authors intend to show that ROA is not used much in practice despite the great theoretical advantages. What other studies have pointed out as short comings of ROA will then be highlighted and subsequently a clarification of why the authors of this study have selected the implementation problems to look at and why they are relevant to investigate.

In a study carried out by Graham & Harvey [6] in 2001 among CFOs in the USA, it was shown that only 27 % of the executives participating in the survey used ROA when making capital budgeting decisions. This is slightly higher than many other surveys conducted by institutions and researchers in the USA. For instance, Teach [7] reported that approximately 11 % of the 205 CFO:s surveyed used the method. Similar studies show that the use of ROA in project evaluation is even less prevalent in Europe (Brounen et al [8]). Along the same lines, surveys done in Sweden indicate that the use of ROA in capital budgeting decisions is negligible (Sjögren & Sandahl [9]). Only 60 % of large public companies listed on the Stockholm stock exchange were aware of the method and even so, they mostly applied it in a very non quantitative and informal fashion (Kritz & Persson [10]).

Previous studies have pointed to many factors for ROA not being more widely accepted, such as the illusion of ROA being a black box. Management is often said to have a hard time understanding the assumptions behind the real option method and experience difficulties with the calculations involved. These reasons are often argued as being the primary forces for the resistance towards the model. However, during later years, the computational development and digital applications have allowed real options to be calculated and modeled through simple algebra and computer aided applications to create binomial lattices for valuing an option. This making it easier to explain to, and envision for management. In addition, there exists software sold off the shelf that assists the analysts or executives with solving complex problems through ROA (Teach [7]).

The mathematical assumptions of the model have come under fire too. Miller and Park[11] point to the difficulty of estimating the volatility used in the model and Figlewski[12] points out that, for example, asset returns may not always be log normal as assumed by real option framework.

In recent times, others have instead started pointing towards the match of the organization with ROA theory and the ensuing management problems as a major reason for not using ROA. Triantis [13] indicates that the ability of managers to actively manage real options, behave in en entrepreneurial fashion and act upon existing flexibility is an important factor when deciding if ROA can be applied. Having a system that can identify, create and subsequently exercise real options is critical. He points out that many companies have had valuable real options but simply failed to exercise them.

1.2 PROBLEM DISCUSSION

Much of the previous research carried out regarding the application of ROA (see: Trigeorgis [14], Luehrman [15] and Dixit and Pindyck [16]) treat the firm as a monolithic actor. Practically this is not the case since managers charged with managing a task clearly have one set of motivations whilst executives charged with evaluating a portfolio of opportunities have another set of goals and motivations (Myers [43]). Addressing this agency problem opens up a whole other dimension of difficulties in applying ROA in addition to those often discussed in conjunction with the model assumptions. Along these lines both Adner and Levinthal [17] and Kogut and Kulatilaka [18] point out that the whole ROA process from capturing to maintaining and finally exercising the option deals with both management and organizational challenges. Thus, Adner and Levinthal [17] also point to organizational factors as being important when applying ROA and vital in reaching the full flexibility inherent in the firms projects, and thus reaching the full potential of ROA. Triantis [13] goes as far as to say that the ability of managers to manage in an active and entrepreneurial manner is crucial when deciding if real option analysis can be applied at all.

The formation of the project discovery activities and the project team's scope of authority draw the boundaries and frame the project using real options logic (Adner and Levinthal [17]). McGrath [19] also points out that firm action is of great importance in developing the value of the option at hand. Hence, it is important to bear in mind that the firm in question is capable of affecting the underlying option which makes it a situation of "act and see" versus the "wait and see" of financial options.

Many studies [40] [42] [50] have been carried out, in particular at "Gothenburg School of Business, Economics and Commercial Law", regarding the theory of ROA, these include comprehensive case studies as well as examinations of the mathematical assumptions made behind the model, such as if project values follow Brownian motion or how the volatility of project returns is calculated. As this critic of the real option model has already been amply dealt with, we have decided not to focus on it.

Further criticism regarding the assumptions and the factors leading managers to perceive real options as a "black box" is dismissed by Myers [2] who implies that managers have been taking account of flexibility for ages and that the real option rationale is nothing new that managers need to be educated in. It is simply a way of quantifying flexibility. Furthermore Teach [7] dismisses the "blackbox" critic as today's computer aided computation methods are often both transparent and easy to work with. Eapen [20] indicates that the mathematical assumptions are not a reason for real options not being more readily accepted. Essentially, managers do not care about the assumptions and whether the model assumes prices are mean reverting or not. What managers care about is if the model takes cognizance of the major risks and opportunities facing the business and how these affect business value. Managers simply focus on the practicability of the method in real life (Myers [2]).

As the tough examination of the theoretical side of ROA implementation indicates, there exists a lot of critic against the method, some of which may not even be relevant, regarding the applicability of the method. There exists a vast body of literature and studies regarding the critic against of ROA itself but perhaps at least some of the causes for the method not being applied could be found in the organizations in which it is to be applied. Thus, the practical match, the "marriage", between the organization and ROA theory is of more interest and should be examined more specifically. The authors thus believe it is more relevant to investigate some of the demands on the organization and management structure when implementing ROA.

1.3 PURPOSE

The objective of this thesis is to, from an intra-organizational and managerial perspective, determine if selected Swedish firms are ready to meaningfully apply and successfully employ ROA.

1.4 RESEARCH QUESTIONS

- Do the currently existing organizational processes, systems and structures allow the successful application of ROA?
- What aspects, above those already prescribed in ROA literature regarding the qualities and functioning of an organization, might be the key to successfully apply ROA?
- Are Swedish firms ready for real options?

2 METHODOLOGY

In the methodology chapter the authors strive to give legitimacy to the results of the thesis by clarifying the research approach and going through the research process in a chronological fashion, followed by a description of the methodological considerations of this thesis. The chapter is concluded with a discussion of the credibility of the research approach and how the rest of the thesis is structured.

2.1 INITIAL RESEARCH

The ambition throughout the research process has been to gain an understanding of and investigate the application of ROA in Swedish firms. This proved to be complicated as so much had been done in this field; however, it was simultaneously found that many aspects had barely been touched upon.

The authors extended the scope of literature studies to also include psychological, organizational theories as well as theories involving business strategy in an attempt to link ROA to the intra-organizational structures and systems including the human capital of the firm. At this point, the niche of the research was found, namely the match or mismatch between real option theory and the organization it is to be applied in. This aspect seemed both relevant and interesting as it could perhaps give an answer to why so few firms applied real options. A systematic mismatch between the prescriptions of real option theory and how organizations currently are structured and operate was to be examined more firmly. The focus of the study therefore took form and it was decided that a comprehensive review of relevant literature and subsequent round of interviews was to be conducted.

2.2 RESEARCH FRAMEWORK

Secondary data was gathered from scientific articles and books on the relevant topics. By investigating the literature, the authors tried to get acquainted with the relevant factors which the academics had identified as impediments to the implementation of ROA within firms. Time was put towards finding any impediments in the organization structure and systems of firms. The intention was more to structure and systematize previous research than to criticize it and we thus conducted what Esaiasson [21] defines as, a qualitative text analysis.

Most of the articles used were found using JSTOR, Google Scholar or Business Source Premium. When relevant articles were found, they often lead to other articles which deepened the research within the real options field. However, previous research that had lead up to, but not fully encompassed our research questions, was heavily based on.

Primary data was gathered through a round of interviews which will be more specifically described further on in this chapter.

2.3 RESEARCH APPROACH

A qualitative approach was mainly employed when gathering and processing data. Qualitative interviews provide a deeper knowledge that was indeed the goal. The gathered data cannot, at least not in our study be readily quantified. Trost [22] compares the qualitative approach to the quantitative with a comparison to a field of flowers. The qualitative approach could be measured up to finding which flowers grow in the field and their living conditions, while the quantitative approach could for example be compared to counting the flowers of a certain color. The aforementioned was more relevant to the purpose of the study as this is a new field of research with little previous information. Thus, as searching for mismatches between real option theory and the organization it is to be applied in would in the metaphor be seen as trying to find new types of flowers. As Trost [22] point out, qualitative research needs not to be representative. However, subsequent studies could possibly quantify the findings of the study if necessary with questions along the line of: What fraction of Swedish firms have organizational issues when applying real options?

In this research, an inductive method is applied which entails that collected data is analyzed in an exploitative manner (Trots [22]). As a consequence, the research framework is adapted along the way as one does not fully know where one might end up.

2.4 THE INTERVIEWS

Having formulated an idea of what the desired objective of research was and a framework to analyze it, the research proceeded with finding the appropriate firms and respondents to partake in the interview process. Lundahl and Skärvad [23] describe some of the difficulties with the interview preparations such as identifying people who are interesting to interview, contacting these people and making them partake. The work proceeded from a list of business fields that were believed to have strategic flexibility, such as the construction industry and industries with research & development such as the medical sector and industries with high technological nature. Further, a list of people of interest that had relevant positions in the firms was identified such as middle management (also named project managers; project managers usually origin from middle managers and get assigned to lead projects) and executives whom would be able to provide us with useful insights. Many of the contacted people declined an interview due to time, other business related commitments or due to their conviction of not being able to provide useful answers. However, five people in different ages and positions in firms operating in various business fields were found to interview. This was seen as beneficial because of the many different angles and views on similar issues that could be obtained.

The fact that the interviewees were deemed very knowledgeable in their field meant they could be questioned in great dept. As Trost [22] indicates, a few deeper interviews are better than many shallow ones when gaining understanding of an area.

The interviews were conducted in a relaxed and semi-standardized fashion as described by Lundahl and Skärvad [23], which in our study translated to more conversation-like interviews around a few topics with following sets of questions. The order of the questions was changed when it was felt necessary and the questions were adapted to the situation. Some characteristics of a semi-structured interview, according to Lundahl and Skärvad [23], are especially applicable if the purpose and limitations of the interview is not precisely specified and that the interviewer aims to elicit the opinions, attitudes and values of the interviewee. Accordingly, the scope of the study was not fully known and one might have suspected that a given factor mentioned was relevant but had yet to see it at play in practice. Repetitively, to use the previously mentioned metaphor, more type of flowers was found with only a vague idea of what possibly could be hidden. It was tantamount that the topics of questioning where all well researched and that these went hand in hand with the theoretical framework, focusing on the topics of organizational strategy, organizational structure, psychological biases in decision making as well as mechanisms for decision making (see interview guide).

