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MATHIAS GEHL

VALUATION AND STRATEGY IN BRAZIL: An exploratory study

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Master's dissertation presented to the Instituto Coppead de Administração, Universidade Federal do Rio de Janeiro, as part of the mandatory requirements in order to obtain the title of Master in Business Administration (M.Sc.).

Supervisor: Prof. D.Sc. Antônio Roberto Ramos Nogueira Ph.D.

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ABSTRACT

The never stable Brazilian economy is currently facing increasing political and economic challenges. Consequently, Brazilian firms face an expanding multitude of uncertain factors in their business decisions, calling for ever more flexible strategies. In this scenario, the author explores how companies handle this growing challenge with ten in-depth interviews of leading Brazilian companies. The study explores the steps of the valuation process, the actors in the process and the uncertainties associated. We can establish a common process among the research group that it is driven top down by the decision-makers of the firm and its consequent structure. Yet, the observed process appears incomplete as it lacks a step of reflection and improvement. The flawed practice continues with regards to uncertainties and strategy. Both are recognized as important value drivers but the goal remains a valuation as certain as possible. Consequently, we were not able to observe a conscious process to connect strategy with the valuation nor consistent approaches to capture the volatility of values due to uncertainties, such as the regular utilization of Real Options. We can explain these observation when we recognize that the choice of valuation tool and even the whole process is driven by more factors than the theoretical fit with the valuation problem. Most prominent factors are meaningfulness to the decision-makers, fit with the organisational structure and, available resources. In conclusion the study finds evidence that we need to include aspects of organisational behaviour to explain the application of valuation techniques such as culture, education and, incentive structure.

Key words: Uncertainty, Valuation, Real Options, Strategy, Brazil, Valuation Process, Valuation Techniques, Assumption Building, Decision Making

LIST OF TABLES

LIST OF ABREVIATIONS

CAPM	Capital Asset Pricing Method
DCF	Discounted Cash Flow
NPV	Net Present Value
RO	Real Option
ROV	Real Option Value
WACC	Weighted Average Cost of Capital

CONTENT

1. INTRODUCTION

1.1 INITIAL CONSIDERATIONS

Since the beginning of management literature authors have complained about the increasing competition and speed of innovation (Chandler, 1990) which makes the business more and more challenging. The addition of new players to the markets and the ever faster emerging of new products makes planning even more demanding by inflating the number of uncertainties. Hence, rigid planning is no longer sufficient to develop long-term success orientated strategy (Day, 2007; Fleck, 2009). Strategy development needs to be increasingly flexible to cope with the business challenges of our times.

Valuation of assets serves as an important tool to supply the strategy development with crucial inputs, especially regarding capital allocation decisions. Over the last century, valuation techniques have constantly evolved to incorporate the latest developments in financial theory and to cope with the emerging demands of the business world (Dias, 2014, p. 133-135.).

One of the latest developments is the Real Option (RO) valuation that implements elements of the financial market into the business world, combining them with established valuation techniques. Its advocates hope that it can inject the necessary flexibility into the valuation process for it to be able to incorporate the resilience required to supply the input modern strategy development needs (Copeland & Tufano, 2004). The objective of RO are to help "...a firm's management under uncertainty [...] to employ market-oriented risk attitudes to maximize shareholders wealth," (Trigeorgis, 1996, p 40).

1.2 THE PROBLEM

In the last 20 years, Real Options gained traction as a project evaluation tool, expanding the DCF method with the element of flexibility. The method is established in the academic but is not without controversy among practitioners. All of the limited research on how Real Options are used is focused on North America and Europe. So far, no research has been done regarding the usage of RO in either South America or a developing country. Yet we know that the business realities of these countries differ severely from North America or Europe. Hence, the research needs to take this aspect into consideration (Bethlem, 2014, p. 94).

Among the various publications on the matter, we find extensive literature about the application of RO to a specific problem, written from a financial perspective. What we lack is

literature on the strategic use of RO and their application in the daily operations of firms. Moreover, we struggle to find literature that describes how corporate valuation is embedded in the company's process and especially how it is linked to the strategy formulation of a firm.

In summary, there is theoretical evidence that RO could be an answer to the increasing uncertainties in today's business world. They could allow practitioners to capture uncertainties in the valuation and thereby allow a more objective treatment of uncertainties in the company's decision-making and strategy process. However, we cannot determine whether this applies in Brazil because we do not know how RO are utilized here, nor do we know how the valuation process with RO is linked to strategy.

1.3 OBJECTIVE OF THE RESEARCH

This thesis to narrows the two gaps described earlier. It tries to determine to which degree the RO technique is established in Brazilian companies. Going beyond the limitations of the earlier quantitative research, it attempts to capture a picture of the reality of the valuation process and how RO are utilized. This will allow understanding the problems and motivations of the users regarding valuations and RO in particular. With this new information at hand, this thesis aims to describe how uncertainties are currently captured in the valuation process and how RO they help to link strategy with valuation.

1.4 RELEVANCE

There is little research that elevates valuation beyond numerical models and methods. The same holds true for the utilization of RO. Furthermore, it was solely focused on North America and Europe. This thesis will add the perspective of a South American and developing country to the scientific canon. Moreover, the aim is not to document statistically the usage of valuation and specially the RO method, like most comparable studies, but to explore more in-depth the factors that surround its application. Therefore, this work will provide a unique perspective combining the qualitative approach and Brazil.

1.5 ORGANIZATION OF THE WORK

In order to search for answers to the questions raised by the author, this thesis is divided into five chapters: Introduction, Context and Literature Review, Method, Analysis of Results and

Conclusions.

In this first chapter, Introduction, the purpose of this work, its relevance and its boundaries are set. The second chapter reveals the current state of the research on the topic. This includes a brief history of Real Options and the development of valuation techniques, a summary of the current state of the RO technique and an overview of the current research trends. Also in this chapter, the view is extended to put RO in context with the more traditional valuation techniques and the regional aspects of the research.

The third chapter presents research method, the type of research conducted, the respondents' selection criteria, the data collection mode, and the limitations of the method.

Dedicated to the analysis of results, the fourth chapter introduces the reader to the material collected in the field by the researcher, comparing this information with the context and reviewed literature, culminating with the subsequent chapter, “Conclusions”.

Thus, the thesis reaches its final chapter presenting the reader answers to the research questions, whilst showing its limitations. In the final chapter, the author adds his considerations, contributions to academics and professionals and, ultimately opportunities for future research.

2. LITERATURE REVIEW

We will start the literature review by defining valuation and its role for the company. After gaining an understanding of its importance, we will see the challenges connected to evaluation. One of the major challenges is the method to incorporate uncertainties in the valuation. We will explore further the challenge of uncertainties by looking into their nature and how valuation techniques embrace them. The findings lead to the conclusion that Real Options are the best approach to improve the current situation. Following this, we will discuss them in more detail. The literature review continues with a look at country-specific factors. The vast majority of literature originates from North America and Europe. Therefore, we need to explore in how far the setting in another geographical region can influence the research findings. We end the review with a summary of the current situation in Brazil.

2.1 VALUATION

We understand valuation in this context as the part of the corporate budgeting process where the investment objects are financially evaluated. The traditional and common view on valuation is limited to financial models (Kersyte, 2011). We can easily see this in any common text book on valuation. The financial models fill the pages and related issues like information gathering, bias avoidance or, impact on decision making are, if at all, side topics. This work goes beyond the traditional understanding and interprets valuation as a process that begins before and ends after the application of financial models.

Valuation provides information for a wide range of business decisions. It helps the portfolio fund manager determine whether the market price of a share is over- or undervalued (Damodaran, 2006, p. 20-21). Furthermore, in corporate finance, valuations helps to determine how much and where to invest, how much money to borrow in order to invest and how much to return to the investors. Moreover, when offering equity to sell valuation provides critical indication for the price building. It holds true for the acquisition where valuation helps both firms to decide on a fair price (Damodaran, 2006, p. 22-23).

The general objective of any valuation is to provide information for “intelligent” decision-making (Damodaran, 2006, p. 1). De Souza (2014) being precise, says that valuations provide existential input to the investment decisions of a company. Thereby helping build the company’s strategy (Dias, 2014, p. 133-135). On the other hand, the company’s strategy is an important input for the valuation (Copeland & Tufano, 2004; Trigeorgis, 2005). Here we see a close interaction between valuation and strategy, where one drives the other. Hence, it

becomes clear that valuation is a source of competitive advantage and thus of growth and shareholder value generation (Dias, 2014, p. XI). Consequently, valuation is one of the critical tools for organizational success.

2.1.1 GENERAL APPROACHES TO VALUATION

The traditional view of valuation is dominated by the financial techniques used. Hence, we will take a brief look at the major financial techniques used to establish a frame of understating for the following chapters. We begin with is the discounted cash flow (DCF) valuation. Second are the relative valuations and last are claim valuations (Damodaran, 2006, p. 9). This section will provide a short summary of them to set the basis for further discussion.

“In the discounted cash flow valuation, the value of an asset is the present value of the expected cash flow on the asset, discounted back at a rate that reflects the riskiness of these cash flows. This approach gets the most play in classrooms and comes with the best theoretical credentials.” (Damodaran, 2006, p. 10)

“In relative valuation, the value of an asset is derived from the pricing of comparable, standardized assets using a common variable. Included in this description are two key components of relative valuation. The first is the notion of comparable or similar assets. From a valuation standpoint, this would imply assets, with similar cash flows, risks, and growth potentials. In practice, it is usually understood as other companies that are in the same business as the company being valued. [...] Dividing [their] price or market value by some measure that is related to that value will yield a standardized price. When valuing stocks, this essential translates into using multiples where we divide the market value by earnings, book value, or revenues to arrive at an estimate of standardized value. We can compare these numbers across companies.” (Damodaran, 2006, p. 16)

While these first two approaches are established and did not see much new developments in the recent years, the claim valuation, which is largely contributed to Real Option, has seen increasing attention (Damodaran, 2006, p. 18).

2.1.2 CHALLENGES OF VALUATION

As crucial and helpful as valuations are, they are limited in their performance by certain factors. First and foremost, the bias that the valuators hold will alternate the results from the objective value, either because the inputs chosen have tendencies or because the calculated

value gets adjusted towards a value that is more consistent with the believes of the valuator (Damodaran, 2006, p. 3). It starts with the projects that are sorted out be valued and for which purpose the value is needed. This includes prejudgement of the valuation object by the market or the own company. In addition, the information that is chosen as input contains bias, either from the provider of the information or by the valuator's selections. Furthermore, the institutional factors influence the bias as well. Here, the company's business situation (growth phase or consolidation) plays an important role. Lastly, the position of the valuator in the company and the connected incentives create a source of bias (Damodaran, 2006, p. 2-3). For example, whether a valuator receives positive incentives for reducing costs or increase revenues can shape is view on a valuation object.

Valuation models have become more and more complex as a reaction to the increasing development of software tools, availability of information and uncertainty of the markets. The growing amount of details might give the perception of precision. However, complexity comes at a cost. It can lead to an overflow of information that distracts, especially under time pressure, from the important variables. This also makes it also difficult to distinguish between the assumptions that have greater impact on the value and the less impactful ones. Moreover, the models can become too complex to fully comprehend the results and to communicate their mechanics, which undermines the trustworthiness of the results (Damodaran, 2006, p. 8).

The inputs of any valuation always contain uncertainties. These uncertainties limit precision and meaningfulness of a valuation. Dealing with uncertainties in the valuation have caused a number of responses from valuators (Damodaran, 2006, p. 5-6). Due to the increasing uncertainties in the business-world (Day, 2007; Fleck, 2009) these responses have gained increased attention in the literature (Copeland & Tufano, 2004). In the following chapter we will explore what kind of uncertainties valuators deal with and how they respond to them.

2.2. UNCERTAINTIES

To begin, we will define what uncertainties in the business context are and then see how they are incorporated in the valuation.

2.2.1 THE CONCEPT OF UNCERTAINTIES

To start, we will clarify the terms uncertainty and risk, the differences between them, what they are and which implications they have on business, an issue that mostly is taken as a given but often treated in inconsistent or limiting ways. Therefore the definitions used here will depart from the common understanding in the financial research.