All the interviews were conducted in person as this was deemed better as it increased legitimacy and allowed deeper questioning. During the personal interviews, both authors were actively taking notes and participating in the conversation. The interviews were also recorded on tape with the permission of the interviewees to secure the reliability and accurateness of the transcription. After each interview, a thorough review and discussion of the information received was made and centered on topics to allow a more simple analysis. The opportunity to phone/ mail the respondents was obtained to check over any further questions that may arise. This was made in two of the interviews to reduce uncertainty regarding ambiguity.

In many ways the law of declining information can be applied as suggested by Trost [22]. In the first interview, much new information was obtained that was of assistance with the orientation within the field. Subsequent interviews gave less new information, and instead confirming information already gathered and enabling the authors to be more deepened in the questioning. Therefore, a revision and extension of the interview guide for every subsequent interview to more precisely center the scope on the most interesting and relevant research questions. With the help of the interview guide, more concentrated questions were asked regarding specific topics. At the same time though, it is important to note that many of the companies were different and warranted different approaches. As mentioned, the more knowledge that was amassed, the deeper one could speculate and question. This allowed the authors to plan the next interview and/or possible follow-up questions on the new knowledge. In this way, it was attempted to view the research as a spiral as suggested by Blaxter, Hughes and Tight [24]. Accordingly, research:

·is cyclical;

·can be entered at any point;

·is a never-ending process;

·will cause you to reconsider your course of action;

·will lead you to a point other than your starting point.

This is shown below:

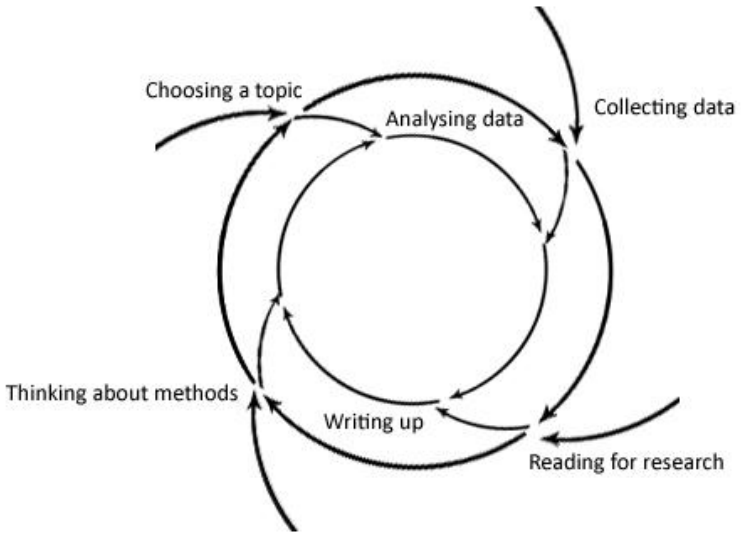

Figure: Spiral of research

2.5 CREDIBILITY

To allow the reader to fully grasp the limitations, the legitimacy as well as the potential to generalize from the research results, some aspects of credibility surrounding the way the interviews were conducted and the interpretation of the empirically gathered material are presented and further discussed.

2.5.1 RELIABILITY

Lundahl and Skärvad [23] define reliability as the absence of random errors in measurement. In the case of this thesis, if the information gathered from the interviews were in some sense unreliable, the result of the study will be unreliable. Trost [22] points out that in a qualitative study the ethics and credibility of the authors is important for the reliability of the research. The method of research is thus documented as accurately as possible and in a narrative way to describe as closely as possible how this research was conducted. The interview guide used during the interviews is also included and the names of as many as possible sources. Not all are presented since some of the respondents did not want to be named and this too seemed like a step towards soliciting sincere and reliable answers.

Another element of reliability could be that the authors have misinterpreted the information obtained from the interviews. This is safeguarded against by recording the interviews on tape and thus allows the constant confirmation of what actually was said during the interviews. Reliability was also enhanced by contacting interviewees when understanding difficulties was encountered.

Furthermore, another aspect of reliability which was seemed to increase the reliability and reduced uncertainty was the fact that all interviews were conducted in person and in a relaxed environment. The sense of time pressure and stress so often associated with a telephone interview was alleviated and thus, a relational bond was created between the authors and the respondents.

It is important to bear in mind that the research has been conducted during a brief period of time in a fast moving area where ideas of what practice is the best changes very rapidly. Organizations are an ever moving and evolving entity. Therefore what is true today might be outdated tomorrow. The interviews conducted and the study of business practices will therefore inevitably be at best a snapshot of the current practice. To prevent this, a forward-looking approach to our research was utilized.

Being objective is a part of reliability and is sought after and defined as being the relaying of information correctly and free of biases (Lundahl and Skärvad [23]). An attempt to achieve this has been made by showing the used premises and research process as recommended by Lundahl and Skärvad [23].To secure the ethical aspect of this thesis, an attempt to establish an open and see-through pattern of work as possi-

ble, giving the reader an insight into how the thinking and planning process have been like as the ability to confirm sources.

2.5.2 VALIDITY

Validity can be seen as internal validity and external validity (Esaiasson [21]). An introduction by defining and discussing this thesis in terms of internal validity is given. The problem with internal validity can often stem from the researcher taking theoretical definitions and operationalizing them. In this study, this is primarily a problem when going back and forth between the literature and our interview material. The validity of the literature and the operationalizing of theoretical definitions in the literature have been secured by using mainly literature from scientific sources and multiple sources/views on topics.

When coding the interview material and connecting to operationalized theoretical definitions a second aspect of the validity problem will arise. Esaiasson [21] describes this as being a question if one is measuring what one is sought to measure. In this study, because the focus is on firms that don't apply ROA it can mean an extra step between the operationalized theoretical variables and the interview material. Bearing this in mind, when drawing all too specific conclusions and have explained in depth how and why a codification of interviews is made in a certain way and how we operationalized theoretical variables. Whether or not one in fact is measuring what is intended to measure will hinge primarily on which question one chooses to ask and how these are coded. The questions in this study are based on a comprehensive literature study and are backed by multiple sources to insure that these are the right and relevant questions. In a further attempt to bolster the validity in this sense, an inclusion of the interview guide so the reader can see for herself what type of questions are asked and judge if we have missed any important factors.

Moving on to external validity, if the people interviewed always remember correctly, are perfectly informed and never lie, high outer validity is reached (Lundahl and Skärvad [23]). To address this, a selection of people with long experience in a relevant job position that would render them informed and able to answer our questions. Representatives work with the management of projects and have backgrounds that are highly relevant to the study. This assures that the information presented is up to date as well as being reliable. Little reason is seen to why an interviewee would answer untruthfully as enmity was offered; participation was not forced as well as the nature of the questions not being conceived as being extremely intrusive or as regarding an infected topic. However realizations that answerers could be affected by the personal nature of some of the question are made. This is more discussed further in the conclusions of this study.

With regard to what the interview measures, the topics of conversation stem naturally and clearly from the frame of reference, (see interview guide), and are followed up in a logical manner throughout our thesis.

2.5.3 CRITIC OF SOURCES

The sources used have been published books as well as scientific articles. This as well as the fact that we have sought out many complementary sources increases the legitimacy of our findings and framework. We have sought out articles and books that are well supported by the previous body of knowledge in the relevant field and the research community at large. As a final attempt to secure the legitimacy of this thesis as well as the sources, the authors have made sure to include all used material in the literature list.

2.5.4 GENERALIZATION

First and foremost as Trost [22] says, there is no reason or guarantee that qualitative research is representative of the population at large. Thus the point of this study is not to be able to make any sweeping statements regarding what fractions of firms do what. This type of generalization is not possible. However given the way the study was conducted and the fact that certain organization types exist and react in a certain way to say for instance flexibility should give a good ability to generalize. Say if a certain Swedish firms' structure or systems are found to be detrimental to real option application, this conclusion could most certainly be applied to say a German firm with the same systems or structures. On the other hand, various types of firm structures and systems will be more prevalent in different parts of the world and when including the effect of regional culture differences on organizational culture, the ability to generalize the conclusions of this study decreases.

2.6 GENERAL STRUCTURE OF THE THESIS

The research questions have been operationalized through a few topics of interest. They have in turn been used to create four headings. The theoretical framework and empirical findings, as well as the results bear these four headings as a source of structure. The four structure driving headings are as follows.

Project characteristics – What is the nature of an investment, project structure, the nature of project flexibility and the role of it.

Firm strategy – How are projects viewed on the level of the firm as well as the firms general strategic mindset.

The role of project managers – What is the role of project managers and what powers and responsibilities are involved.

Blame for failed projects and encouragement of entrepreneurialism – how are initiatives encouraged and how are failures treated.

The relevance of these topics is to find out and analyze the type of flexibility the firm possess and what the firm's general goals and strategic reasoning are. What if the firm perhaps already strategizes and evaluates projects in a real options sense? Following on from this we look at the empowerment of project managers and the potential to curb psychological biases and allow middle managers to be entrepreneurial and dare to take risk. The relevance of this is that it is often middle managers who get assigned to lead and manage projects as project managers. Therefore they need to be assigned the power to exercise options in a correct fashion.

2.7 LIMITATIONS

The research is limited in the sense that soft values, organizational processes, structures and strategic reasoning that might affect the successful ROA implementation are investigated. The study is further limited to only include Swedish firms operating in and around Gothenburg with existing operations during the spring of 2011 due to the geographic proximity to the authors and the point in time when the research was conducted. The firms have been selected according to the authors' belief of appropriateness in the sense that all the firms in one way or another work with research and development and in areas traditionally acknowledged to have much inherent flexibility such as highly technological firms, and firms with large human capital expenditures in association with investment.

3 THEORETICAL FRAMEWORK

In this section the authors intend to acquaint the reader with the academic view surrounding Real Options Analysis as well as how strategic planning and real options are tied together. Furthermore highlighting the theories regarding the importance of project managers and psychological biases as well as agency problem they may face that will aid in analyzing the empirical findings.

3.1 REAL OPTIONS

In this first section an examination of what constitutes a project as well as the surrounding structure in real option terms is put forward followed by a clarification of what it means to view a project in option terms. This is a bid to acquaint the reader with real options theory as well as to set the firms interviewed into a real option framework.

3.1.1 REAL OPTIONS: AN OVERVIEW

Real options stem from financial options. A financial option entails that the buyer buys a fixed contract giving the owner the right but not the obligation to buy or sell a financial asset at fixed price on/or any time before a given day. The option holder chooses only to exercise his option if it is "in the money" otherwise the option is simply left to expire unexercised. Given the volatility of the underlying asset, the strike price, the value of the asset and the time to maturity, the option's value can be calculated through the Black and Scholes model of option pricing. These options are based on a financial asset but the same rationale works for options based on real assets. Real assets however differ from financial assets in a few ways such as that they often have very long durations, are based on very large investments and are harder to value as they are not traded on a stock exchange (Trigeorgis [27]). An investment in a financial option is also a much more passive investment than an investment in a real option which may demand a lot more of the option holder; this will be treated in depth further on.