Almost every business decision incorporates uncertainty (Block, 2007 and Trigeorgis, 1996, p. 33). Given that, most companies tend to classify projects by their risk and risk premiums have great influence on an assets value we need to address the matter.

Uncertainty is a “Situation where the current state of knowledge is such that (1) the order or nature of things is unknown, (2) the consequences, extent, or magnitude of circumstances, conditions, or events is unpredictable, and (3) credible probabilities to possible outcomes cannot be assigned. Although too much uncertainty is undesirable, manageable uncertainty provides the freedom to make creative decisions.” (Business Dictionary, 2016)

An uncertain situation is neither positive nor negative because the outcomes can be favourable or unfavourable (Dias, 2014, p. 29). Hence, uncertainty always incorporates both: opportunity and risk, whereas risk is "The probability that an actual return on an investment will be lower than the expected return." or "The probability that an actual return on an investment will be lower than the expected return.” (Business Dictionary, 2015) and opportunity can be seen as the opposite: The probability that an actual return on an investment will be higher than the expected return. It is also important to note the degree of knowledge about the subject. While “...risk is when the random variable has a known probability.” “Uncertainty is when this distribution is unknown.”, hence “... it is always possible to convert uncertainty into risk by introducing subjective probabilities.” (Dias, 2014, p. 27) To follow that through, we need to keep in mind that most probabilities in business problems can be considered subjective because they do not fulfil scientific standards. In order to fulfil such standards, probabilities need to be built on a sufficient number of experiments or repetitions. Yet business problems are complex real life problems whose surrounding parameters hardly repeat itself (Dias, 2014, p. 27). This approach, using subjective probabilities, is widely used in the different RO

approaches that will be presented in the section “The different approaches towards Real Options”.

Consequently, every business situation is uncertain because the real probabilities for either higher outcomes than expected (opportunities) or lower outcomes (risks) can’t be known. Therefore, we can’t reduce uncertainty to risk because this conservative view that only highlights the incorporated threats to business success. Yet, we also have chances of more success than expected. Thus, adopting the conservative view will limit the business perspective and can result in rejection of promising projects because opportunities are overlook and the focus is on risk, the possibility of negative outcome.

Simplified, uncertainty refers to a situation whose outcome is unclear to me. Therefore a make an assumption about the outcomes. Yet, the outcomes can be worth, which we describe in the risk, or better, which we describe in the opportunity.

The common sources of uncertainties in business can be ordered in three categories: market, technical and, strategic. Market uncertainties include commodity and energy prices, price and demand for products, market size and growth, interest and exchange rates, effective taxes and, inflation. Technical uncertainties cover: volume and quality of natural resource excavation, the success of an R&D project, cost of labour and material and, project lifetime. Strategic uncertainties are mainly concerned with competition behaviour. Hereby the uncertainty of the variables increases with increase of the time horizon. Furthermore, uncertainty only resolves gradually over time as new information becomes available. (Dias, 2014, p. 67-70, 78; Trigeorgis, 1996, p. 33)

Research in psychology and behavioural science has shown that managers, like most humans, are risk adverse. Hence, they prefer to pay an insurance premium instead of accepting a fair gamble. By doing so they miss opportunities to maximize their company’s value. (Trigeorgis, 1996, p. 33, Kahneman, 2011, p. 344-350) Hence we can conclude, that, even though uncertainties and risk play a major role in business and they are profoundly covered by research, the natural human biases lead to flawed reactions.

2.2.2 RESPONSES TO UNCERTAINTY

Valuators react to the uncertainties in various ways. Some of them try to pass the responsibility for the estimation of inputs on to others, which might help the valuator depending on the incentive situation but does not eliminate the uncertainties. More common responses concern the valuation method itself. One tendency is that valuators try to avoid

dealing with uncertainties by using more simplistic valuation methods like multiples and comparable. Others try to further refine the valuation method and use simulations or RO. Nevertheless, only valuators have accepted that uncertainties are unavoidable and provide range values or probabilistic answers, which have to be incorporated in the valuation and give a more realistic picture. (Damodaran, 2006, p. 5-6).

This indicates that the current valuation approaches deal insufficiently with uncertainties. To better verify this idea, we will take a look at the most common valuation techniques. We will not include comparables or multiples because Damodaran (2006, p. 5-6) understands their utilization as an unappropriated response to uncertainty. He argues that the method prevents the valuator to examine the underlying uncertainties of the object and limits the results to a relative statement only considering objects that face similar market uncertainties.

2.2.2.1 Discounted Cash Flow Methods

By far the most common valuation techniques belong to the discounted cash flow (DCF) method (Block, 2007; Ryan & Ryan. 2002). The DCF methods see only the risk, the possibility of a negative outcome, in uncertainty. Thus, investments in more uncertain situations are valued with high discount rates, which will undervalue them compared to similar investments in a less uncertain situation (Hamilton, 2000; Block, 2007; Kester, 1984; Remer et al., 2001). Yet, by focussing on the risk, it overlooks the opportunity, the possibility of a better than expected result, that is also part of an uncertainty. Thus excluding critical value from the valuation. This undervaluation can result in the rejection of crucial projects. (Hamilton, 2000; van Putten &McMillan, 2004).

DFC methods do not only ignore the opportunities in uncertainty, which can produce substantial value, they also ignore that management has the flexibility to react to a changing business environment and new information (Block, 2007; Remer at al., 2001). Investment is not a one time, take it or leave it decision as DCF methods assume (Gong et al, 2011). More, long-term forecasts are naturally flawed, which makes static DCF calculations for long-term investments less suitable (Remer et al., 2001). Management can adjust its actions to the circumstances at several points in time during the investment period, through which management can limit potential losses (risk) and increase potential gains (opportunity). If there are opportunities in uncertainty and management has the capability and flexibility to react, then we need a valuation method like RO, which can incorporate this. Such method would allow an as accurate as possible decision under uncertainty (Gong et al., 2011). Hence, it helps the company’s survival because the highly uncertain projects can bring most gains

(Hamilton, 2000; van Putten & McMillan, 2004; Kester, 1984). Considering that the uncertainties and the dynamics of the business environment are increasing (Trigeorgis, 2005) such a method is also of increasing importance.

The DFC methods ignore flexibility and also encourage inflexible investments. They favour projects that use a smaller amount of cash. That leads to the construction of cheap structures, which tend to have lower flexibility than more sophisticated and thus more expensive structures. (Ferreira et al., 2009)

Due to this criticism on the DCF method as early as the 1950s, scientist and practitioners were looking for alternatives that could incorporate more of the business uncertainties. Among them the sensitivity analysis, the Monte Carlo simulation, decision trees, and Real Options are the most established and common methods (Trigeorgis, 1996, p.52).

2.2.2.2 Sensitivity Analysis

Trigeorgis (1996, p. 52-55) describes the sensitivity analysis as a useful tool because it offers a “manageable and consistent solution”. By determining the impact of the single variables on the NPV, it helps to identify which elements of the valuation have the highest impact and therefore deserve the most attention, thereby helping to avoid critical over or underestimation. Yet, it does not allow the combined alteration of variables and ignores their interdependence, which in reality are most likely. Furthermore, the sensitivity analysis does not incorporate uncertainties in a flexible manner into the valuation. It rather shows a realistic frame of decision instead of just a single value (Trigeorgis, 1996, p.52-55).

2.2.2.3 Monte Carlo Simulation

Monte Carlo or “traditional simulation techniques use repeated random sampling from probability distributions for each of the crucial primary variables underlying the cash flows of a project to arrive at output probability distributions or risk profiles of the cash flows or of the NPV (sometimes IRR) for a given management strategy. Simulation attempts to imitate a real world decision setting by using a mathematical model (consisting of operating equations or identities) to capture the important functional characteristics of the project as it evolves through time and encounters random events, conditional on management's prespecific operating strategy.” (Trigeorgis, 1996, p.54)

The Monte Carlo Simulation (MCS) can handle complex problems with large number inputs

and interdependence and interaction between them. It is possible to capture all variables of the valuation problem. Yet, the complexity requires experts to use the technique. Furthermore, the results of a MCS are probability distributions which raise the issue of how to translate these into managerial actions, how to interpret the probabilities. In addition, it is possible for extreme values to occur which are close to impossible to integrate into managerial decisions. MSC is still a determined model. Nevertheless, it is a very useful tool to determine the risk neutral probabilities which are used in the RO valuation to discount the expected returns (Trigeorgis, 1996, p.54-57).

2.2.2.4 Decision Trees

Decision tree analysis (DTA) does not yield the mathematical power of the MCS but its results are more structured and easier to integrate. More, building the trees helps to structure decision alternatives. It forces the practitioner to think about and state an operational strategy. Thus, it helps recognizing the interdependence between variables and captures the flexibility. This make the DTA a great fit for the analysis of complex and sequential investment decisions. However, Trigeorgis (1996, p. 57) points out that the DTA has its shortcomings. To begin with, very complex problems can lead to an unmanageable and confusing amount of tree branches. Furthermore, the DTA requires fixed decision points while in reality decisions happen over time. Last, a proper discount rate is hard to determine because the risk changes depending on the decisions (Trigeorgis, 1996, p. 57-59).

2.2.2.5 An Outlook at Real Options

Summarizing the common valuation methods, we can state that the DCF deals insufficiently with uncertainties. The methods that have been developed to be enhance the DCF solve the challenge only partly or add others, mainly complexity. Because of this unsatisfactory handling of uncertainties in valuation, the Real Option method has gained momentum over the last years. The RO approach aims to enhance the DCF methods. It recognizes that most non-financial investments have certain degrees of flexibility to react to uncertainties and enables to measure its value (Hamilton, 2000; Copeland & Tufano, 2004; Gong et al., 2011; Trigeorgis, 1996, p. 201).

Considering its strong impact in financial and management literature and its promise to significantly improve the current way of handling uncertainties in valuation, we will dedicate a whole section to RO.

2.3 REAL OPTIONS

In this section, we will have a closer look at Real Options (RO), the valuation method that tries to improve the handling of uncertainties by integrating strategy and valuation. We will start by explaining the basic idea of RO. Build on that we will show which options exist in the business decisions, which different approaches are used to capture them, and where in the business world we are likely to apply the RO method. We end the chapter by scrutinizing the limits of RO.

2.3.1 A BRIEF HISTORY OF THE REAL OPTION APPROACH

Meyers first coined the term Real Options in 1977 as he developed the idea to expand the Black and Scholes Model to real assets. The model provides a formula that allows to determine a theoretical price for financial options using acceptable simplifications and stochastic methods. Following this idea, Tourinho (1979) developed the first model between 1977 and 1979 (Dias, 2014, p.70, 138). The next step was to build on the recent developments in financial models and the long-standing criticism of the exiting methods. When Fisher developed the groundwork for the DFC in the early 20th century, he clearly described it for a certain environment (Dias, 2014, p.128). Starting in the 1950s, criticism began to emerge, pointing out the discrepancy between the predetermination of the DCF approach and the flexibility in real life business situations. In reaction to the criticism, the 50s and 60s saw the introduction of approaches such as simulations or decision trees, which tries to incorporate the uncertainties in some way (Trigeorgis, 1996, p.15).

With the publication of the Black and Scholes model in 1973, emerged a new way to consider uncertainty and value together, explaining the market behaviour and not relying on personal risk preferences. When the model worked successful at the financial market, scholars, such as Meyers, thought about expanding it to real assets in order to overcome the insufficient consideration of uncertainties and flexibility in exiting valuation models. Together with the earlier developed theories on risk-neutral valuation, the non-arbitrage argument, and the irreversible nature of investments the Black and Scholes model promised to be a powerful tool. Tourinho was then the first to apply the idea onto oil extraction, modelling the oil price with the Brownian movement (Dias, 2014, p.138 and Trigeorgis 1996, p. 16f).

In the 1980s, the topic of real options picked up traction and about 200 articles and several PhD thesis were written about it, which already covering the most common fields of

application: oil extraction, leasing contracts, property value, utilities, production with learning curves and R&D. Among them were the first comprehensive frameworks. At the same time, as RO gained attention, the failures of the DCF became clearer and more well-known (Dias, 2014, p.138; Trigeorgis, 1996, p.8, 15-18).

By the mid-1990s, RO had entered the mainstream of research, when it was incorporated in finance textbooks. At the same time, the first books solely focusing on RO were published and an annual conference established. The theory was enriched by elements from the game theory as well as the introduction of a variety of different mathematical and theoretical approaches, all centred around the idea of RO. Till today more than 50 books and a couple of journals have been written on the subject and its scope has grown from purely economic issues into the field of socio-economics like sport, crime and career development (Dias, 2014, p.70, 138-139).

The attention on the topic stayed strong with the beginning of this century. In our decade, the declining amount of publications can serve as an indicator for a reverse trend. It also seems as if practitioners are rethinking the idea of RO as a general valuation tool and start to consider it more as a tool for valuation in particular circumstances.

2.3.2 THE BASIC CONCEPT OF REAL OPTIONS

The term RO approach or RO theory can be explained as “The modern analysis of investments under uncertainty in projects and real assets is called the theory of real options, whose objective it is to maximize the value under uncertainty.” “With the emphasis on the value of flexibility to make decisions that can alter the course of a project or the operations of a real asset.” Whereas an example for a real asset would be a factory (Dias, 2014, p. XIII; 67; 69). Hereby, according to the most wide spread definition, a Real Option is “the right, but not the obligation, to take action at a predetermined cost called the exercise price, for a predetermined period of time – the life of the option” (Copeland & Antikarov, 2001, p. 5)

Firstly, this demonstrates the close connection to its origin in the financial market (Carr, 2002): “A financial derivative that represents a contract sold by one party (option writer) to another party (option holder). The contract offers the buyer the right, but not the obligation, to buy (call) or sell (put) a security or other financial asset at an agreed-upon price (the strike price) during a certain period of time or on a specific date (exercise date)" (Investopedia, 2015) This let W. F. Hamilton (2000) to call RO "options of a non-financial nature".

Secondly, it illustrates that possessing options only adds possibilities but no obligation to the

action portfolio. Hence, the returns are asymmetrically distributed, meaning that the losses are limited to the initial investment, while the gains can be unlimited. (Hamilton, 2000)

In summary, Real Options are embedded in resource allocation decisions. The aim of the resource allocation process is to reach an optimum between the resources used and the gains received. The RO approach helps to solve this optimization problem under uncertainty (Dias, 2014, p. 70; Trigeorgis, 1996, p. xi). Besides the uncertainties, restrictions like financial capabilities or legal issues set the boundaries to the calculation (Dias, 2014, p. 69, 78).

Traditional valuation methods like the NPV, the most used of the DCF techniques (Block, 2007), assume that business decisions are static and once made cannot be changed. The RO method recognizes that most non-financial investments have certain degrees of – at least timing – flexibility and allow it to translate into a monetary value. It links investment decisions with the dynamic business developments and is therefore more consistent with the decisions made. The RO approach is not aiming to replace the Net Present Value (NPV) calculation but to enhance it and allow practitioners to include the value of flexibility in their valuations (Hamilton, 2000; Copeland & Tufano, 2004; Gong et al., 2011; Trigeorgis, 1996, p. 201). Therefore, Trigeorgis (2005) developed a formula to connect both methods. In his approach, the value of the classic NPV calculation is summed with the RO value (ROV) to create the strategic NPV, which more precisely and completely represents the value of a valuation object.

Expanded (or Strategic) NPV = passive NPV + Option Premium (ROV)(Flexibility)

The five basic elements for the calculation financial options (FO) are also necessary for the most common calculations of a ROV (Block, 2007): value of the underlying risky asset, exercise price, time to expiration of the option, the standard-deviation of the value of the underlying risky asset and risk free interest rate over the life of the option. (Copeland & Antikarov, 2001, p. 6)

Besides the elements for calculation, there need to be two more conditions fulfilled to give value to a RO. Van Putten and MacMillan (2004) as well as Hamilton (2000) point out that the willingness and capability to execute a RO are important conditions. RO have to be executed in the real world environment, which is of higher complexity and more likely to create situations in which it is not possible to execute the option. A scenario that is unlikely for financial options. Furthermore, in the NPV analysis it is assumed that all decisions must be done at the start of the calculation period. The RO approach acknowledges that many decisions can be taken at a later point. However, this delay of decision only produces value, the ROV, if new information has arisen that improves the investment decision. Otherwise, the

later decision is made under the initial assumptions and resulting actions will be the same. Hence, the same decision would have been made at the beginning. (Remer et al., 2001) Thus, for ROs to give value to the project it needs the willingness to execute them and new decision relevant information needs to arise.

"Active management" together with the strategic interaction of the market players are the corner stones for the emerging and successful application of RO (Trigeorgis, 1996, p. 4, 122-125, 269, 400). Hereby "active management" is the willingness to act on options, the active search for new information and options and, the awareness about the possible courses of action at hand.

Table 1: Necessary conditions for the valuation of a Real Option

Category of condition	Condition needed	Condition is needed for:
Numerical information	Value of risky asset	Calculation of theoretical option value
Numerical information	Probabilistic measure for the value of risky asset	Calculation of theoretical option value
Numerical information	Exercise price of the option	Calculation of theoretical option value
Numerical information	Time to expiration of the option	Calculation of theoretical option value
Numerical information	Risk free interest rate over the life-time of the option	Calculation of theoretical option value
Managerial behaviour	Willingness and capability to exercise the option	Realization of the theoretical option value
Managerial behaviour	Constant gathering and applying of new relevant information	Realization of the theoretical option value

In summary, the RO method can significantly improve how uncertainties are incorporated in the valuation process by recognizing strategic flexibility as value drivers. This diverse strongly from the traditional understanding of valuation as practised in the DFC. Early research shows indicators that the application of the RO logic slightly improves company

performance compared to traditional approaches (Klingbiel & Adner, 2015). The following table helps to highlight the differences between the traditional perspective and the option perspective.

Table 2: Traditional Financial versus Option Perspective (Hamilton 2000)

Traditional DFC Perspective	**Real Option Perspective**
Views uncertainty as a risk that reduces investment value	Views uncertainty as an opportunity that increases value
Assigns limited value to future information	Values future information highly
Recognizes only tangible revenues and costs	Recognizes value of flexibility and other intangibles
Assumes clearly defined decision path	Recognizes path determined by future information and managerial discretion

This table shows that the concept of RO is closer to the reality of strategy-makers. It gives them a tool at hand, which allows to capture the flexibility that they need and normally have, to prepare as objectively as possible for the unpredictability of the business environment (Hamilton, 2000). Several authors (Hamilton, 2000; Day et al 2000; Day & Schoemaker, 2005) recommend that the combination of RO and strategy development tools such as scenario planning merge to a tool-set that enables quantived strategy development.

Nevertheless, Hamilton simplifies the concept of ROs when he only mentions their focus on opportunity. This is an incomplete view that some criticise about RO (Block, 2007). Properly used, the RO approach captures opportunity and risk of a project or strategy. It is the DFC approach that only sees risks.

2.3.3 TYPES OF REAL OPTIONS

According to Trigeorgis (2005), there are eight types of options that present themselves in business live.

Table 3: Types of Real Options

Type of option	Definition	Example
Defer investment	Is the possibility to invest at a later point in time, when the uncertainty is reduced	exploration rights Common in resource extracting industries like farming and mining
Stage investment	Is the possibility to make step wise investments, where each stage is requirement for the next and at each decision stage more information is available	Common in industries with long investment times like R&D projects in bio/ pharmaceutical industries, power plant construction for utilities, high-tech start-ups or venture capital
expansion option	it is the possibility, if the investment gives high returns, to upscale the investment and by that the returns	Common in cyclic industries with fluctuating profits/losses like natural resource industries. Common in case of a new product introduction to uncertain market or building new production capacity
reduce or contract option	The possibility to downscale the investment during low returns to limit or avoid losses.	Same as expansion option.
temporally shut down	Is the option to stop the investment for a limited time period in the event of unfavourable business conditions, to avoid or limit losses	Common in cyclic industries with fluctuating profits/losses like natural resource industries or consumer goods.
abandon option	Is the possibility to sell of the investment for a salvage value to avoid or limit losses.	Valuable abandon options are common in capital-intensive industries, such as in airlines and railroads, in financial services,

		and in new product introductions in uncertain markets
switch input/ output	The possibility to adjust the production and distribution settings of the investment according to the business environment.	Examples are fuel switch in cars
growth option	similar to the expand option, but here the possible to upscale does expand beyond the realms of the single investment and adds strategic possibilities to the whole investing organization	Growth options are common in all infrastructure-based or strategic industries, especially in high-tech, R&D, and industries with multiple product generations or appli-cations (e.g., semiconductors, computers, pharmaceuticals), in multinational operations, and in strategic acquisitions.

Among these options, the stage or compound option deserves special attention. Hereby the result of an option is not a direct cash flow but the creation of another option. Example projects for the compound option are the new exploration of an oil field or the initial R&D for a new drug development. It is especially common in projects that aim at expanding a company. In any way, the interconnections between two or more options make them very difficult to capture and calculate (Trigeorgis, 1996, p. 196-197; Dias, 2014, p. 101).

Most projects will have several if not all of these options occurring simultaneously. Hence, they cannot be treated exclusively (Copeland & Antikarov, 2001, p. 127). Most authors follow roughly this classification. Yet some earlier publications take a different stand on the classification of ROs. For example, Gong et al. (2011) reduce the range to just two types. In their argumentation all RO can be classified either as an abandonment or as a growth option.

In one of the earliest publication on ROs, Klester (1984) proposes a completely different classification method that focuses on the outcome of the option instead on its functionality. According to him, there are three questions to be asked: Is the owner of the option the sole profiteer? How long is the time frame of the option? When is the point of decision? Is the result of the execution of the option a cash flow or the right to another option?

Dias (2014) takes the ideas of Klester (1984) and develops them further. In his scheme, ROs occur in three different fields of uncertainty: the investment itself, the operations of a project

and, the need for knowledge. Investors have the opportunities to wait with their investment, to adopt the size of it, hold it while under construction and, they have to consider the interaction of the options present. During operation, the project can be expanded, scaled down, temporary shutdown or abandoned. Furthermore, one has various switch options at hand, which include switching inputs, outputs, the use or the location of the project. The last area of application is the need for information before making an investment decision. Hereby the sources of information can be internal or external. Internal means that the investor can only obtain new information by executing a project. This can be captured with the classical Bayesian model or other stochastic models. External refers to the market uncertainties, which are captured by the waiting option, and strategic uncertainties, which can be handled with game theory. (Dias, 2014, p. 97-100)

2.3.4 THE DIFFERENT APPROACHES TOWARDS REAL OPTIONS

We can find different approaches in two levels of the RO theory. One is the technical application of the method and the second is the general conceptual understanding. The latter involves the whole organization while the first only concerns the setup of the valuation itself.

Concerning the conceptual understanding there are three stages with which companies apply RO. Ideally, the usage develops continuously over time from the first to the last stage. At first, RO are a way of thinking. A new vocabulary together with a new mentality that is concerned about strategic flexibility and actively thinks about emerging options in the business context. In this stage, options are valued qualitatively. The second stage is the application of the mathematical models of RO on valuation problem. This would start with some pilot projects and then develop further into a regular usage. Now the method produces quantitative results. The last step is to integrate the RO as an organizational process into the company. This means applying the quantitative and qualitative aspects of RO to the complete process of decision making from strategy development to operational decisions. This requires that the company adapt its organizational structure and processes to accommodate the successful application of the RO methodology. (Dias, 2014, p. 72)

There are plenty of different technical approaches on how to mathematically capture RO. A detailed look at them goes beyond the frame of this thesis. Nevertheless, it became clear that the reality is too complex to just put it into the elegant but simple model of Black and Scholes (Copeland & Tufano, 2005). Consequently, several other more sophisticated approaches were developed. The most commonly explained in the relevant literature is the binomial lattice or market asset disclaimer approach and variations, which can be categorised as numerical

approaches (Lo Nigro et al., 2014; Borison, 2005). Authors describe as well as a revised form of the classic Black and Scholes model and other closed form approaches (Lo Nigro et al. 2014; Borison, 2005).