Many of the traditional financial valuation techniques assume that managers are able to predict the future, such as next year's market price for oil, changes in consumer tastes or strategic moves by competitors. The market conditions of many firms are instead often filled with uncertainty, however, in the zone of uncertainty there is valuable information hidden which is gradually revealed through the passage of time, events and actions. For instance, oil drilling companies often face unpredictable oil price fluctuations which make planning of optimal output in advance difficult. The information about the market prices for oil a year in advance is very valuable for oil drilling companies and thus the more time passes by, the more the uncertainty about future market prices will decrease. Consequently, the traditional financial

valuation techniques are inadequate because they assume that managers can calculate the value of future outcomes of a project using their predictions about the future. This would be rightful actions for managers operating in a world where everything, such as future market conditions, is known with certainty. Since this is not the case, managers need a more appropriate capital budgeting method that will allow them to adjust the direction of the firm depending on how the source of uncertainty is resolved. In other words, a capital budgeting method that incorporates the ability for managers to adjust their decisions after receiving new information that affects the outcomes of an investment (Mun [5]).

A real option gives the right but not the obligation to make a business decision or initiate a project after deciding if the conditions are favorable and the uncertainty is reduced. The higher degree of uncertainty, the more valuable an option is because it set offs business opportunities and makes it possible to explore the uncertainty, thus makes it possible for a firm to have the flexibility to react and respond to varying operation conditions. It is this flexibility that is ignored by other capital budgeting methods and consequently traditional capital budgeting methods fail to recognize the true value of a project since they only focus on valuing future uncertain cash-flows without considering the opportunities available in the future (Amram and Klatilaka [25]).

ROA is open to the possibility of postponing decisions to the future when the level of uncertainty has decreased. The method complements the "static" DCF techniques since these traditional techniques assume a static path with fixed outcomes of a project with no possibilities to adjust the direction along the way. On the contrary, ROA considers multiple directions to take upon receiving new information associated with the managerial flexibilities inherent in the projects. This allows managers to choose the optimal strategic direction depending on the status of the project and the information that becomes available when uncertainty is reduced. Therefore, flexibility is valuable and should not be ignored since this may mislead managers to undervalue the true project value (Brach [26]).

3.1.2 Different types of flexibility

There are many types of flexibilities and they differ heavily depending on the firm structure and underlying industries. Some industries do inherently have more built-in flexibilities in their projects and others have less. In exploiting this flexibility, active management is often crucial. The basic requirement for the application of real options in project valuation is that there exists a large amount of uncertainty regarding the outcome of the project. Also, the firm per se must be able to accommodate flexibility in an appropriate way. In other words, the firm must be flexible enough to respond to changes in market conditions as well as exercise the options optimally at the right time (Trigeorgis [27]).

There are two different kinds of flexibility when it comes to real options, reactive flexibility and proactive flexibility. Reactive flexibility refers to the situation in where the manager is not actively trying to affect

the value of the project after accepting the project. This is similar to an investor holding a financial option and the task is to exercise the option optimally or simply let it expire worthless. The challenge for the manager is to exercise the option optimally since the option value is based on a timely and correct exercising. On the other hand, proactive flexibility assumes that the firm using ROA not only exercises optimally but also that managers try to affect and improve the value of the project. This is in contrast to financial options where the holder cannot affect the value of the underlying asset (Leslie & Michaels [1]).

3.1.3 DIFFERENT TYPES OF OPTIONS

Industries highly suited for the use of real options are industries in where the projects consist of multiple sequential investments (Amram & Kulatilaka [27]). Typically, industries with a lot of operations in research & development are ideally suited for the use of real options since the outcomes are never known and there have many alternative paths to choose from along the way depending on the results of previous actions. Other industries in where the ROA is of great use are venture capital firms when valuing entrepreneurial start-ups, oil and mine industries and projects that require a large amount of either financial capital or human capital. In short, depending on the project and industry, the flexibilities inherent differ vastly but some of the most prevalent are presented below:

Option to expand
An option to expand is appropriate to exercise when market conditions prove to be better than expected. The price paid to acquire the option can represent the investment in an upgrade of currently employed technology or it could be the cost for a pilot project in a foreign market if the expansion is to be made internationally.

Option to wait
In industries where there exists a high uncertainty about future prices and market conditions, such as real estate development, agriculture and natural resources, the option to wait could be valuable to postpone the investment to allow an investigation of nature of prices and demand structures before continuing with a large investment. The options price of procurement in this case could be a rent paid on a property in order to have it readily available for a possible investment.

Option to abandon
As touched upon in the introduction, the option to abandon becomes relevant if circumstances motivate an abandonment of operations to prevent further losses. The flexibility inherent reduces the total losses after new information is received about the poor market conditions for example. The task is therefore to "save what can be saved" and this is often the case when expanding to new uncertain markets and in capital

intensive industries where technology could be sold on the second hand market (Brach [26]).

Sequential Compound option
The sequential compound option is an option on an option in which the second option is exercised only if the previous stage is successful. This option can be identified in investments that are multi-staged and the expenditures are put gradually and the next step is contingent on the status of the previous step. The outlays for the investment are continuous along the whole project life rather than large outlays in the initial stage of the investment. This kind of option is frequently occurring in strategic investments and in companies with a lot of research & development processes such as pharmaceutical firms (Mun [5]).

These above mentioned options are the most common options that fits the businesses of most firms, however, there are also other kind of options that could be firm or industry specific and repetitively, different firms operate in different environments and the available inherent options should therefore be identified according to the circumstances (Brach [26]). For instance, a mining firm with many mines finds it easier to shut down underperforming mines as they have more flexibility as a result of their larger organization and can easily transfer resources, such as managers, to other mines in their possessions. However, large companies can facilitate longer time periods to reach a decision as there is more negotiation between different units (Moel and Tufano [28]). Another example of flexibility is the flexibility to beat your own bid. By sighing say a building contract at a certain price the building firm can then attempt to build to a cost bellow the cost quoted thus saving money. This is discussed in - *rational under-pricing in bidding strategy: a real options model by* Yiu & Tam[29].

Adner and Levinthal [17] also point to organizational factors as being important when dealing with the flexibility of real options that the firm possesses. A great possibility exists to modify initial initiatives when the uncertainty is endogenous to the firm. The structure of the discovery activity and the scope of the authority of the project team draws the boundary's and frames the project using real options logic. These topics will be looked into in more depth further on.

3.2 General firm strategy and mindset

Here the authors' purpose is to acquaint the reader with how ROA can be used in strategic planning as well as looking at how a firm's strategy and general mindset toward strategy tie in with real options thinking.

Strategy as portfolio of real options

In today's versatile markets no one just expect to stick to a plan previously made but constantly changes

the map as more information becomes apparent and we thus need a flexible capital budgeting method. Firm strategy can be viewed as a portfolio of real options since a firm strategy is a projection of the firm into the future, a path from where the firm is to where it should be in the future. Thus, strategies are real options designed to affect other real options. In accordance with this, real options might, but not necessarily, be related to each other in sequence in the sense that option 1 has to be exercised before option 2 can be exercised. The value of the second option needs to be included in the value of the first option (Luehrman [30]). This has been practically observed in major corporations where the traditional capital budgeting methods have given a negative Net Present Value of a project but the firm has still gone ahead with the project since it is seen as beneficial from a strategic point of view (Eapen [20). This allows financial thinking to influence strategy synthesis instead of just being used after-the-fact, as is too often the case (Luehrman [30]). The primary goal is to identify and capture the strategic value inherent in investment decisions that are missed when only using traditional capital budgeting techniques. Indeed, good and experienced managers regularly try to evaluate projects and any interdependencies among them in order to create additional strategic value and synergies among projects and thereby optimizing the portfolio of real options with both strategic and financial value (Trigeorgis [27]).

Strategic adaptability

Executing a strategy often entails making a sequence of major decisions, some taken immediately while others are deferred until circumstances have evolved to better facilitate the decision. This wait and see mentality leaves room to learn, adapt and act on new information (Luerhman [30]). Aaker[31] describes the decisions taken immediately as appropriate in a market which one believes is foreseeable with great certainty and strategic commitment is suitable. On the other end, in a market that is too uncertain for pursuing a desired line of action, strategic opportunism is more appropriate since information cannot to be received before acting. These two phenomena represent the extremes of strategic planning. A more moderate mixture of these strategic views is the strategic adaptability which implies that the market can not only be foreseen, but also influenced and managed. It is this general view that play in with ROA generally and proactive flexibilities specifically.

Strategic adaptable firms are seen to be having a culture of encouraging innovation, entrepreneurship experimentation and an acceptance of failure. This view requires the leveraging of the entrepreneurial side of middle managers and needs to be reverberated through the organizational structure and bonus systems employed (Aaker [31]). Further Trigeorgis [27] tells us that it is indeed of vital importance to design an appropriate control and incentive system which essentially is integrated with the overall firm strategy. This will allow internal entrepreneurs to thrive and less attention is given to short term results, rather, middle term results will be central (Aaker [31]).This will be followed up further on in this section.

Many researchers note that the strategic mindset is needed and is encouraged by ROA (see. Trigeorgis [27]; Luehrman [30]; Myers [2]). The mindset of venture capitalists is an example of the required mindset for ROA, since the funding of ten business ideas will only result in two successful ones. This mindset

implies that two big successful ideas are seen to be outweighing the failure of the other eight projects. Metaphorically, the cultivation of flowers where one should allow thousand flowers to bloom and tend those that thrive and let the rest wither illustrates this idea (Quinn [32]). This could practically mean, for instance, entering many weak markets and wait to exploit a potential market change (Aaker [31]). In reality, only 20 % of growth initiatives are successful and therefore many projects should be abandoned (Zook [33]). Firms should focus on good thriving projects and will thus need a procedure that allows the early termination of failing projects. Otherwise the firms will have a portfolio of projects all out crowding one another and none will be successful (Aaker[31])

3.3 POWER TRANSFER TO MIDDLE MANAGEMENT

Here the authors reconnect with the previously aired theories that indicate that the firm must delegate more power and responsibility to project managers. While this might facilitate ROA implementation, it may however be accompanied by an agency problem. It is also the purpose in this section to list ways of dealing with this agency problem. There are thus three distinct sections and topics; why project managers should be empowered, the ensuing agency problem and finally the conclusion with some ideas regarding the solution and remedies for this problem.