There will be no further description of the different approaches here because it will not help to better understand the general usage of RO in companies or the motivations to use or not use RO. It is interesting to mention that there is no clear terminology established. Common methods like binomial ones and the Black and Scholes model are clear defined but besides that, a number of overlapping definitions and names exits. Furthermore, while there is a consensus in the management literature that the binomial approaches are preferable, there is no such consensus in research publications. The discussion is mainly concerned by the question which simplifications of reality are to be tolerated, which concludes to a trade-off between functionality and precision of the model (Kester, 1984; Lo Nigro et al, 2014; Baker et al., 2011; Borison, 2005). Yet, the different ideas and approaches among researchers lead to a multitude of concepts and vocabulary that might make it difficult for practitioners to comprehend the subject.

2.2.2. APPLICATIONS FOR REAL OPTIONS

This section is dedicated two three aspects of utilization. It aims to answer in which industries ROs are used and why they are used. Going further, we are looking at research regarding the degree of utilization that ROs enjoy in companies. Lastly, we will cover the company specific factors that might influence the application of ROs.

2.2.2.1 Fields of Application

One commonly suggested field of application is R&D and the development of new technologies because especially ground-breaking new developments face high uncertainties due to lack of market information and untested reliability (Hamilton, 2000; Day & Schoemaker, 2005; Trigeorgis, 2005). More, they need high investments. Luckily, these investments can be made gradually, synchronized with the development phases. At each step, more information about the technology becomes available, allowing a better judgement whether to continue, abandon, delay or upscale the project. Hence, R&D projects incorporate all elements that call for the use of the RO approach. In general, the RO approach suits investments with high uncertainty, long time horizons, high (real) interest rates and that incorporate compound options, which by their nature are undervalued in a NPV analyses. (Cohen et al, 2013; Gong et al, 2011)

Another frequently suggested field of application is high value, long time investments that can be found in the utility industry or in industries that extract natural resources. Due to the long time frame, they incorporate high uncertainties and are prone to undervaluation by the NPV method. (Trigeorgis, 2005; Copeland & Antikarov, 2001, p. 5-10). These industries are the ones that adopted the RO approach most thoroughly as research from the US (Block, 2007) shows. These might be due to accessibility of information, a fact that most authors touch on the side (Copeland & Antikarov, 2001, p. 8-15). As shown earlier, the value of the underlying risky asset is important for their calculation. In commodity-producing industries the main risky asset is the community price. The price and its volatility can be easily obtained on the stock markets, which facilitates the calculation. Hence, the utility industry and industries that extract natural resources have not only the investment characteristics for the RO approach but also the available information facilitate the application of it.

With all its limitations, the NPV is still a solid valuation tool. Hence, it should be used for a first assessment of the object of valuation. If the NPV is around zero or two investment objects have the same NPV, the RO approach should be applied because it can add additional value that can alter the decision. If, on the other hand, the NPV is already clearly indicating a

positive or negative outcome, practitioners have sufficient information at hand and don't need to engage in a RO valuation to improve the basis for decision making (van Putten & McMillan, 2004).

The theoretically suggested fields of application are confirmed by the survey of Block (2007) who found that the majority of RO users are in the fields of technologies and energy/utilities.

2.2.2.2 Degree of utilization

While there is evidence that RO are mainly used in these industries, which the literature finds suitable, there are somewhat contrary indications about its general use. Between 1999 and 2007 five studies surveyed the use of RO and other financial management and budgeting tools in North American (4 studies) and European (1 study) companies. Three of them, including the one that solely focuses on RO, found that between 9 to 14.6% of companies use RO in their valuations. That is no statement about the regularity of usage, it just indicates that they use RO more or less regularly (Block, 2007; Ryan & Ryan, 2002). The other two found significantly higher numbers, ranging from 26.5% in the USA to up to 44% in Germany (Brounen et al, 2004; Graham & Harvey, 1999).

Yet these results seem unrealistically high, given that the value for the usage of ROs in Germany is nearly as high as the one for NPV. Futhermore, it contradicts their findings (Brounen et al., 2004) that shows a connection between the goals of companies and the usage of more or less sophisticated financial tools. Together with fact that the authors of these studies do not further discuss their extraordinary findings, while their other findings (usage of other techniques and connections between company features and techniques used) resonate with the other three studies, we have to reject their findings until further research can combine the results.

The sampling methods are an obvious difference between the two groups of studies. The more conservative findings were achieved by focusing on large companies (Fortune 1000 or comparable). While the higher numbers were obtained sampling more broadly, including also smaller companies. That could indicate that smaller companies are more likely to use RO but that contradicts other findings of the authors that we will discuss below.

2.2.2.3 Company related influence factors on the application

Several authors have observed company characteristics that influence the financial tools used.

First and foremost, it appears that the size of a company is positively correlated to the degree of sophistication of the techniques used (Graham & Harvey, 1999; Bournen et al., 2004; Frezatti, 2005). Furthermore, the top management's degree of education is also positively correlated to the degree of sophistication of the techniques used (Graham & Harvey, 1999; Bournen et al., 2004). There is also an indication that the same applies to the leverage of the company positively correlates to the degree of sophistication of the techniques used (Graham & Harvey, 1999).

Considering that RO are among the most sophisticated financial techniques at the moment, we can conclude out of these findings, that large firms with high leverage and an executive board consistent for holders of a Master or higher degree, should be more prone to use RO.

2.3.6 LIMITATIONS OF THE REAL OPTION APPROACH

The RO approach is limited at least in two aspects: the mathematical model and its application in the corporate world. In the first aspect, in order to create a manageable mathematical model RO, practitioners have to adopt certain assumptions from the financial options, even though it is clear that they do not apply to the reality of the corporate world. Yet as Dias (2014) puts it, a 5% precision tolerance for the calculated value is acceptable, because it enables calculation in a practical manner and the aim of the RO is not to give the company a precise value rather than a reasonable decision frame. Among these assumptions is the idea of a complete and perfect market. That means that the options will find a buyer, can be sold at any time and with no transaction costs, which results in the non-arbitrage argument to hold true. We know that in the real world real assets cannot be as easily traded as financial ones. Thus, the market for RO options does not fulfil these conditions. Furthermore, as in any valuation, RO practitioners need to make assumptions about interest rates, which are perfectly acceptable on the financial market but have little to do with the real assets market. For example, for companies there is a wide spread between the cost of lending and the gains of borrowing money. In addition, the risk free interest rates are hardly fixed over the lifetime of a 25 years mining project. Last, is the assumption that the value of the underlying asset can be describe by the Brownian movement, which considering the low trading volumes for certain assets and their specific market conditions doesn't always apply (Dias, 2014, p.XVI-XVII; Trigeorgis, 1996, p. 83).

These limitations do not undermine the ability of the RO method to provide useful information to the company because some limitations, like the interest rates, apply to all

valuation methods and other valuation methodologies face their own limitations. It is therefore a reminder that not one of the methodologies can provide the “perfect” valuation, it needs rather a combination of methods helps to achieve an acceptable decision frame.

The other limitations concerns its usage by companies. We have already seen that RO is not even closely as popular as the most common methodology, DCF. Even though it seems to be a rising trend, it stays clear that RO still are limited in their application in companies. Block (2007) showed four major reasons in his research for not using RO as seen below.

Table 4: Reasons to not use RO (Block, 2007)

Lack of top management support	42.7%
Discounted cash flow is a proven method	25.6
Requires too much sophistication	19.5
Encourages too much risk taking	12.2
	100%

Clearly, the main obstacle for the usage of RO is the support of the top management. According to Block's (2007) research, it is not so much lack of trust or lack of understanding for the method that makes top management reject it. It is the fact that the RO approach narrows the decision process down by making it more objective and structured, which can reduce the actual decision down to a go or no-go one. Thereby, top management's influence on the whole project and its course of action is diminished. It is this demise of their "perceived power as sophisticated decision makers" that makes them shun RO (Block, 2007). This is an astonishing finding, considering that allowing a more structured and more objective decision-making process is one of the advantages of RO that scientists advocate. (Baker at al, 2011)

Secondly, practitioners believe, following its dominance in teaching and literature that the DCF approach is the proven method. Therefore, they do not see need or do not feel comfortable to expand their portfolio of methodologies (Block, 2007). Block (2007) concludes here that the variety of books written on RO has obviously not reached the mass of valuation practitioners.

Thirdly, the use and understanding of RO requires higher mathematical knowledge than other methodologies. In certain industries where higher management positions are occupied by graduates of mathematically dominated studies, the usage of RO more common (Block, 2007). Thus, to achieve a higher utilization of RO in practice, the mathematical skills of practitioners need improvement or the RO methodology needs to be adapted accordingly.

Lastly, Block (2007) reports that lack of trust in the method stops practitioners from using RO. He finds a two-part problem. For one, the RO method is only applied in complicated, highly uncertain case. In these companies it has earned RO a bad reputation because it is only used to oversell high-risk projects. Secondly, for the values calculated using RO to hold true who ever executes the projects needs to follow the logic, decision points, and options lined out in the valuation. Yet some practitioners do not trust that executive managers will do so. Hence, the method produces unreal values (Block, 2007).

Given these limitations, we see that RO can improve the valuation approach towards uncertainty but is far from being the perfect solution. Yet, simplicity and responsibility avoidance are not the answer. Uncertainties must be acknowledged and treated with caution in the valuation. No matter how sophisticated a valuation method is, variables will change over time and the valuation will need updates (Damodaran, 2006, p. 7). Therefore, valuation is not a static tool but a dynamically evolving tool.

Considering its limitations, we need to adjust the expectations of the valuation. “It is unrealistic to expect or demand absolute certainty in valuation, since the inputs are only estimates. This also means that analysts have to give themselves reasonable margins for error in making recommendations on the basis of valuations.” (Damodaran, 2006, p. 7) Certain objects can be more precisely evaluated than others depending on the nature of their business. Yet a high uncertain valuation is not a bad valuation. “The irony is that the payoff to valuation will actually be highest when you are most uncertain about the numbers.” (Damodaran, 2006, p. 7) The aim is not to value a company or project as precisely as possible but to value it more precisely than the competition is evaluating it. Accepting and dealing responsibly with uncertainties in the valuation by using appropriate methods gives valuators a “differential edge”. (Damodaran, 2006. p. 7)

2.3 IMPACTS OF LOCAL FACTORS ON THE BUSINESS REALITY

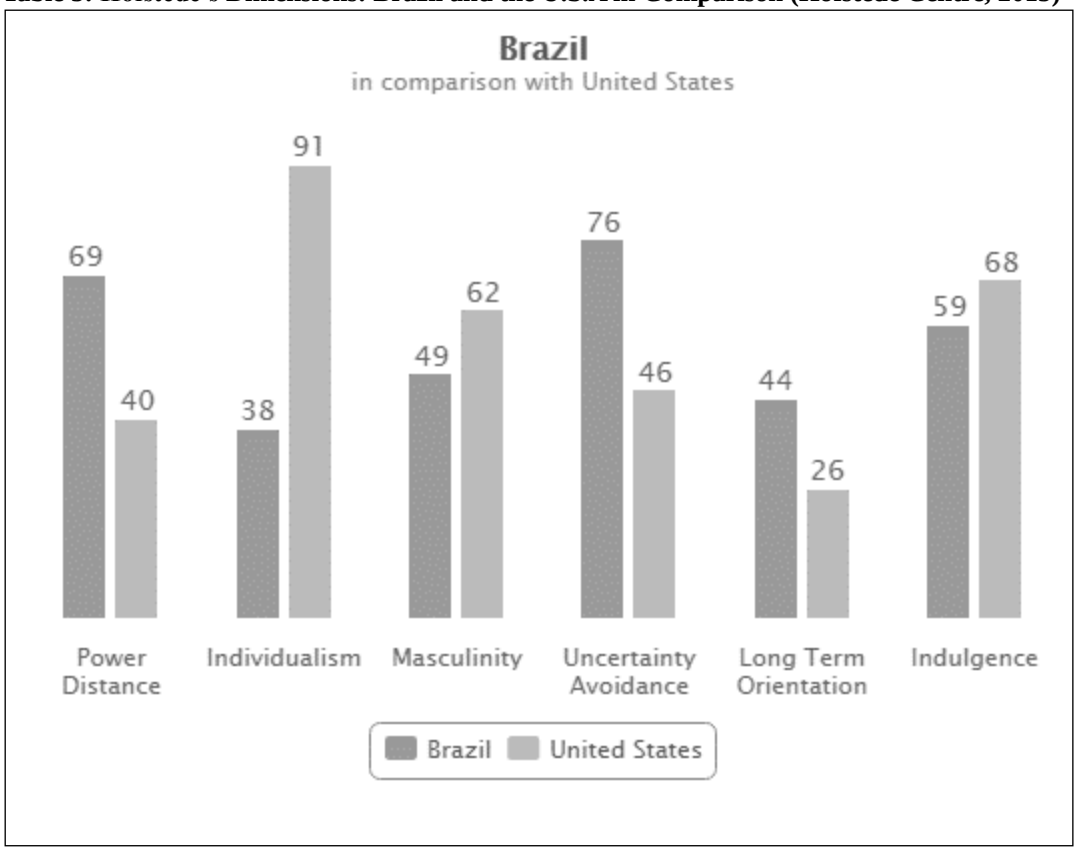
Considering that, the vast majority of literature for any area in the field of administration is authored in North America and maybe few other developed countries, we need to consider if and how far their theories are applicable to the Brazilian context. Bethlem (2014, p. 94) makes it clear that these main stream theories and findings cannot be adopted directly Brazil due to cultural and economic factors that greatly differ from North America.

2.3.1 CULTURAL ASPECTS

Culture influences communication within a company, with its partners and in the market as a whole. It helps to explain the behaviour of practitioners in a country and it is the base of their motivation, which needs to be understood and addressed in order for a successful business (Gil et al., 2010, p.100-101; Quick/ & Nelson, 2011, p.38-39; Dalbosco et al, 2013; Costa et al., 2013; Wang et al., 2013).

In terms of cultural aspects, it is worth looking at the well-established Hofstede's (Hofstede Centre, 2015) six dimensions. When talking about a valuation method that is specifically designed to incorporate uncertainties, we need to highlight Brazilian's attitude towards uncertainties.

Table 5: Hofstede's Dimensions: Brazil and the U.S.A in Comparison (Hofstede Centre, 2015)



The Hofstede Centre (2015) explains Brazil's score in this dimension as follows: "At 76 Brazil scores high on UAI [uncertainty avoidance] – and so do the majority of Latin American countries. These societies show a strong need for rules and elaborate legal systems in order to structure life. The individual's need to obey these laws, however, is weak. If rules however cannot be kept, additional rules are dictated. In Brazil, as in all high Uncertainty Avoidance societies, bureaucracy, laws and rules are very important to make the world a safer place to

live in. Brazilians need to have good and relaxing moments in their everyday life, chatting with colleagues, enjoying a long meal or dancing with guests and friends. Due to their high score in this dimension Brazilians are very passionate and demonstrative people: emotions are easily shown in their body language."

Firstly, when one sees that Brazil has a high score in uncertainty avoidance, one would think that anything that helps to reduce the risks involved with uncertainties is welcome. Nevertheless, after reading Hofstede's (Hofstede Centre, 2015) explanation, the opposite becomes clear. The avoidance does not characterise the urge to face one's uncertainties but to create a system that makes one feel safe and suppress the uncertainties. This could be an indicator that RO are not well accepted in Brazilian companies because RO forces the practitioner to face the uncertainties, which would go against the Brazilian cultural tendency.

The dimension of time orientation shows a neutral score, therefore does not allow any conclusion. Furthermore, interesting are the high scores in power distance and the low scores in individualism, which is explained (Hofstede Centre, 2015) the following:

"With a score of 69, Brazil reflects a society that believes hierarchy should be respected and inequalities amongst people are acceptable. The different distribution of power justifies the fact that power holders have more benefits than the less powerful in society. In Brazil, it is important to show respect to the elderly (and children take care for their elderly parents). In companies, there is one boss who takes complete responsibility. Status symbols of power are very important in order to indicate social position and "communicate" the respect that could be shown."

"Brazil has a score of 38 which means that in this country people from birth onwards are integrated into strong, cohesive groups (especially represented by the extended family; including uncles, aunts, grandparents and cousins) which continues protecting its members in exchange for loyalty. This is an important aspect in the working environment too, where for instance an older and powerful member of a family is expected to "help" a younger nephew to be hired for a job in his own company. In business, it is important to build up trustworthy and long lasting relationships: a meeting usually starts with general conversations in order to get to know each other before doing business. The preferred communication style is context-rich, so people will often speak profusely and write in an elaborate fashion."

Both aspects are interesting if we look back at Block's (2007) finding that lack of top management support is the main reason for not using RO because the executives perceive their position as decision makers threatened. If that was the case in North America, which has a way lower power distance, then we can assume that this issue might be even more severe in

Brazil. Furthermore, the collectivistic nature of the society makes it less likely that subordinates will push for something that is not approved by their superiors. Hence another indicator that the cultural tendencies of Brazil are adverse to the use of RO.

The last two dimensions, masculinity and indulgence, allow only highly speculative conclusions about their relationship with the utilization of RO in a country. Therefore, they will not be explored here.

2.3.2 ECONOMIC ASPECTS

From the economic standpoint, Brazil presents itself as a country with a high uncertainty. Brazil has shown strong swings in the political agenda a liberal, pro capitalistic one to a socialistic one. At the same time, we can observe a high degree of regulation as well as the high involvement and influence of the government on the businesses in the country. These two combined result in a constantly alternating business environment driven by government forces (Bethlem, 2014, p. vii; de Souza, 2014). Furthermore, the quality of official information and statistics is not always reliable (Bethlem, 2014, p.154, Wang et al., 2013), which adds additional uncertainties to several key factors of a valuation. Moreover, the ambiguity and sometimes ineffectiveness of the legal system further increases the uncertainties for a company because it will face difficulties to enforce contracts or time when it will be granted necessary permissions. Consequently, companies operating in Brazil are facing more uncertainties than they would in North America, which is reflected in the lower investment grading (Trading Economics, 2015; Pereira, 2002, p.245). Therefore, tools that help practitioners to deal with uncertainties in their valuations seem even more important.

2.4 THE CURRENT SITUATION OF REAL OPTIONS IN BRAZIL

Looking at the current state of RO research and practice in Brazil, we see a split picture. On the one hand, we have the research centre NUPEI at the Pontifical Catholic University of Rio de Janeiro (PUC), which is strong in research and publication on RO. On the other hand, PUC is the only university that has a program solely focusing on RO. While there are attempts at other universities to establish pure RO courses, it seems that PUC is the sole centres of RO research and teaching in Brazil.

This further supports the notion of a low utilization of the RO method which harmonizes with the predictions based on the cultural tendencies of Brazil. Yet, given the economic situation of the country it is clear that practitioners are missing out at a valuable tool. This raises the questions:

I: To which degree do companies utilize RO?

II: What are the reasons for the degree of utilization?

III: How do practioneers incorporate uncertainties into the valuation?

In the course of the literature review, we were not able to find a study that focuses on the utilization of Real Options in Brazil or no recent study that focusses on the utilization of valuation techniques or even the whole process. Therefore, in order to answer those questions we need first to describe the Brazilian business reality in terms of the valuation process, which leads to the following question.

VI: Which process apply practioneers to evaluate corporate assets?

3. METHODOLOGY

3.1 RESEARCH TYPE

As shown in the literature review, we could not find a recent study about the use of valuation or capital budgeting techniques and their use in Brazil or even the more focused niche of Real Options. Consequently, studying the use of valuation techniques and specifically RO in Brazil, this research is in a relatively unexplored field of study in which the theoretical foundations are weak. This calls for a study that explores the reality of the valuation process in Brazil in detail, which can help to strengthen its theoretical foundations.

Thus, according to the recommendations of Bento and Ferreira (1982), due to lack of information on the topic and the inability to respond to questions I and II only with the literature review, this research was conducted as exploratory study. It is a first step in the process of knowledge generation, which allows the formulation of hypotheses for future research.

According to Malhotra (1999), a method for performing the selected study must fit the purposes of research. Again, it should be noted that this thesis aims to understand and describe the use of RO in Brazil and to identify factors that may influence the selection of the techniques used by the valuators. It was decided to use the qualitative method, as suggested by Yin (1989) for research, in which theory is still meagre and where it is necessary to deepen the knowledge about the phenomenon that is investigated. Garcia and Quek (1997), confirm this and specify how the qualitative method is suitable to investigate processes and meanings that are not evaluated according to their intensity, quantity or frequency.

This exploratory study used the multiple in-depth interviews, as it is adequate for examining a contemporary phenomenon in its own context, in which its behaviour cannot be, controlled (Yin, 2003). Gil (2002) describes the case as a research approach to analyse few social objects with the purpose of deepen the knowledge about them, which applies in the case of this thesis. In short, it is assumed that in-depth interviews are an efficient method to understand the characteristics of a reality in depth (Triviños, 1987; Creswell, 2003).

3.2 SELECTION OF INTERVIEWEES

The selection of respondents, followed pre-determined criteria that can enhance the quality of information received (Patton, 2002). The criteria used was the work experience of the interviewees in the fields of capital budgeting and valuation, their direct involvement in the process of the valuation and the involvement in the decision making process which is based on their valuation. Therefore, it is believed that the interviewees are persons with necessary experience and knowledge in order to provide relevant information for this research.

The group of interviewees was chosen to increase the possibility to find active users of real options and are well represented in the region of Rio de Janeiro. These attributes can be found for one in the commodity and utility producing industries. Here the literature review tells us that the use of RO is common and well established for commodity and utility producing companies (Dias, 2014) and Rio de Janeiro is the Brazilian hub for mining and, oil and gas (Hansen, 2013).

Furthermore, companies that undergo a high volume of valuations have an increased possibility to use RO in there valuation. We can find such high volumes in banks, investment funds and consulting firms. Rio de Janeiro is Brazil’s second largest financial hub (Hansen, 2013). Therefore, companies from the financial sector were targeted as well. In total, ten semi-structured interviews have been conducted. Additionally, the author engaged in talks with two of the leading RO experts in Brazil.

The interviews were conducted under strict confidentiality. Thus, information about interviewees will only be given as far as it does not allow an identification of the participants. This might, because of the relatively small universe of companies in Rio de Janeiro, lead to a restriction in the information published.

The interviews represent six different companies from the areas of mining, petroleum, consultancy, banking, investment funding and utilities. Their market value ranges from slightly under one billion R$ to over 500 billion R$. Only exception here are consulting firms that have small-scale operation but work for companies of earlier described size.

All the interviewees are working in positions and departments that are highly concerned with valuations such as budgeting, treasury, acquisitions, project development and capital investment, which ensures the relevance of the interviews and interviewees' necessary experience. The interviewees are all between 30 and 50 years old and represent in average 15 years of work experience. None of them have worked in the market for less than six years. Of them 80% are male and 20% are female. They represent the range of employees from senior analysts up to head of departments and, in case of the consulting firm, managing-partner. In

terms of highest degree of education, 70% have a Master or comparable degree, 20% a Bachelor or comparable and 10% a PhD. Of all of the interviewees, 20% hold a degree in economics and 80% in finance. In addition to their finance degrees, 50% of the finance Masters also graduated in engineering.

The projects discussed concern two areas: equity valuation or project valuation. Equity valuation is used for either mergers and acquisition or the partial purchase of a company's equity. Project valuation is used for internal projects, be it the construction of a new production site or infrastructure project (Greenfield) or the expansion of existing facilities (brownfield). Projects for both types of valuations cover investment volumes from roughly hundred million R$ up to ten billion R$. Of the interviewees, 70% were engaged in equity valuation projects and 60% in project valuations. In other words, 30% were exclusively engaged in equity valuation, 30% exclusively in project valuation and 40% in both.