3.3.1 THE NEED TO EMPOWER MIDDLE MANAGERS

We are told by (McCormack [34]) that ROA goes hand in hand with the allocation of decision making authority. Unlike financial options, where the value is fixed independent of the holder, the value of real options has everything to do with the firm's management and operational competence. Firm management structures need to have an organizational structure that empowers middle managers to allow them to deviate from their marching orders. Operating managers with an understanding of how to initiate and abandon projects are needed to take the wheel to enable the firm to maximize the real option value. Similarly, Trigeorgis [27] points to enabling the responsible middle managers to actively manage projects on an ongoing basis as one of the corner stones of the real option solution. This argument is based on the fact that on site middle managers are often the best informed regarding their projects and have the ability to make the day to day changes required by ROA.

In contrast to financial options, real options are often not suited for a "wait and see" approach, rather, an "act and see" approach is required and there is no one more fit for this task than the middle manager on site. (Luehrman [35]). The decisions that need to be made are often based on ongoing project information which is not readily available as is the case with the information required by financial options. This project information is often solely possessed by the project manager and thus, higher management will have to either delegate responsibilities to or rely on information from middle management (Leslie and Michaels

[1]).

The quality of managers is a crucial factor when deciding if ROA can at all be applied. Good management is a requirement to identify, create and subsequently exercise the real option. Many firms have had valuable real options but simply failed to exercise them and thereby making the process worthless and the envisioned flexibility value is lost (Triantis [13]). Further along the line of exercising options (Teach [7]) points out that since real options do not have fixed contracts for expiration dates like financial options have, it is important than middle management has the ability to exercise them when they need to be exercised, whenever that may be as projects have different lengths and time structures.

3.3.2 Empowerment but at the peril of an agency problem

In a firm context there is an inherent struggle between those seeking to maximize total firm value and those employees seeking to maximize personal utility. Those seeking to maximize firm value often shareholders/owners are the principles and try to induce the agents (managers/ firm employees) to act in a rational firm value maximizing fashion. The principle agent theory is based on the assumptions that employees in an organization exhibit self-interest, bounded rationality and risk aversion according to Jensen and Meckling[44]. These qualities could lead to a discrepancy between what the principle wants done and how the agent in fact acts. The principle can most often not simply get around this by being all controlling as the agent usually possesses more information in a specific area than the principle and hence, information asymmetry will be a fact. Neither can the level of effort be stated and quantified usefully in a contract. Different incentive systems can often be used here to align the agents motivation with that of the principle (Eisenhardt [46]).

Empowering middle managers is one aspect of real options, but their interests and their taste for risk might not be consistent with the firm's. Many academics treat the firm as a monolithic actor (see. Trigeorgis [27], Luehrman [30], Dixit and Pindyck [16]). In reality, this is not the case since managers responsible for managing a project opportunity and executives charged with evaluating a portfolio of opportunities will have different opinions, goals and motivations. Such differences stem from their different incentives and opportunity structures (Bower [36]).This as project leaders are more affected by say project termination than an executive who just loses one of many projects. Obviously there is a conflict of interest here (Statman and Caldwell [37])(Adner and Levinthal [17]. The challenge of exercising an option, in particular an abandonment option is highlighted by the different perspectives and motivations of stakeholders at different organizational levels (Adner and Levinthal [17]). Executives are seen as *holding* the real option whilst managers as *being* the option and thereby managers are more connected to it emotionally and regard it as their livelihood. In addition, the different perspectives induce managers to focus on their own projects and disregard the greater set of alternative projects available to the firm and how the own project fits in with the firms overall strategy. This entails that actions taken on the project level might

not be in line with the appropriate action that should be taken from the viewpoint of the whole firm as a real option portfolio (Luehrman [30]). There is added to this the information asymmetry previously mentioned with project managers often being more informed regarding their projects than management.

This agency problem suggests that a firm's internal structure dictates its ability to manage real options (Adner and Levinthal [17]).

3.3.3 SOLUTION TO THIS REAL OPTION AGENCY PROBLEM

To combat this agency problem it is of great importance to have selection and resource allocation mechanisms that are manifested in the organizational hierarchy in order to successfully exploit the flexibility offered by real options analysis (Trigeorgis [27]). In the absence of strictly followed structures, deadlines and proofs of failures, firms will face a difficult organizational challenge when exploiting the full theoretical flexibility of real options on sequential like real options. This (Adner and Levinthal [17]) tell us is due to the fact that it is often hard to set a time limit on a real option and this paves the way for an arbitrary and idiosyncratic justification regarding termination criteria often supported by the previously mentioned agency problem.

Most managers, academics and consultants assume that option holders will make optimal and timely exercise decisions based on rational analysis. This is however unreasonable since the even simpler process to exercise financial options are often exercised suboptimal (Copeland and Tufano [38]). Due to this fact supported by the agency problem associated with delegating more responsibility to managers, the employment of real options must be complemented with appropriate control and reward systems. Such systems could be designed and built in to the organizational structure and systems, such as previously mentioned, having fixed rules to follow as well as well-designed bonus schemes (Adner and Levinthal [17])(McGrath and Macmillan, [39]). Similarly, Trigeorgis [27] recognizes the need for clear but strict systems that encourage and guide managers to follow the preset portfolio strategy for value maximization. These systems will enable the responsible managers to actively manage projects on an on-going basis. In fact, rigidly specified agendas of initiatives and success criteria are critical for the effective management of real options (Adner and Levinthal [17]).

A way to align employee's efforts with the overall strategy of the firm is incentive systems. These systems may be pay for performance or instead rewards such as promotion, workplace privileges or social recognition (Frank et al.[47])**.** The point of an incentive system is to focus employees attention of what is important to the organization as a whole and motivate them to achieve the desired goals (Merchant and Van der Stede [48]). There are two main types of bonus systems that pay for performance, individually basesdsystems and group based systems.

In an individual based incentive system an individual will get a higher salary if they perform well in relation to predetermined goals. The salaries are individual and two employees doing the same job but one

doing a better job will thus get different salaries (Armstrong [45]). Alternately bonuses may be set by a group's accomplishments as a whole**.** Armstrong [45] points out that a risk with group bonus systems is that they may promote and allow team members to hide their own poor performance with little incentive to seek to perform better. He goes on to name this free-rider phenomenon as one of the greatest difficulties of group incentives and bonuses. This free-rider problem entails that some members of the group might not contribute as much effort as other group members yet still be entitled to an equal share in the reward. This can lead not only to certain employees slacking off but also to frictions within the group as hard working co-workers can easily build up a resentment towards those believed to be underperforming. In a team effort one would idealistically hope that when some team members perform less others would perform more, however the free rider problem leads to the opposite with instead all group members decreasing their effort (Rutte [49]).

In ROA literature the most frequently mentioned way of aligning the interests of middle management with that of the firm as whole is to let middle managers share in a common bonus pool with higher management. Having large bonus pots that span many projects and portfolios of real options allow bad luck to average out and law of large numbers to apply. This is optimal as it rewards skillful management and not mere luck (McCormack [34]) (Trigeorgis [27]).

3.4 Blame for failed projects and encouragement of Entrepreneurialism

In this section real option decisions are examined, especially abandonment decisions since it is perceived as being the hardest. Furthermore, initiatives within the firm may be encouraged through firm culture and social climate. This is operationalized by going through psychological decision making biases and how they affect the exercising of real options as well as how they might be curbed.

3.4.1 Encouragement of entrepreneurialism and risk taking

Aaker[31] discuss the tradeoff between the strict control of managers and flexibility. Firms with rigid structures and strict control of managers avoid many of the agency pitfalls previously mentioned but on the other hand they lose out on the entrepreneurship of managers. A real option can be seen as a purchase of an opportunity; however, an opportunity also entails a risk of not materializing. Consequently, firms need a structure that encourages managers to assess opportunities and take risks regarding a project in where the outcome could be positive or negative. This could be a problem if managers are risk averse due to fear of repercussions if the project outcome is disappointing (Kogut and Kulatilaka [18]). Managers need to be encouraged to take fare risks that benefit the firm as a whole. Along these lines Aaker [31] tells

us that the correct mindset for a firm allows the loss of small amounts of money in an attempt to securing a future cash cow. Consequently, this "luxury of being able to lose money" is how a firm accrues options and is a key aspect for securing the future of the firm (Kogut and Kulatilaka [18]).

This fear of taking on risky projects can be dealt with by measures from top management. Corporate head office can offer to underwrite a part of the investment and thus sharing in the responsibility for the project Kogut and Kulatilaka [18].

3.4.2 ENTRAPMENT

Dead ends can drain firm finances and the talent possessed by the firm, thus leading to the suffering of other business areas of the firm and the firm as a whole. This can be due to managers not wanting to terminate projects and thus can render the whole firm victim to their stubbornness and misplaced loyalty. As a result, abandoning business in a timely fashion means that further losses are stopped and project assets sold at a fair price. In contrast, when the divestment occurs to late, the assets are sold at a forced price (Aaker [31]).

It is common that managers become entrapped in bad projects and find it hard to abandon them even when the numbers tell them to (Statman and Caldwell [37]). A project manager may so badly want the project to be a success that he becomes committed and emotionally attached to the project although the right decision would be to terminate it (Aaker [31]). In the attempt to save the project and recoup losses, the project manager may exhibit risk loving behavior. This is due to the fact that managers are reluctant to realize losses because losses cause regret. The feeling of regret is heightened if managers have to take responsibility for the outcome and face consequences, such as penalties. Penalties due to, for instance, project termination can cause project champions to work even harder to try and save loosing projects and thus become even further entrapped (Statman and Caldwell [37]).

Managers that feel insecure in their positions and do not feel the support of management are at greater risk of being entrapped. It is important for superiors not to encourage failure per se but to admit that the task is hard and point out that failure may not necessarily be the fault of the manager (Fox and Straw [40]). Otherwise, project managers of terminated projects can become isolated and alienated in the workplace and thus feel guiltiness for the project failure (Statman and Caldwell [37]).

3.4.3 PREVENTIVE MEASURES

To combat the managerial risk of entrapment, decisions need to be made objective, transparent and free from emotional gut reactions (Aaker [31]). Companies need a way to lessen the feeling of regret among managers in order to force them to act rationally. Predetermined rules is solution as are used by financial

traders to force them to realize losses. However, even with existing rules, many fail to abide by them. Instead the firm can then have a system where external reviewers, other than project managers, review the project periodically and decide to continue or terminate the project. It is crucial that the reviewers are unbiased as project managers often are biased to their own projects. The reviewers should be given equal power to project champions in order to take decisions needed (Statman and Caldwell [37]).