Table 6: Overview of Interviewees

Participant	gender	age	area of education	degree of education	work ex-pirience	position	industry	Type of projects
A	male	40-50	engineering and finance	PhD	15	partner	Utility, consulting	green and brown field
B	male	30-40	economics	Bachelor	11	senior analysts	investment fund	equity purchase
C	male	40-50	finance	Master	20	middle manager	Oil & Gas	M&A, greenfield, brownfield
D	male	40-50		MBA	14	team manager	Mining	M&A, greenfield, brownfield
E	male	40-50	engineering and finance	MBA	15	upper management	Mining	M&A, greenfield, brownfield
F	male	30-40	economics	Bachelor	8	senior analysts	Mining	greenfield, brownfield
G	male		administration, finance	Master	15	team manager	Banking	equity purchase
H	male	30-40	engineering and finance	Master	8	team manager	Mining	greenfield
J	female	30-40	engineering and finance	Master	15	upper management	Mining	M&A
K	female	30-40	economics	Master	6	senior analysts	Banking	equity purchase

3.3 DATA COLLECTION

The main purpose of the interview in this thesis is data collection. The interview is considered a social interaction process in which the interviewer tries to obtain relevant information from the interviewees (Haguette, 1997). According to Kvale (1996), the interview is a kind of "conversation" during which you can learn about the ideas, feelings and, perceptions of the interviewees on the subject.

Among the many possible formats for the application of interviews, the author opted for the semi-structured interview technique. This interview mode provides flexibility for the interviewers and interviewees, promoting spontaneity and encouraging the sharing of their perceptions about the object of study. The semi-structured format allows for new topics appear naturally in the interview, which enriches the study (Mann, 1975). Thus, the in-depth interview is built on key questions that reflect the issue at stake and the literature review on the subject. The interviewee should be free, to discuss their ideas spontaneously, so that the researchers only listens and directing the interview towards the proposed topic (Mann, 1975). In this way, the interviewer is allowed to come up with new questions and the order them according to previous answers of respondents, enriching the process and allowing a natural flow of conversation and ideas. To compensate for the inherent flexibility of semi-structured interviews and to maintain the consistency of the data collected, the author develops a script whose relevant questions have been previously selected to serve as a guideline as proposed by Patton (2002). So the script served as a guide to ensure increased convergence of issues discussed with relevant topics of the literature review.

The script is designed around main questions with complementary, built-in checkpoint questions. The purpose of this structure is to facility the investigation of the main points, even if the interviewee does not directly reply to them by using the complementary questions to direct the interviewee. It is therefore assumed that the script structure allows the interviewer to actively investigative and at the same time to preserves the flexibility of the process and ensures that all-important topics for research are examined, as proposed by Walsham (1995).

All respondents allowed their statements to be recorded for later analysis. The recording has the advantage that the interviewer has a closer contact with the interviewee, which facilitates the interaction between the parties. The attention of researchers is not bound by taking notes. Moreover, by taping the interviews, the researchers is able to transcribe it later, facilitating data analysis based on the literature (Walsham 1995).

In addition to the semi-structured interviews, secondary data of companies was used. Examples of secondary data sources for this study: press releases of the companies,

shareholder reports and, reports from trade publications. Yin (2003) recommends the use of secondary sources to give as a path to greater safety on the evidence provided by primary sources.

Between May and July 2015, the researcher visited the six participant companie. The interviews lasted about one hour each. At the end of the last interviews, the answers proved to be similar. Eisenhardt (1989) argues that researchers need to end the interviews when theoretical saturation or the contribution of each new interview to the study is minimal. Yin (1989) argues that exploratory qualitative research are looking for patterns to the collected, to promote the validity of the results obtained information. The repetitiveness of the answers suggests that this was achieved.

3.4 DATA ANALYSIS

Analysis of data in qualitative research must be understood as a process of review and interpretation of the information collected, as well as the reduction and the preparation for displaying them. So we can summarize the qualitative data analysis in four successive stages: implementation and transcription of the interviews, the organization and the consequent reduction of the collected data, developing the structure of the presentations of data (text, tables, graphs and so on) and, eventually the screening of collected data and the emerge of results (Miles & Huberman, 1984). The data analysis of the dissertation followed these steps and will be described in more detail below.

Data reduction is a process that performs continuously during the study. The researcher is undergoing the process of reducing the information available, beginning at the time of defining the issue as well as during the process of literature review and during the data collection. The data reduction is therefore a continuous process for refinement and compression of data in the field, whereby structured data is favourable for further analysis (Miles & Huberman, 1984).

After the reduction of the data is the data display step. In general, it is believed that it is difficult to analyse the majority of the population simultaneously. Therefore, it makes sense to look for ways to simplify the presentation of the collected data and facilitate its analysis. Thus, the process of the display of information necessary and relevant for organizing and simplifying the collected data thus as for the researcher to fully understand about what has been collected in order to continue with the analysis (Miles & Huberman, 1984).

Finally, there is the completion and verification level, dedicated to the search for regularities,

patterns, explanations and relationships of cause and effect. It is believed that the earlier simplification of data in the research stages eases understanding of the reality, allowing the researchers to perform inferences and reach conclusions. In general, throughout the data analysis, the results and conclusions appear weak early in the process, becoming more solid as the process goes on (Miles & Huberman 1984).

The researcher went through all these steps manually, without the help of software for qualitative analysis (CAQDAS2). According to Van Den Hoonaard et al (2008), even though these programs facilitate the collection of data from a much larger number of respondents, their use does not guarantee a more detailed qualitative analysis. The authors emphasize that the use of such software is still controversial because of the possibility of such a change unpredictably analysis are collected from the study. They point out that this unpredictability would be a result of the rigidity inherent in these systems, and the distance that impose between the researcher and data deficiencies pointed out by the authors of the harmful for qualitative analysis and solution yet.

In detail, the recorded interviews were transcribed by the researcher. We have to note, that the interviews were mainly conducted in English, as wished by the interviewees, and in small part in Portuguese. All interviewees were native Portuguese speakers. Consequently, a free speech interview leaves room for grammatical improvement. The researcher very carefully conducted these improvements in order to preserve the meaning of the statements. The same holds true for the translation of the few Portuguese passages into English.

The transcripts were then uploaded to Nvivo to help with the organization of the analyses. Then the interviews were screened for common topics, which represent the headlines of the “results”. Obviously, certain topics were to be expected, given the questions, but unexpected topics emerged as well. In order for a topic considered relevant, the majority of the interviewees must have talked about it. In total, more than 80% of the interview content could be assigned to the different topics. All the different topics in all interviews were colour coded and cross examined to find common patterns within the topic. These patterns build the foundation for the results presented. The topics, that were examined, have overlapping content because of their interconnected nature. Therefore, the researcher assigned certain statements from the interviews to more than one topic and analysed them with the respective focus. The analysis was not limited to the statements made. It also considered which statements were not made but could have been expected regarding to the literature.

3.5 METHOD LIMITATIONS

There are some natural limits to the in-depth interview method. In general, the researchers who choose this method (Gil, 2002) are subject to issues such as lack of motivation of the interviewee, difficulty of the interviewee to understand the questions, wrong answers (intentionally or not), and the influence of the personal opinion of the interviewer on the interviewee. In fact, it should be noted that due to the position of the interviewees, their highly competitive markets and, the current economic crisis an interviewee might omit or even distort information to protect his or her company or position.

Moreover, it is possible that a respondent fails to tell the truth simply by an unconscious desire to describe an ideal situation instead of the reality. Nevertheless, the interviewee could feel uncomfortable to answer certain question or lack the knowledge to do so and therefore answers knowingly wrong. Moreover, the experience of the interviewer himself can influence the quality of the data collection and thereby affect its analysis.

Finally, Fontana and Frey (1994) have argued that the inherent flexibility to an in-depth interview can jeopardize the comparability of answers. The freedom, the order of the questions of semi-structured script can lead to change in the omission of some important issues for research so that the contents of each interview will clearly differ from each other (Fontana & Frey, 1994).

In addition to the common limitations of in-depth interviews we need to add the possibility of a language barrier. All the interviewees were native Portuguese speakers. Nevertheless, the interviews were mainly conducted in English and only small parts in Portuguese. This incorporates the possibility that interviewees were not able to fully express themselves in the non-native language or that the translation from Portuguese to English modified the intended meaning.

Despite these limitations, the choice of the qualitative method that point to semi-structured interviews is appropriate. In fact, the study of valuations techniques in Brazil and in particular RO is an area of little knowledge exploration requiring methods that deeply investigate the topic.

4. RESULTS

Hereafter, we will analyse the interviews. First, we will look at how the interviewees undergo a valuation, this includes the process they are going through, people involved, and the resources and techniques they are using. After that, we are going to take a closer look at how the valuators handles uncertainties and harmonize with the company's strategy. These two are the areas, in which the advocates (Copeland & Tufano, 2004; Trigeorgis, 2005) of RO promise that RO could offer improvements to the traditional valuation techniques. Lastly, we are going to examine the use of RO by the interviewees in details and analyse the reason using them or not using them. Building on these insides this thesis will propose directions to increase the use and the harvest of potential of RO in Brazil.

4.1 CLIENTS OF THE VALUATION

When we start talking about the valuation in a company, it is helpful to realize first why the valuators evaluate an asset, what motivates them and gives them direction. They all have in common that by the end of the day they are required to present some indications to the decision makers of the company, who then use this information as the base for their capital allocation decision. So before we look at what the interviewees do in detail, we will have first examine at what, in their own eyes, is required from them to do.

The interviewees serve two client groups with their valuation. There are the internal decision makers and the external partners. The latter consist of potential buyer or seller of assets, potential or existing investors and government officials, which is consistent with the literature (Damodaran, 2006, p.7). Depending to whom they are reporting the valuation techniques are different and more profound. The tendency here is clear that higher number of techniques and sometimes even non-company resources like banks or consulting firms are used for the valuation if external partners are among the clients.

Nevertheless, for this set of interviewees the internal clients are the most important, given that most of the clients' related answers were addressed to the internal clients. Yet, it became clear that the interviewees predominantly see the high-level decision makers in the company as their clients, which reverse mainly to the executive board or members of it.

> "And then we pack all this information and present it to the board and then the board approves or not the business strategy of the asset and of the business." (Participant F)

When talking about clients we need to differentiate them from the initiators of the valuation. The interviews cover the topic of the initiation of the valuation only rudimentary. Hence, we

cannot draw strong conclusions. Nevertheless, no one reported about external initiators. Furthermore, two groups of internal initiators seem to exist: the top management and the project/asset manager, who wants to expand the operations, the department responsible for controlling might also give indications for assets that should be valued for sale.

Given that in most of the participant companies the roles of the project valuator and the project executive differ, it is noteworthy that most interviewees did not mention the project executives as their clients. Even though there are working relationships between the valuator and the project executives, they are not organized in a formal way and their quality is no dominant concern for the valuators.

> “So my team is responsible for developing the deal, negotiating, valuation the signing the closing, the money is in. Then comes another team and they manage that investment." (Participant G)

> “I talk a lot with the management team. But it's not a structured process." (Participant G)

Hence, we can assume that the high-level decision makers of the companies, in some cases by the demands of the external partners, set the requirements for the valuations. How this effect the valuation techniques used we will examine in the section “Valuation Techniques”.

Internal decision makers expect a numerical answer from the valuation. The result needs to be packed in a set of numbers, sometimes even one single number. Yet, the participants make it clear, that the number alone is not enough. The valuation needs to provide understandable explanations for the origin of the numbers. It needs to translate the details of the project and its processes into a comprehensible language that helps the decision makers to obtain a better understanding of the projects reality, including the critical aspect of the projects in order to serve as a draft for the decision-making.

> “And at the end of the day we need to translate all kinds of information to the partners of the project in cash flow and NPV." (Participant A)

> "We need to show a lot of things that have happened and what limited our projection and explain what happened why our valuation dropped down,” (Participant A)

Notable is here that most decisions are yes or no ones. There are indications in the interviews that after the presentation to the decision makers there might be, if necessary, a revision in which suggestions of the decision makers are considered, but the goal is to present a valuation based on which binary decision can be made.

> “Yeah we present it to the board and they give us the green light or the red light.” (Participant H)

The aspect of project reality implies that the valuation is supposed to be a somewhat neutral exercise, in which the objective value of an asset is estimated. That this does not always hold true is obvious. The interviewees emphasizes the fact that they do not “work” the numbers

and that they try to avoid biased inputs. This suggests that objectivity is a concern to them and a quality feature of their work. That being said, it is not clear whether this motivation arises from company internal factors or from external social factors.

> "We needed to report to this partner, how the project was performing" (Participant A)

> "And we keep working on adjusting the numbers, not torturing them, not making them positive, no different ways to construct this investment. Postponing it, constructing a smaller one, using a different source of energy ... by the end of the day we managed to find out a great solution" (Participant H)

An indication might be, as one interviewee mentioned, that in especially important projects an additional valuation from an outside party, such as a bank or consulting firm is requested. This aims to provide the decision makers confidence in the findings, which could refer to capturing the unbiased reality of the project. However, it raises questions about the confidence that decision makers have in the internal valuations.

> "Or depending on the size of the valuation when we take it to the board, sometimes to give insurance to the board we do our own valuation but also hire a bank to do a valuation. So you can go to the board and say: look, we are selling the company for x, we believe the value is in between this range and we have [consulting firm] that has done an external, independent valuation and the things that we found." (Participant E)

Furthermore, to ensure that the valuation is meaningful to the decision makers, valuators use mainly methods, especially for the official presentation and documents, which are known to the decision makers. This includes the utilization of outdated methods, against the better intend of the valuator, in order to make a result understandable for the decision makers.

> "What I would say is, and I know that when you talk to people which have been in the business for a long time, I had one ex-CEO of [company name] that would only understand pay back. He would say, 'Look I only see pay back. If a project doesn't return my money in two years, in three years, I won't advance.' Because he was not that familiar with DCF."

The element of comprehensibility is driven by the fact that the observed companies have to make decisions between a high number of projects or assets. Therefore, they put a high emphasis on the comparability of the valuations. Hence, imposing strict standards on the techniques and processes used to undergo the valuation.

> "Let's say in [company name] we have more than one hundred [projects] for which we have to do business valuation models. Then 50-60 expansion projects for which we also have to build valuation models. Then, talking about [company name] it is very important to have a standard. We have to have one best practice of business valuation." (Participant F)

Besides setting requirements regarding the techniques used for their better understanding, the decision makers also impose limits and thresholds that the valuation has to pass before being presented to them. Thereby, they make a pre-selection and ensure "relevance" of the projects

and/or decision options presented to them. The limitations serve as guidelines for the valuators in their choice of projects/assets evaluated and in the choice of input.

> "... they [the top management] established limits and we worked with these limits." (Participant A)

In the eyes of the interviewees, valuation serves as an important input to the decision making. Usually decisions are only made if a valuation had been done for the project. Thus, we can call the valuation a necessary condition for capital allocation decisions. Hence, it has severe impact on the companies' actions. Yet the interviewees are aware, especially the closer they are to the decision makers, that the valuation is just one of many factors. The details about influence factors will be discussed in the section "strategy". So far, we can be assume that, especially for the lower ranks, not all of those factors are known to the valuators and thus cannot or only partially be incorporated in the valuation.

> "When you say the valuation is the main driver for the decision.... It is the necessary driver. There might be. But there are strategic considerations, which are not taken into consideration in the valuation. Some options might be in the valuation consideration. "(Participant C)

> "I think high. On a capital allocation decision most of that at least here will be done based on a DCF" (Participant E)

Although, the valuation is important, it appears that its influence on the decision-making process decreases when dealing with projects including negotiations with external partners.

> "But by the end of the day it was a negotiation. The valuation, the technical one, points out numbers. Now, they can vary around the base case. But at the end of the day the choice is [made by] the directors and they try to decrease the price and that's the real show. We are just the back stage guys to indicate, you know: boss, this is the number it can go this or can go that." (Participant H)

> "It helps to guide us on decision making prices. Although it is very common that the price is different from what the valuation indicated because there is also effects that can affect the valuation not only peer valuation." (Participant J)

To summarize the relationships of the interviewed valuators with their clients, we can assume that their main clients are the internal decision makers. External partners' only concern is regarding the choice of valuation method. Other internal clients are of marginal influence. The internal decision makers, in the eyes of their employees, require a number from the valuation, objective, understandable and well explained for the decision making, which they approve or not. Decision makers impose standards for the valuation techniques and process; establish limits to the variance of some inputs and thresholds for the valuation in order to be presented to them. The valuation might be a necessary condition for their decision-making but it is by far not the only influence factor. Yet these factors are, if at all, only partially communicated to the valuators.

4.2 VALUATION TECHNIQUES AND PROCESSES

In this section, we will have a look at the techniques that the interviewees use for their valuations, the processes these techniques are embedded in and the reasons for using each approach to valuation.

Independent of which techniques the interviewees used, the valuation is a long lasting process that is mainly focused on gathering information. Thus, the gathering of the inputs is the first and more critical part of the valuation, in which building the model is perceived as less critical. As reported in the interviews we can describe the valuation as a four-stage process:

1. gathering input information
2. building the valuation model
3. readjusting model and inputs
4. reporting results

In this section, we will discuss these steps. For everyone familiar with processes it becomes obvious that an important last step is missing, some form of constant checking and refining. This could only be observed in the cases of the valuators that accompany the budgeting of already running projects, yet not in the cases of valuators working on new project or external assets valuations. This is due to the separation between the valuators and executives of new projects. Once the decision makers have finally decided a project's fate, the job of the valuator ends. Hence there is no automatic control of how precise the valuation was. Consequently, for the valuators there are rarely reality checks that would make them engaged in a critical discussion of their process of valuation and thereby start a learning process.

> "So my team is responsible for developing the deal, negotiating, valuation the signing the closing, the money is in. Then comes another team and they manage that investment." (Participant G)

> "Sometimes I do that: Oh, I thought this is going to happen, that happened. But that's not really structured" (Participant G)

On the other hand, valuators that accompany ongoing projects or assets in form of a budged manager or asset manager – let us call the accompanying valuators - have a constant check of their valuations.

Nevertheless, we could not observe a real discussion about the assessment of the used valuation processes and techniques among the interviewees. There are some criticism and some aspects that could be improved but no ground-breaking discussion if the way the valuations are conducted were up to the task. If small doubts are raised, then by accompanying valuators.

> "Nowadays we are very strict to this method we are not looking outside of the box to see; OK we can do something different nowadays. Maybe we have something better that we still don't know. That's my personal view." (Participant F)

In conclusion, only few interviewees reported that changing the way of valuation was a topic in their company at all. One of them reported that the overall approach changed while only one of them reported that it had actual influence and lead to an improvement of the valuation method, which resulted in, improved results.

> "At some point by 2011 there started to be a discussion on how to improve the valuation method, review the [determination of discount rates] and do different ways for different [inputs]. There was as start to that discussion but that didn't progress since it was no longer the priority of the company it started to become a theoretical discussion." (Participant D)

> "Then I study the segment, the industry. When I think it's a good one, then I search the industry. Top down. [Before] It was more bottom up. So we change a little bit." (Participant G)

> "And I mean throughout the years this methodology that I'm describing, did not just appear. [...] So it took five years. And we developed that based on our mistakes, what we got right what we got wrong throughout the years." (Participant B)

The interviewees go more or less structured through those steps, depending on the guidelines of their companies, which are set by the decision makers. For on-going projects or assets that are already in possession, the common procedure seems to be an on-going revision cycle once or twice a year during which the value is updated and the continuation of the project/possession will be decided.

For new projects, we found a series of project approval decisions that are made by different committees of the company to be most common. The number of steps can range from two to five. With each step, the valuation becomes more refined and detailed. At the same time, each step has a set of limits and minimum values that need to be passed, otherwise the project might be cancelled before it reaches the decision makers, either by an intermediate committee or the parties involved in the valuation.

4.2.1 GATHERING INPUTS FOR THE VALUATION

The gathering and judging of the inputs to the valuation models seems to be of high importance, effort and difficulty for the interviewees. There is clear indication that they spent most of their time on a valuation developing the assumptions.

> "… built up the forecast assumptions is for me the most important part. Because: garbage in garbage out." (Participant H)

> "We spent one week, one whole week, only to work in London, just to discuss the key assumptions to the valuation, one whole week." (Participant H)

> "I believe the biggest challenge is to design the right assumptions. To have the right assumptions. There are a lot of things, a lot of uncertainties. To have a good view of that is not easy. But I believe that the calculus, the calculations that you make in the end should be simple, no rocket science." (Participant C)

The collection is not a one-way process. Once the data is collected and put into the models, the valuators interact again with their informants. They see if they can improve the input data or, mostly, if there are possibilities to alter the specification/function of a project or asset. Their aim is to increase the value so that it fulfills the limits and thresholds set by the decision makers. This can be seen as step three "readjusting model and inputs" In some cases, the valuation will only advance to the report stage if the information gathering involved parties reach consensus.

> "Once you have a consensus you build up the NPV and discuss them again. It is not a once in a lifetime step. You do it and come back to the team, discuss it and adjust it." (Participant H)

> "We do an internal consensus, which one to apply in our valuation. Once we have set these main assumptions we build up the project, that's it. […] the operations guys, the market guy, and then we have the team consensus about scenarios then we run them all and show to the board: look as the view of the company the value is that," (Participant H)

> "... and then after there is a certain consensus on the project, the project is taken to the correct levels of approval." (Participant D)

We will first discuss which inputs/assumptions are most important to the interviewees and on which they are trying to reach a consensus. After that, we will have a look at whom they are reaching a consensus with, the parties involved in the data gathering and assumption making.

4.2.1.1 Gathering information and building assumptions for the valuation

The inputs in the valuations are forecasts and future revenues or costs. All forecasts are assumptions. Hence, it is their nature to be uncertain (Baker et al., 2011). Therefore, we will call them following uncertainties or assumption interchanging. As we established earlier, the comparability of different valuation is a key requirement. Consequently, it is of high importance that the assumptions used in one valuation are coherent with the other valuations. Therefore, certain "key assumptions", namely prices, exchange rates and inflation are set by central departments for the whole company.

> "The assumptions are corporate assumptions, not just [made by] one mangers. All projects are always compared on the same basis. When it comes to technical aspects, each area has its own technical

> aspects; they are evaluated by the same technical corps. You will apply the same mind set making each [assumption]." (Participant C)

> "They [the assumptions] are used for the whole process at [company name] not only the valuation. But to be coherent all valuations are made using this assumptions and if you believe at some point these assumptions are no longer holding you just do some stress scenarios to see how that works." (Participant D)

We can see two types of capital allocations that set a different focus for the valuators. First, is investing in another company's equity (external equity investment). Here information about the valuation object is harder to accumulate, especially about its inner processes and objectives. Hence, the focus of the interviewees is to get good understanding of the company's business model, quality of its management, business context it is operating in, position in the market and a forecast of how this market is going to perform. Also of concern is how the competitors and the stock market are going to react, because both can drive the price of a potential purchase up or interfere otherwise which could render a purchase obsolete. Additionally, of course, revenue and cost drivers, as well as the potential values of soft assets of that company, like technologies, are important.

> "We look for companies with good management. Some type differentiation. Of course for us the business plan is very important." (Participant G)

> "What the [evaluated] company does is most important. Then I go to the market. What is happening in the market? What is going to happen in the market? I probably use the five forces of Porter for the industry. […] Then we go to the business model, to the excel [spreadsheet], because we are way more comfortable [now] in changing the business forecast, because before that it is only guessing numbers." (Participant G)

The valuators spend a large percentage of the interviews explaining the importance of the asset's strategy and the managerial capabilities. That does not mean that the number based valuation model is unimportant, but it seems safe to say that without knowing the asset's strategy and the managerial capabilities it would lack meaningfulness.

The second type of resource allocation is the case of a project, asset, or company that will be added to the operations of the own company (internal asset). Here we need to outline the specific nature of the participating companies. All valuations of this second type of resource allocation situation deal with commodities. Thus, they are not concerned about the demand for their products. That clearly eliminates a main uncertainty that other businesses face. Furthermore, the internal processes and management capabilities are of no concern because the management and processes will be established by the evaluating company and are well known to the valuators

> "... being commodity, everything you produce you sell, you only have to define what level of price."