Furthermore, a reward system that encourages the early termination of losing projects can counter the effect of entrapment. A better reward system would encourage project managers to provide accurate information, this is important since project managers often have more accurate information than anyone else regarding their projects. Hence, a reward system that encourages the early termination of losing projects can counter the effect of entrapment effectively (Fox and straw[40]).

Legitimizing the abandonment decision can also be a way to go. Shell for instance has recently appointed a head of divestments which indicates that more attention is being put to formally delegate responsibility for exercising options. The decision to abandon can save huge amounts of money for the firm but are seldom celebrated or praised, this needs to change with bonus packages tailor to this type of designs and public acknowledgement (Copeland and Tufano [38])

4 EMPIRICAL FINDINGS

The empirical findings are presented and based on 5 interviews and a relevant study of literature, around the themes of flexibility, strategy, organizational systems and structure, psychological decision-making biases and management in relation to the useful implementation of real option. The interview answers have been divided and structured according to the topics touched upon.

4.1 INTERVIEWEES

The interviewees who required anonymity are named after their respective workplace rather than their actual names. Since firms from different industries were chosen, it will be simple to follow the firm representatives' answers as they will be named after the kind of firm they work for.

The bio-med-tech is a small/medium sized biotechnical & medical device development firm in Gothenburg, Sweden. The firm operates on a global market with the business concept to develop, produce and market high-quality products for the preparation, cultivation, preservation and support of human cells, tissues and organs. The company operates within a field of ongoing research and sees huge growth potential within the coming years. The vision is to be a leader in the production and quality assurance of high-technology media. The representative of this company had the role as the head of research and development department

Göteborgs Energi is a large-sized municipality owned energy supplier and offers electricity, heating, piped gas, energy related services as well as communications services. Their turnover for 2010 was 7791 million SEK and the long-term goal is to create energy solutions. The firm recognizes the importance of energy supplies to a well functioning society. The representative for Göteborgs Energi was Hans G Pettersson who has the position as the head of the internal consulting division.

NCC is one of Scandinavia's biggest building and property developers. It is a large firm with a turnover of 49 billion SEK for 2010. The vision is to be the leading company in developing future commercial real estate's and living areas. Their main areas of focus in order to achieve that are customers, pricing and competence. The representative of this firm participating in our study was Martin Ohldin who had the position as a project coordinator but also the responsibility for other surrounding tasks.

The med-tech firm is a small/medium sized firm that has been in the medical device industry since the 80s and therefore leading to extensive experience in product development. The firm claims their edge is through knowledge and expertise that make them market leaders in many areas of research/production. Products are backed up by research and clinical tests. These clinical studies are conducted on a global stage. The firm's research has resulted in numerous prominent patents. This is supported by an on-going dialogue with patients and practitioners that enable them to have an ear to the ground and get first-hand

information for successful research & development. This is then put to work in their production facilities. Their strategic goal is to collect scientific evidence for new innovations and thus gain further experience. The representative of the firm participating in the study had the position as an executive manager

The software developing firm is a small sized firm that develops and creates digital games; in addition, the firm operates platforms connected to these. Their software and platforms are expected to experience significant growth and an increase of activity in coming years. The vision of the firm is to become a global player creating an exciting, entertaining, safe and environmentally friendly way of spending time. A huge part of their operations involve investing into software production, i.e. programming. The representative participating in the study had the position equivalent to an executive manager.

4.2 General firm information and project structure

The respondent from the bio-med-tech firm state that projects are often initiated after recognizing customer needs. The demand from customers is originated from the dissatisfaction of or the lack of equipment, thus making the customer need the initiator of development projects within the organization. The customer-oriented employees are the ones that can see what irritates the customer and thereby identify the need for initiating a new modification or development of a product. Because if customers are satisfied with their current products there are no incentives to develop something new and one "shouldn't change a winning team". The respondent acknowledges that medical needs are in focus and since the firm operates within an ever changing business arena, the projects often involve modifications of currently existing products. Furthermore, projects are initiated after considerations between three different managerial functions in combination with the CEO. The Research & Development, Marketing and thus the Production department works closely when considering a new project to initiate. In short, management decides whether to accept a project based upon a medical, market and production evaluation. Thus, business cases and literature studies are made use of when considering if a new project should be initiated. However, in order to even consider a project it must fall within the overall realm of corporate strategy. A typical project could be to improve or modify a syringe or to make better substrate for growing tissue.

The representative of the energy supplier defines a project in his organization as an effort that has a definite beginning and end. He goes on to say that a project for him could be very varying and everything from an IT upgrade, building new capacity, expanding the power grid, connect customers to the grid and installations. The underlying causes for initiating the projects could be legal reasons, customer demands or to render more efficient processes. Moreover, the projects are initiated after conducting a profitability analysis with regard to the cost of maintenance, time and possible efficacy gains that the project can bring forward.

The construction company representative views the building of a bridge, block of flats and other construction projects as typical projects for the firm. The project initiator is customer demand and the important factors are if the customer can afford the project but also to assure that the firm has the free capacity needed to execute the project. The planning of the construction process is critical and is often an important factor in conjunction with the capacity issue when deciding if a project should be accepted. This is due to the overhanging threat of fines due to contractual breaches if projects were to be delayed.

The med-tech representative implied that a typical project could be to develop a new type of hearing-improvement device or modifications of surgical equipment. Many, if not all, product developments involve lengthy research & development processes and are seen as risky since the outcome is envisioned but not known. The results only appear after clinical trials and only then one can determine if the result is successful. Most of the projects are initiated after recognizing customer demand or after strategically realizing a need for a new product.

The representative for the software developing firm indicated that a normal project could be to develop simple and small digital games "such as Tetris". After investigating the market, customer preferences and competition, a group of programmers are assigned to projects and constantly report back to management about the progress made.

Project flexibility

The bio-med-tech representative stated that the nature of flexibility is often different between projects and it depends on what is being researched and developed. The length of research &development projects can be vastly different. The respondent however emphasized that, in contrast to pharmaceutical firms, the operations are more flexible and open to changes whenever needed since many of the projects that are observed to be running into problems could be redirected and at least made into something else. In short, few projects are abandoned and sunk costs always produce at least something. Nevertheless, the biggest problems observed are projects that deliver too late or projects that produce a final result which was not as good as envisioned.

Furthermore, the bio-med-tech representative also had experience from working at a large pharmaceutical firm with research &development and pointed out bureaucracy and inflexibility as being a problem in a large size firm. Accordingly, the size of the firm entailed less value creation per person and instead more administrative exercises were focused on. This was one of the fundamental reasons for the respondent resigning and starting at the current workplace since the smaller sized firm is more focused on value creation in contrast to the larger where much of the resources were put on controlling the firm. This can however be contrasted to what the energy firm's representative tells us about his firm's large size allowing the freedom to initiate many projects.

The energy supplier representative mentioned that in their line of business they often cannot think of abandoning a project due to the nature of the electricity supply business and the importance to society, although it was repeatedly mentioned that many projects should be abandoned because of changing pre-requisites along the way. "Sometimes we need to say: alright we have to stop this project, it has cost us more than 500 thousand for example".

The construction firm representative stated that in a sense, there is little flexibility as contracts specify exactly what to be built and at what point in time. If it were not for the contracts, many projects could be abandoned especially because the building quotes are often given years ahead which amplifies the risk of changing circumstances. The method of construction is however not pre-specified in the contract and the project manager often attempts to accomplish the construction under the originally quoted and calculated price. By doing it successfully, the firm gains more profits than originally budgeted. Furthermore, a part of the firm's operations is buying and developing property and here there are often no contracts and the option to abandon is fully open and used. For instance, a piece of land is planned to be built on but due to a market turn it is sold instead.

The med-tech executive acknowledged that timing their projects is crucial since a late market introduction can generate a great loss of value. Also, it is not possible to produce a limited number of the final product to test the market since substantial development costs and efforts are involved.

The software developer point out that not all game development projects are marketed because numerous never reach fruition but instead die somewhere between the rough draft and the finished package. Yet, even if a game is scrapped, parts of the development such as the platform may be reused in subsequent projects or even sold if not needed for future projects.

4.3 FIRM STRATEGY AND GENERAL MINDSET

The bio-med-tech representative mentioned the strategic milestones that are set up by the firm. These include different targets spread around a time horizon such as in a specific time period the firm should reach some targets and further into time they should reach another target. Also, the respondent stated that especially in businesses with research & development there are always a lot of ideas that could be developed and the challenge is to "choose the right horses to bet on". The processes involved when considering projects to take on is to have an up-forward and honest discussion with the involved parties (CEO, Marketing, Production, R&D) and come to consensus about which projects are most suitable to invest in. Projects that are not invested in could also be postponed for the moment; they need not to be thrown away.

The energy supplier representative implied that in practice it very seldom happens that a project is abandoned due to changes in circumstantial factors and it was the respondent's belief that many projects that had run to completion should actually have been stopped earlier. The prerequisites of a project maybe have changed because of other projects coming up, and this could probably be explained by the need to focus on the overall picture. The ability to shut down or abandon different projects is seen as a point of strength rather than a weakness. When viewed in the wider sense, many projects should have been discontinued. It was however added to this context that, especially in their line of work, it can be hard to pull the plug on one project without harming another as projects are often much interconnected. It is finally expressed that it would be beneficial to view more projects from wider lenses. Following on from this, it was pointed out that being able to do away with projects is especially important as the firm has free capital and can start many projects. The limiting factor in project initiation is not financial but rather the limited number of employees in the firm. This is especially true as the number of members eligible to serve on a project control group is limited.

The construction firm employee pointed out that all projects are summed up, forwarded to above-level managers and eventually reaches the hands of the group executive who had the responsibility to see the overall picture and find any interactions and synergies between projects. Again, the systematic assumption that one could often build under quote was also emphasized as a strategic consideration when evaluating projects.

The med-tech firm associate indicated that sharp ears and eyes were required to look for market opportunities. It is also noted that even though the firm works within the medical sphere, the production of products vary greatly. A great amount of the produced products are purchased by large buyers and governmental organizations and to be positioned right to negotiate for large contracts is critical. Contracts with few other competing actors and contracts that require new or superior products not already available in place are favored since the profitability of these products is extraordinary.

The software developing firm is aware of consumers' discriminating taste and that demand changes rapidly in the industry. A game may be designed and developed that ceases to be popular. In addition, a project can also run into problems along the way and it is therefore just easiest just to abandon it and move on. That is why it is important to constantly have many creative projects on the go and not rely too much on a single game. A strategy is formulated regarding what kind of games to produce and where and how to launch it. The cost of producing one game is often quite small compared to the profits that one could be make of just a single game - "just look at Tetris".

4.4 POWER TRANSFER TO PROJECT LEADERS

The bio-med-tech associate implied that project managers are assigned to projects by the management and the appropriateness was decided after competency and the ability to lead. Moreover, project managers are responsible for much of the organizing in a project, in terms of establishing time plans and short-term goal determination, but they are also expected to frequently report to management at critical phases of the project. It is encouraged if not expected for the project manager to, if encountering any problems, to immediately bring it to the attention of management and from there collectively decide upon a course of action. However, it was also mentioned that it would have been more pleasant to see project managers act more entrepreneurial. But since the firms' project management procedures have been recently introduced, the boundary line for when to seek help from senior management and when it is appropriate for project managers to make own decisions is quite unclear to all involved.

Furthermore, the firm had strict written procedures for how a project's different phases are to be managed at different phases, but besides this, there are no control mechanisms such as bonus schemes to ensure a projects direction. The risk of project managers being motivated to make their project seem to be going better than it actually was also recognized, however, it was revealed that in a smaller firm this behavior could be curbed by management being well informed and constantly overseeing new projects. What's more, there is a bonus system in place for all employees based on the firm's performance as a whole. There is however no individual compensation system for project managers and the representative indicated that there should be such a system in place to encourage project managers to strive for better results and act more in the interest of the firm as whole.

The energy supplier representative mentioned that the project leaders have certain direct guidelines to follow regarding the execution of a project. This is mainly connected to the work with time plans, quality demands and general guidelines for both running the project and reaching the goals of a project. There are also numerous standardized tools available for project leaders such as templates to fill in regarding project progress. The members of the control group represent a broad background and host of competencies that act as a resource for the project manager. Hence, there is a continuous dialogue between the project manager and the control group, not only on predetermined occasions but also when problems occur. Much of the operative activities are to be conducted by the project manager independently and much of the work processes are reflected and described in the directive for the project. The representative did not believe that there was any risk that the project manager would withhold information from the control group as it was in his interest to receive their valued input and help. Maintaining a relaxed and friendly climate where it was generally accepted to seek assistance was emphasized and highlighted. Furthermore, there is no compensation system linked to project performance but there is only a bonus system based on the firms performance as a whole and includes all employees and is divided amongst all the firms employees equally. However, if a project manager handled a project competently, it elevated the chances of being assigned to lead future projects and could motivate future salary increases at the time of wage negotiations. Nevertheless, the pay is fixed in the short run.

The representative from the construction firm stated that project managers aspire and are encouraged to save money when managing a project and therefore they are given much power of the project to be able to do so. Of course, the manager cannot choose to build a bridge if the project is to build a building but the manager can choose wherefrom to source supplies, what building methods to apply and how to plan the labor force. There is however a structural framework with check-points in place to monitor the progress and help project managers. The manager often needs help with financial calculations, quotes and other administrative work as well. Finally, bonuses are seen as important but the firm has no individual bonus systems for project managers, instead, a general bonus based on multiple projects within the firm on an overall level exists. Thus, the bonuses are also not tailored to the time horizons of projects.

The med-tech representative mentioned that project managers are locked in by rules and have to follow a strict procedure to carry out a project. They are closely monitored by a management group composed of higher level employees and, in some occasions, experts within a certain field. Meddling and evaluations are scheduled at pre-determined times along the project development process and project managers are seen as being more of "middle overseers" than innovators.

The executive manager employed at the software developing firm indicated that the head programmer for each project had the total responsibility for the project. Innovative ideas and actions was a requirement in development projects. Although it was required to report to management continuously, the reporting occurred more along the way and was not set up in predetermined schedules since the firm was of smaller size and more "compact". Management incidentally interfered regarding the time period of development and when projects should be given less attention or even terminated.

4.5 Blame for failed projects and encouragement of entrepreneurialism

The bio-med-tech representative described a witch hunt in the firm whereby the organizational culture demands that someone takes the blame informally, if not formally, for a project failure. A project manager who is perceived to have failed can be informally punished by being excluded and/or given the cold shoulder. Formally, a project leader who has failed to execute a project with the expected results may never get to manage a project again or be transferred to another post. In addition, since there was no performance based bonuses for project leaders, failure was punished and success not rewarded. Finally it was stated that entrepreneurship, initiative taking and risk-taking was not encouraged within the firm and could be improved.

The representative for the energy supplier stated that as soon as a project encounters difficulties, a project manager was to seek assistance from the controlling group for the project; this group is comprised of senior management representatives of the firm's different departments. This was of great help and rescued many projects in crisis. Also, it is seldom the project manager alone that takes the blame for a project failing but instead the blame is shared with the control group. It is vital that the relationship between the

project manager and the control group is relaxed where the project leader can openly admit any encountered problems and is unafraid to show his hand.

Furthermore, there were no formal or informal punishments for failed projects that the representative knew of but proven inadequacy of project managers could make it hard to be assigned future projects. However, this was as long as the project manager had been open and forthright with the control group during the course of the project. On the other hand, if the control group was kept in the dark during a project and the project manager subsequently runs into difficulties to accomplish the project, there was a potential risk of being repositioned or even fired in extreme cases. Finally, the representative stated that the good financial standing of the company was pointed out as being good for encouraging initiatives as many project could be financed.

The construction firm representative indicated that there are a lot of responsibilities associated with being a project manager and there are external punishment mechanisms such as workplace safety regulations in place whose breaching might lead to legal action being taken against the project manager personally. However, punishments for project managers internally were seen to be unusual.

The med-tech executive implied that since project managers are given strict orders, deviations from these are given the blame for if the project fails to deliver. The representative recaps two examples of project failures where the project managers have quit after the failures. The firm culture is described as such that a project failure is a sign of a loss and this is believed to force managers even more to follow the project guidelines and thus sacrificing entrepreneurship in order to avoid the blame for failed projects.

The software developing representative pointed out that the programmers employed are highly qualified and that there always exists good and bad ideas. Sometimes a game becomes popular but it is not necessarily the case with all games and therefore no outright failing exists that needs to be blamed on anyone. In addition, it is mentioned that management usually work closely in conjunction with the development team and are therefore quick to assist if problems arise or any hinders come up. Projects are more seen as team efforts with virtually the whole firm included in the team. The organizational culture is friendly and management's goal is to create a friendly and helpful atmosphere where everyone continually assists each other to create a dynamic environment of exchanging ideas. The ultimate goal is to be as entrepreneurial as possible and in some cases this creativity and freedom generates results but not necessarily.

5 ANALYSIS AND INTERPRETATION OF RESULTS

In this first section the firm's business is firstly seen through a ROA framework , in section two the general strategy is analyzed, in section three the firm's ability to empower project managers is examined and in the final section we analyze how decision making biases might limit the firm and in what sense.

5.1 THE FIRMS' BUSINESS IN A REAL OPTION CONTEXT

In this section the authors intend to connect real option theory to the interviewed firms. This is done in a very general sense to get an idea of the firms and what flexibilities the firms possess and how ROA might be applied.

As noted by Brach [26], different firms and industries face different environments and have varying operational factors that makes it hard to generalize as to in what sense ROA could be embraced and utilized. Based on the answers given by the respondents, one can see that the project initiation process differs vastly across industries but the common aspect is that all of them focus on the demand of customers, which essentially is understandable and fundamental since this is the source of survival for all firms. When following customer taste uncertainty inadvertently follows.

When compared with the literature it is noted that all the firms interviewed have business areas that encompass fields traditionally suited for ROA, at least in theory. In some firms, such as the energy supplier and the construction firm, the option to abandon and the option to wait are more relevant than what it is in the bio-med-tech firm. This could be attributed to the existing nature of the bio-med-tech firm in question, where all sunk costs at least produce a result, although the intended ultimate goal was something different. The energy firm representative does not stop at presenting the possibility to abandon projects as suggested by Brach [26]; the respondent also promotes more cases of project termination and clear-cut rules for doing so since it is felt that too few projects are terminated. Moreover, the option to expand is suitable for all firms because if market conditions are proven to be good, the firms could ride on the wave and maximize the value of the rise in demand. All firms could therefore identify options to expand as suggested by Brach [26]), however, this is especially valid for the energy supplier and construction firm due to the high volatility of energy prices and commodities. Similarly, the option to wait, sequential compound options and many other options could be identified specifically and tailored to each of the firms mentioned in this research.

The flexibility possessed in the various firm's projects differ extensively. This can in part be due to the firm size, in the sense that the smaller bio-med-tech firm easily can switch their research focus to another area of medical research, whilst the construction firm as well as the energy supplier often is obliged to fulfill contractual agreements or bound by customer duty and possess less flexibility in this sense. Conse-

quently, these contracts of civic duties limit the courses of action available to the firm. The contracts can be formed several years in advance which makes the exercising of options a bit more difficult, however, there are always possibilities to rearrange current contract negotiation practices and incorporate actions into contracts that are more real option friendly. For instance, the construction firm can decide to incorporate the right to expand a construction project by incorporating a contractual clause that gives the right to buy up land adjacent to the land already possessed in order to allow growth if conditions permits. Similarly, the energy supplier could incorporate options to expand, options to wait and sequential compound options with regard to developing and marketing green energy technologies in order to react quickly depending on the overall success and acceptance of these technologies in the market. Especially when fossil fuel prices are peaking, the firm could gain many projects since customers, both industrial and private, become more aware of the need to utilize more green technology and are more receptive to ideas that can reduce their energy expenditures at these times.

The sequential compound option in combination with the abandonment options is appropriate for all firms studied since this would allow them to be more aggressively experimental and creative in their development of products that could lead to the gain of competitive advantages as prescribed by Aaker [31] . The lack of experimental aggressiveness can be derived in some instances from the lack of resources, but also because firms are more secure with testing something that is already tested instead of changing the game and taking the lead by entering new markets to gain first mover advantages and/or innovating new cutting-edge products. This subject will be treated more comprehensively under the topic of general strategy and strategic mindset of the firms.

Furthermore, the human capital restraint is emphasized in the energy firm and is identified as being a factor for not initiating more projects. An option to expand, regardless if it involves a full-scale expansion to another market or expanding to say encompass a wind power plant could therefore be hard to exercise due to the lack of competent personnel. The construction firm mentions that there are possibilities to sell off land if property prices induce the firm to do so and in this case, real options analytics are already in a sense in place and utilized implicitly. In addition, the project manager had free hands to take on a project as long as the task was accomplished. How the supplies were brought in and how the coordination of the whole span of activities was to be made was largely up to the project manager. This makes it a situation where proactive flexibility could be facilitated if the firm was to apply real option analytics since the project manager who essentially holds the option can affect the value of the project by acting proactively and skillfully as indicated by Leslie & Michaels [1]. It is however difficult to determine what type of flexibility that was inherent in the firms' projects specifically, but in general, the projects and the operations of the firm suggested that reactive flexibility was inherent in the projects since much of the operations was about responding to environmental changes. Though, the firms might be able to identify proactive flexibility in projects after considering the processes involved in detail, however, this study did not have the necessary requirements to investigate these processes in detail and therefore the existence of proactive flexibility cannot be determined. In summary, all firms involved in the study face operations and environmental conditions that embrace real option analytics in a way or another.

5.2 General firm strategy and mindset

In this section the intention is to treat the firms' mindset towards real options. This is relevant as some of the firms already possessed a degree of thinking in terms of options. The connection between firm strategy and ROA will subsequently be elaborated.

As mentioned previously some of the firms already saw some of their business areas as containing options, even if they only inadvertently treated them as such. We saw a glimpse option thinking at work in the construction firm. They seemed to almost systematically under price the construction bids. This is discussed in - rational under-pricing in bidding strategy: a real options model by Yiu Tam [29] where it is shown that this represents real option logic in the sense that the bidding firm is prepared to bid to a very low price due to the valuing in of this real option to build cheaper. This underpricing is not explained by NPV but buy real options analysis. So this is clearly an example of ROA thought already existing, even if not always applied through a framework practice. Yiu &Tam [29] conclude that this underpricing strategy and connected flexibility could however be made more rigorous using ROA. This could not be mentioned on in this paper since this would be an act of the future and needs to be determined after an implementation of ROA in the organization.

Overall, the firms lacked a formal strategic mindset, prescribed by Luehrman [31] and Mun [5], that considers what future possibilities a project can give rise to in the future since most of the firms indicate that the project in question attracts most of the focus. These criterions that are given attention are not, exclusively, the focus of real options in a strategic context. Rather, the strategic considerations of a possible project initiation are to see the project as an option and further identify a chain of options linked to the first option but not necessarily in the same "area" of interest. For instance, the energy supplier should consider the options available after completing a wind power plant prior to the beginning of the construction of the wind power plant in order to plan and evaluate the investment accordingly. It is necessary to take more cognizance of the interactions of projects than the firms do today in order to reap the full benefits of ROA.

Along these lines, a few firms seemed to share the reasoning of strategic adaptability mentioned by Aaker [31] and Zook [33], to initiate projects according to the metaphor of planting seeds and simply tending those that flourish and weeding out those that wither. The only firm that explicitly mentioned a strategy along these lines was the software developing firm that confirmed the way of starting many projects and seeing them as options that may or may not pay off. This was however not done with the formal rigor of ROA. They also mention, as do Aaker [31] and Zook [33], the need to try a project, however, if it did not shape into something promising just drop it and move on to the next one. None of the other firms seemed to share this mentality of weeding out bad projects. Most of the firms proudly reported little or no project failures. Concern fully, by harboring this view of all projects being able to be saved; they are barring themselves from taking the financially correct and inevitable abandonment decision at necessary times.

One wonders if the term strategic adaptability (Aaker [31]) is really appropriate to describe the chosen strategic approach of many of the firms. The term strategic commitment is perhaps more appropriate since many of the firms seem to act more on what is foreseeable rather than trying to influence and manage the unforeseeable. This behavior is to take a step away from the ROA logic of act and see. But by the same token, the energy firm showed tendencies toward embracing strategic adaptability since new types of projects and business areas were being tested, but then again they are in a completely different business in comparison to the other firms and can perhaps steer the market in a different way. Finally, not to forget the software developing firm that induces one to wonder if they perhaps are on the other end of the strategic opportunist scale since strong signs of them being very opportunistic is evident. In the case of the biomed-tech firm, one can wonder if they only back safe horses as all projects always result in a final product, and none are abandoned. Is it reasonable to believe that only thriving, already successfully tested existing project ideas are accepted? In other words, one could believe that only safe horses are bet on and no risks are taken to exploit uncertainty. This could lead to strategic consequences for the firm if other actors decide to take on a more aggressive approach in the same market backed by real option logic. One can speculate whether the firm would benefit from an option mindset and the accompanying ROA framework that in a sense might legitimize the termination of failure projects and might lead to an earlier abandonment of risky projects that might increase the opportunities to gain a competitive advantage.

The energy firm on the other hand seemed to be indicating that they should be a bit more opportunistic as they have the capital base to take the risks and fund several projects. Even though they might not use ROA presently, this type of reasoning might lead them to attempt to apply ROA in the future.

Strategy as portfolio of real options (overview, interactions, synergies)

The different sizes of the firms made it apparent that the procedures for implementing an optimal portfolio of projects varied heavily. The larger firms, the construction and energy supplier, indicated that the central function had the responsibility to consider all currently on-going projects and projects under consideration to choose an optimal portfolio of projects in order to take possible synergies and interrelations of different projects into account. However, the energy supplier indicated that it was hard to have an overview of all projects since there are many projects in place. This could be a huge loss of synergies since the energy supplier had many operations in different kind of businesses which creates opportunities, both financial and strategic, since overlapping projects could be of great value. The opposite is also true since overlapping projects can also conflict and as the respondent mentions “change the prerequisites for other projects”. The need for more detailed management of the firm’s different projects in order to create an optimal portfolio of projects can be seen in order to stay focused on the “good” projects and abandon the others. Of course, the problem with having an overview of all projects implemented in the firm could be framed as an organizational problem since the issue is where the optimal decision making should be taken about the firms various projects. Based on the empirical studies, the idea of centralizing the responsibility for finding interrelations and interactions between projects was favored since the overall picture of

the business is currently available at that level. Nevertheless, project managers also have a responsibility to find any interactions and consider these when taking on a project. These operational and strategic interactions may not be of concern to the manager per se they are to the firm as whole. Therefore, a responsibility to assist the centrally placed corporate management and forward crucial project information or ideas is of great importance for the firm as whole. However, except for the energy supplier, there were no substantial insights obtained about the different firms' handling of the overall portfolio of projects. This could be explained due to the absence of the overall strategic mindset required by the ROA but it could also be explained by the fact that this procedure is more valid in theory where abstract ideas seem to be well-suited on paper, but less practical in reality. Yet, it is noteworthy that the smaller size firms in the study such as the bio-med-tech and the software firm chose to take on projects after consensually agreeing on what is appropriate to take on. In smaller firms more attention is put on choosing the optimal portfolio of projects informally. This could be derived to the fact that smaller firms are more capital rationed than what larger firms are and must therefore specifically evaluate and prioritize what projects that should be taken.

Furthermore, when the bio-med-tech firm stated that all projects lead to something, one wonders if the interviewee perhaps subconsciously classified actual abandonment projects as successful projects after being able to sell the technology and gain the salvage value. The salvage value in case could probably have been a definition of some kind of success rather than failure and loss for the interviewee.

5.3 EMPOWERING PROJECT LEADERS

In this section the empowerment of project leaders is examined and how the ensuing agency problems are resolved in a sophisticated and detailed manner.

Who within the firm is best suited to exercise a project option can of course be discussed, the director with their all seeing vantage point and experience, or the on-site managers with absolute knowledge of the limited area that the project encompasses. McCormack [34], Trigeorgis [27] and Teach [41] point to project leaders needing to be empowered, but guided by directors. They talk about the need to empower project leaders in terms of being able to make their own decisions when needed regarding the project. By doing so, project leaders can actively make the relevant and timely decisions required when managing real options Trigeorgis [27], as well as obtain the flexibility to deviate from their marching orders McCormack [34]. The representative of the construction firm clearly mentioned thinking along the lines of McCormack [34] with project managers allowed to achieve much flexibility by deviating from predetermined plans. This is due to the responsibility being passed on to project leaders regarding the planning and fulfillment of a given project in terms of managers planning the sourcing of nuts and bolts and coordinating labor. This is practical as it allow for flexibility to be acted upon in a timely fashion and without having to wait for the approval of upper management.

The representatives of both the bio-med-tech and the med-tech firm also mentioned that project managers have the ability to set short-term project goals and oversee the project on a day to day basis. However, at critical points the project manager will seek the counsel of the supervisory board. One wonders how much of this behavior actually fits with ROA logic. This of course would depend on what is deemed day to day and what is critical. The overall impression was however that project managers did not have any meaningful room for entrepreneurialism. In the context of control vs. flexibility balance previously mentioned, the control had the upper hand.

The representative of the bio-med-tech firm stated that he did not believe the firm's current structure supported entrepreneurship, initiative taking and indicated that risk-taking is not encouraged within the firm. It was believed that there is room for improvements on this front. This was in conflict with most of the literature that calls for more independent project managers. One wonders if firms with these organizational structures would be able to extract the inherent flexibility if they were to apply ROA. This structure of upper management pulling all the strings, in one way or another, in almost all firms surely would entail that major decisions regarding the options are only made at discrete moments and not at the trigger points mentioned by Copeland and Tufano [38]. This in turn will affect the value of the project flexibility (Mun [5]). The software firm could be an acceptation to this as it is such a small firm that decisions are unlikely to be limited and taken at a pre-determined meeting. This is of course due to the fact that they are a much smaller firm than many of the other firms participating in this study. One could perhaps defer here that larger firms with more bureuocracy might have a harder time extracting the full flexibility of ROA due to the inflexibility of their organizational structure. This is especially evident when comparing to the smaller and more dynamic firms interviewed. Nevertheless, the ability of larger firms to fund more projects should not be ignored when weighing advantages and disadvantages between small and large sized firms.

The representative of the bio-med-tech firm recognizes the type of agency problem described by Adner and Levinthal [17] and Statman and Caldwell [37], but points out that in a small firm it is hard to pull the wool over management's eyes. Management is described as being very much on top of new processes and the development so even if a project manager would try to distort project information they would quickly be aware of that. Likewise, the representative of the construction firm did not see the risk of this problem as project managers in any difficulty would not withhold information but instead consult the supervisors. Firstly, one must bear in mind that the authors are interviewing the very people involved in this principal-agency relationship. Secondly, one must recognize that if the project in question has a project manager who reports to a control group, the control group could itself be caught up in the agency problems described by Jensen and Meckling [44]. Theory however indicates that a properly thought out bonus system could remedy this and other agency problems.

But unlike McCormacks [34] recommendation that the firm should have a bonus system for project managers based on project performance, all the firms interviewed had only, at best, general overall bonus

systems for all employees. These bonus systems, often based on accounting figures, such as annual turnover, fail to align project managers' incentives with that of the firm in a meaningful way. Many of the interviewees do point out the chance of a pay raise if a project goes well. This isn't what McCormack [34] was asserting, since one single project success can be based heavily on luck and this is far away from what a good bonus system should actually reward. The representative of the bio-med-tech firm does however recognize this problem and thinks that his firm should have its bonus system looked over. As he puts it: to serve more as a carrot to motivate managers to strive for excellence and align their interest more with the firm as whole. So here change could be in the wind.

The construction firm did have a bonus system based on multiple, maybe 25, projects. This is more along the lines of McCormack [34], at least in the sense that it spans multiple projects. Here it is pivotal that the firm develops a well thought out bonus system that motivates managers but also avoids the free rider problem (Armstrong [45]) associated with the group bonus systems employed in all the firms interviewed. This problem leads to managers not trying harder and not being as motivated as intended by the bonus system.

5.4 Blame for failed projects and encouragement of entrepreneurialism

In this section the authors address the problem that arises even if managers are empowered. They might still fall victim to a few common biases. This is especially a problem if the appropriate systems are not in place to guide them.

Along the lines of Kogut and Kulatilaka [18], regarding the encouragement of project managers to take risks, the representative of both the energy supplier as well as the med-tech firm talks about upper management sharing in the responsibilities. This encourages project managers to simply; as the literature puts it, dare to take risks. This risk taking allows options to be acquired and flexibility to be acted upon. The representative of the energy firm also touched upon the subject of the firm's good financial standing as a reason to be able to undertake projects and risk money. This pay to play attitude or to have the money to risk on the option is along the lines of what the literature sees as a necessity for ROA. The firm's good finance as such will also make management feel comfortable with knowing that the firm can afford the risk.

The reasoning of the representative of the energy firm is along the lines of what Statman and Caldwell [37] prescribe in the sense that they admit that the task is hard and that a manager might need support. This in turn lessens the guilt and helps against entrapment of managers. By doing so, it can be seen as legitimizing risk-taking and that the upper management of the energy firm underwrites the project and in a sense shares the blame of failed projects. This creates an open and transparent environment free from punishment as mentioned as vital in the literature. This is clearly what is referred to when told that project managers will be unafraid to "show their hand".

The software firm points out that their work is often done in a team sense where either everyone wins or everyone fails. This seems to point in the same direction as Statman and Caldwell [37] since guilt is shared but one wonders if this team spirit might in itself pose a problem. Project managers might become more aligned to the goals of fellow team employees than the goals of upper management and the firms as a whole. This in turn may mean that regret is heightened as one does not want to let ones' coworkers down. Another issue here is that of potential free riders as described by Armstrong [45]. As tasks and rewards are based on group accomplishments, a situation can easily arise where some workers do more than their share and some less. This could result in a situation where no one wants to work extra or take risks perceived as personal risks when they may not be directly rewarded.

Similar to what Statman and Caldwell [37] asserts, the energy firm points out that it is important to bear in mind that not all failings are the fault of the manager. This seems to be something many of the firms generally fail to take coincidence of when passing blame and especially when setting bonuses.

The representative of the bio-med-tech firm says that they have an organizational culture that demands that someone takes the blame of all project failings. This is against the recommendations of all the literature examined on the topic as it is seen as worsening the risk of entrapment and is not aligned with the flexibility seeking mindset of ROA. Stat man and Caldwell [37] worry about managers being entrapped in projects due to psychological biases related to failure. They talk about regret being heightened if the project manager feels personally responsible for all project failings. This could cause him to not react when he was supposed to, such as not terminating a project when he optimally should and could therefore cost the firm financially and the full flexibility of abandonment will be lost.

Statman and Caldwell [37] talk about unbiased reviewing, the firms interviewed recognize this problem and all have control boards of one type of another. They do not however utilize external parties in this process such as a firm of consultants as Aaker [31] recommends. One wonders if, especially in the smaller firms this 'unbiased' reviewing can do much good as the project is probably not being seen with fresh eyes.

Evidence of Statman and Caldwell [37] 'ironclad' rules of investment are present in many of the firms with strict rules regarding project procedure, in one sense of another. The rules observed in some firms, as in the med-tech firm, often seem to have more to do with a predetermined project notion than project flexibility. As such, one wonders if the rules aren't overused at the expense of flexibility. The optimal level of rules is probably less than we have found in many of the firms, but should instead be backed up by a more comprehensive and well thought of bonus system. A bonus system can work in the same direction as a set of rules as entrapment can also be curbed by a bonus system aimed at making project managers realize the costs for the firm if having a project dragging on. The firms did however not utilize any such "sophisticated" bonus systems as previously mentioned.

It is here worth bearing in mind that the people being interviewed might be the very managers affected by these biases and we therefore should not necessarily expect them to be able to verbalize all of them fully, as a large aspect of a bias is subconscious. Consequently, many of these biases and their effect could and most probably be more far reaching than what we thought our interviews have given credit too.

6 CONCLUSIONS

Do the currently existing organizational processes, systems and structures allow the successful application of ROA?

We saw a mixed compliance at best where some of the firms complied with what the literature prescribes, but only in some occasions. Some of the firms empowered project managers greatly whilst others disregarded it fully. A correctly functioning bonus system is a key in applying ROA mentioned again and again in the literature, and seen as a remedy to a host of problems surrounding the successful capturing and exercising of the firms' options. Bonus systems that play into the ROA way of thinking and managing are present in none of the firms and this is an important factor in the implementation of ROA. ROA demands that managers take risks and are prepared to terminate projects if necessary. In practice, one wonders simply what would cause managers to take risks because generally speaking, the firm structures we encountered in this study do not support risk taking. This is simply because they generally punish failure and/or fail to reward risk-taking. This entails that managers might see little incentive to take fare risks in fear of being punishment.

What aspects, above those already prescribed in ROA literature regarding the qualities and functioning of an organization, might be the key to successfully apply ROA?

We further identified something of an options mindset or awareness of flexibility as needed. Not only to successfully apply ROA but also to even consider using ROA. One wonders how it could be that the studied firms did not seem to have an options mindset at all. Maybe it is due to the lack of flexibility to start with or perhaps simply that they exercise their options in such a predetermined and inadvertent fashion that they do not even realize that they are in fact dealing with options. ROA: s greatest contribution to these firms might not be simply as a valuation method but as a strategic tool that helps discover, develop and strategize around flexibility. We feel that the biggest problem is to take that first step into seeing things through on options framework. If one doesn't see oneself as a holder of options why would anyone be interested in an option managing tool at all? Some of the firms already did see themselves as option holders but in a very limited sense. This of course will facilitate the implementation of ROA as the mindset is there and at best it would just be a matter of implementing the systems and structures to support and add rigor to this way of strategizing. The bonus systems argumentations and other structural changes seem very simple and easy fixes compared to the job of changing a whole firm's mindset towards seeing the options inherent in their business.

Are Swedish firms ready for real options?

To answer this question in short: No, Swedish firms are not ready for real options, not yet. We posed the question are Swedish firms ready for real options and have found a mixed answer at best. Having looked at the firm's interviewed, all of them have on paper the potential to apply ROA but one wonders how much of the value associated with flexibility envisioned by ROA can be reached in a real life firm. Reaching the full value of flexibility is dependent on if the firm can manage its options correctly. By acting incorrectly, acting late, prematurely or not at all, a firm can lose project value envisioned by the real option valuation tool. The firm's management/organization structures as well as the firm's mindset toward investments are thus crucial. As mentioned in the introduction, ROA tends to value projects higher due to flexibility and this may lead to firms accepting projects they otherwise would not accept simply due to the envisioned flexibility. This flexibility may be purely theoretical as the firm lacks the ability to practically manage their options in a value maximizing fashion. It is pointless to value an option that one out of fear of regret daren't exercise. How will one gain real options if one does not want to take risks? A firm with a mindset that dictates that all projects have to succeed does not have a true options mindset and is inadvertently blocking much of the inherent flexibility of their business. This might be hard to change as it is so deeply rooted in many of the firms, not least in their sense of pride. This change of mindset also needs to be accompanied by the type of structure to support this type of strategy. A firm without an options mind set might not realize the firm has options at all and therefore not even consider applying ROA. Following on from this, many Swedish firms might be able to theoretically apply ROA tomorrow but still in many instances not benefit fully from doing so as the systems to utilize the gained flexibility do not exist. It is important not to account for more flexibility that an inflexible organization permits.

In summary, the firms with existing evidence of an options mindset and those without seem to have a long way to come in the sense of changes to organizational systems and structures to further ensure that options are correctly exercised and passivity as well as agency problems are avoided. As ROA is as much a calculation tool, as it is a way of strategizing, as it is also a philosophy, the mindset and general strategy of the firm should not be underestimated when applying it. This means that many Swedish firms might need to augment this strategic mindset before even considering the application of ROA.

None of our studied firms are fully ready for ROA as it stands today, however some of the firms are much closer than others. In general, the authors' feeling is that many of the changes in structures and systems mentioned, such as a more well thought out bonus system, are quickly and easily resolved with the help of guidelines from experts to follow. However the transformation of a whole firm's mindset, as mentioned previously, seems to be a far more acute and daunting task.

6.1 FUTURE RESEARCH AND FINAL QUESTIONS

The possibility to look into firms that have applied ROA and how they operate is highly interesting. If they have different/similar mindset or other systems and structures in place than what was found in this study. Another idea of investigation is to look into firms that have implemented ROA before the "required" system and structures were in place to see how this worked out.

An overall idea expressed by many researchers is that ROA will completely dominate capital budgeting in the near future as firms cannot afford to be left behind with the risk of being beaten by competitions using ROA. If the convergence to ROA is fast, one can expect to see firms changing and transforming fast. Future studies could therefore at regular times check in with firms and see how this is developing and thus gain a better perception of the impact of ROA in practice.

Finally, if this line of work proves to be promising enough to explain the mismatch between ROA and organizations, there are opportunities to show this mismatch by conducting a quantitative study in the future.

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APPENDIX

Interview topics

Topics touched on in the interview, operationalized in the form of questions.

- What kind of projects does the firm engage in?
- Give an example of a typical project?
- What are the expectations of a project?
- How is a potential project evaluated?
- How is it proposed to management?
- How does one consider a new project in the light of existing projects?
- Who has the power in a project?
- Who reports to whom?
- How are different divisions taken along the way?
- What is the roll of the on sight project manager?
- Which are the powers given to middle management?
- What are the conditions attached to this power?
- Is there a bonus system?
- Who is covered by it and what is it intended to encourage?
- What control mechanisms exist for controlling middle management?
- How does the firm deal with failed projects and disinvestment?
- How does one make sure that projects are invested in a timely fashion?
- Are they any consequences of a failed project?

- What discipline systems could be at work here?
- Is there an external project review?
- How does one deal with a project leader who has a failed project?
- Who bears the responsibility?
- Are there programs to assist project managers at these times?