(Participant E)

The interviewees labelled two sets of uncertainties for these valuations: technical and economic, which are consistent with the literature (Dias, 2014, p. 67-70, 78; Trigeorgis, 1996, p. 33). All the reported projects dealt with the construction of large facilities to exploit natural resources. The availability of the natural resources at the location is of high importance to determine the possible sales volumes and thereby the revenues. Furthermore, the geological aspects of the surroundings can ease or hinder the exploration and are therefore an important cost driver. Besides the production capacity technical uncertainties refer to the operational cost of the project and the investment needed for facilities and equipment, depending on the technology of exploration, energy supply – bought, self-made and by which technology –, the size and nature of operation and all the equipment and constructions that come with it. An example is: whether logistics are handled by ship or train. Yet, the access to cost-related information is good and well-structured, the costs are "manageable" and, possible production levels can be explored in advance. Hence, these uncertainties are of less concern to the interviewees.

> "There are a lot of other operational costs. We need to estimate but the total uncertainty is not so big." (Participant A)

The second set of uncertainties are the economic or market ones, that all interviewees share and that are the dominating uncertainty for the internal projects. They predominantly include the prices for the commodities sold by the companies and, if in rare cases they dealt with non-commodity projects, demand. All companies are also highly sensitive to currency exchange rates either because they sell their products in a foreign currency, import raw material and/or finance themselves in the international market.

> " … the biggest uncertainty that we have is commodity prices in the end ..." (Participant E)

Lastly, government regulations or interferences are rarely directly mentioned as an uncertainty. Yet, the interviewees state clearly, in another context, that unpredictable government interference is one of their top business challenges. Thus, we can assume that the government has significant influence on the value of assets, either because they impose additional costs or limit its productivity. This supports the view of the literature (Bethlem, 2014, p. vii; de Souza, 2014).

> "The problem is, when we have non-manageable cost, like regulated costs [that] we can't manage." (Participant A)

> "And less …. less interference and that is very specific in Brazil lately, less interference of the

government into the business area." (Participant E)

4.2.1.2 Parties involved in building assumptions

We can see that several parties are involved in the valuations performed by the interviewees. Not all of them appear in all cases but we can observe a pattern here. There are, of course, the clients of the valuation who we discussed earlier and who are definitely involved in the fourth step of the valuation process (Reporting of the results) as recipients. Yet, we have to assume that they play only, if at all, a minor role during the information gathering and assumption building, because only one interviewee mentioned them at all when talking about building of assumptions.

> "The board is normally part of this discussions. So when primer to approval to the project and the other strategic planning cycle, there is a strong discussion about those assumptions. Some assumptions are less discussed, for instance exchange rates has a lot to do with getting the banks consensus, and use those assumptions." (Participant D)

Interacting with these parties and building assumptions out of the information provided occupy most of the time during the valuation.

> "There are a lot of things to do. We have a lot of meetings …" (Participant A)

There are also indication that the number of people and parties involved in the valuation might be smaller during the project-planning phase than during the project execution.

> “When I only make a consulting for the auction, the people involved is small, smaller than in construction because we can project the costs and the production, a lot of the financial structure and we don't need these people." (Participant A)

4.2.1.2.1 INTERNAL PARTIES

First, we need to mention the valuation team. In most cases, we observed here there was a team involved either in the whole process or at the information gathering and assumption building stage. The teams appear to be not bigger than ten people. In any case, when a team was involved they discuss the assumptions and the final value to find mistakes or blind spots by critical analysis. The teams, as reported, would reach a consensus about the assumptions and the value before advancing to the next step.

> “We do an internal consensus, which one to apply in our valuation. Once we have set these main assumptions we build up the project, that's it." (Participant H)

During the information gathering and assumption building, managers of different departments

serve as information providers. Information providers can be external and internal. Internal providers can be divided into, as the interviewees call it resonating with the uncertainties, technical and economical. Technical providers supply the earlier mentioned information and assumption about the technologies, used capacities, cost of construction and so on. Technical providers are the corporate engineering departments, logistics department and, the actual local operation with its specialist regarding human resources, purchasing, and production. Here we can see that in some cases the headquarter, where the valuators are mostly located, have an equivalent corporate departments which function is to double check the information received from a local team that wants to initiate or expand a project. Yet these departments could not be found in all cases.

> "Because we during the construction we have a lot of people working together, environmental people, engineering people and financial people." (Participant A)
>
> "I would need, for example, the guys from operations to take a look at the technical information and tell me if they see any investments needed or types of cost we need to put into the valuation." (Participant J)

Similar controls or assistance, depending on the view, exist also on the side of the internal economical providers, such as the marketing department (for prices), finance (for discount rates), and the macroeconomics department (for inflation, exchange rates and other macroeconomic data). Those data are considered the company's "key assumptions", which need to be coherent throughout all valuations conducted by the company. Therefore they are only revised periodically and not for every valuation. It seems that in some cases the development of those assumptions is centralized in a department called "strategic planning" or "corporate strategy".

> "… our strategy department has the company assumptions, the long-term assumptions regarding the key prices, the key matrix, exchange rate, commodity prices." (Participant D)
>
> "The owner of the assumptions is the strategic planning area. But this assumption, there is a strategic planning cycle every year and the assumptions are reviewed every year. "(Participant D)
>
> "I need marketing team to look at sales and let me know what kind of volumes and prices I would use, projecting revenues, for example. I also, sometimes I need tax people to take a look at tax information and let me know how should I deduct taxes from that cash flow and if it is a different country" (Participant J)
>
> "The macroeconomic department within the company they study exchange rates then they say for this year we will use this exchange rate curve and we might agree or disagree, but at least we have a guidance in our assumptions that everybody will use, so we have at least common ground to compare things" (Participant J)

Assisting function exist to ensure and control a coherent standard of the valuation process and financial model building. Sometimes the final model might be checked by a part of the

finance department. Furthermore, in some cases the legal department and the tax department are involved to provide their expertise on special issues.

> "The valuation is checked by the finance are for instance. The whole valuation model, the WACC that has been used. Its coherent if the valuation stands" (Participant D)

> "Then we have one corporate area, the global strategy, that spreads what's the best way of the valuation business, the valuation one certain business" (Participant F)

An issue arises when a there is no assigned function in or outside of the company that provides the assumptions to the valuators and takes the responsibility. In that case, the interviewees report that the assumptions are set by "consensus". Nevertheless, this seems to be more a negotiation of opinions rather than a fact based decision. This can be problematic because it is open to biased influences, for example, the operational manager that wants to increase his operation or company politics. Both are problems for the majority of interviewees and compromise the goal of neutral and objective reporting. The ongoing struggle with biased assumptions is one of the key challenges of any valuation (Damodaran, 2006, p. 2-3).

> "You see the owner of the project cannot be the owner of the assumptions. He is entitled to put assumptions, he is entitled to explain the assumptions but there has always … It's always necessary to have another group to revise." (Participant C)

> "So sometimes we use assumptions that are different from the market assumptions and that's a hot topic and there is a lot of discussion in different shareholders bring different perspectives on those assumptions." (Participant D)

> "... because we actually spend a lot of hours actually doing work which actually doesn't add value because of politics ..." (Participant E)

> "Then there are a lot of discussion regarding, not the numbers itself but what were the assumptions about it, meaning a lot on what were the costs of the project, if the costs were stressed enough, …" (Participant D)

> "There are incentives for the people to stay in the business until the deal is closed so that we don't lose people in the process. But of course, depending, it is much more difficult to sell than to buy, because to grow is something everybody is excited about and downsizing is something horrible." (Participant J)

> "I would ask for pure meritocracy, no politics, and no corporate politics. I believe that's sometimes really annoys, the malfunctioning of the organization. NO cannot simply rely on your good performance, you always need to pay attention to the other side of the concrete business." (Participant J)

> "Because sometimes you have a strategic decision or you have a feeling that you have to do something like that and the numbers are not that and you massage the numbers to look the way you want." (Participant E)

4.1.2.2.2 EXTERNAL PARTIES

It is common to approach banks or consulting firms for their take on macro-economic data but also specific market data, especially if the company does not have internal experts for these fields or countries. Banks and consulting firms are also approached in some cases for assistance in the valuation. This might be because a neutral party is needed in a negotiation, the company does not have the internal capacity, the decision makers want a second opinion to increase their perceived security or, because the company is not familiar with the valuation techniques to be used, like real options. Furthermore, external inputs come from suppliers in form of quotes. Construction companies that execute the installations in the project seem to provide the most critical information.

More, it seems common that, when evaluating an asset for pure equity invest, external inputs can come from other players in the market of interest, who are questioned by the valuator about their opinions. In an equity investment or take-over scenario, valuators try to extract information from the employees of the target company, to get the technical information as they would from their in-house colleagues. In addition, they are also talking with the financial departments of that company to evaluate its financial situation. Moreover, valuators engage in talks with the decision makers of other organizations from whom they want to purchase or to whom they want to sell.

> "So in order to do that we have to talk to a lot of people, we have to all the time to the people at the board of the company, to the management of the company, to the shareholders, to competitors, to clients, with suppliers ..." (Participant B)

> “It is very important to talk to the market, to people in the market” (Participant G)

Here again, when handling employees of an external possible investment object, we see the issue of bias and company politics that interfere with the building of objective assumptions because information is withheld or whitewashed. Finally, valuators need to get hold of government agencies opinions to consider regulation, permissions, fees and taxes that can alter the value of the asset.

> “When you start a deal, [...], there are the reasons the company starts negotiating with you and the real reason. And I think if we had like a crystal ball to understand what is really happening would make certainly my life much easier.” (Participant G)

The lack of understanding of the valuation by the people involved is an issue many interviewees criticised. This goes in two directions. First, there is the lack of sensibility for the importance and the impact of the valuation in the fate of a project. Hence, gathering information and working with the involved people can be an uphill battle. This becomes even more challenging when there are no pre-gathering of information by the responsible

departments and valuators, to depict it, need to talk for each line of the model to another person. This lack of sensitivity might be partially caused by the general poor financial knowledge outside of the financial/economic departments.

> "My first challenge is, that I deal with many people who do not understand the tools and knowledge and even the importance of business valuation. [...] Nobody really cares about the guy that connects all the things together and makes the NPV. […] With all the people, whose estimates I get every year I struggle to show the importance of getting the numbers, [...]. In a good world it would be good to have an easier way to get people engaged in the valuation process" (Participant F)

> "And then at the end of the day I have to get 50 people into the room to get the valuation model. I would love to have a more simplified process. I have five to six people and we can have more deep conversations. More easier and quick with the estimates." (Participant F)

The quality of financial education at all levels of the involved parties is lacking. There can be decision makers found only familiar with one or two valuation techniques. Also, inside the valuation team people with an insufficient knowledge of the valuation technique used can be found, that leads to severe technical errors that require rebuilding the models or when not detected in wrong valuation.

> "I think that on my point of view that we have people with more financial education, financial literacy. You wouldn't believe the amount of work, which is done, based on scenarios that don't make sense at all. There is a lot of work being wasted doing work for some people. I wouldn't say it's your boss but you are negotiating with some on the other site of the table and you spend more time actually teaching him what makes sense instead of negotiation. I say that because we are in the middle of a negotiation with the government and everything that they asked us doesn't make any sense and it doesn't make any sense because they don't understand what you are saying. So I think that would be that." (Participant E)

> "I would like more development for the people. Usually people look at training programs like a waste of time, although the company offers a lot, it's the [common] view. I believe that is a good intensive to develop themselves." (Participant J)

Lastly, the people with whom the evaluating company is engaged in negotiations, especially government officials, might also show poor understanding of financial matter. This prolongs and complicates the negotiations because common practices might apply and extensive time needs to be invested in educating the other party.

> "I like to have money to give free courses of finance valuations to anyone that wants to see. It would be an academy that sponsors all the finance courses and anyone can sit down and learn. [...] And with that we can improve the country as a whole. I would be really happy as a finance guy." (Participant H)

To summarize, we can state that the interviewees spent, compared to the other steps of the valuation process, most of their time and effort on gathering information and building the assumptions to be put into the model. The assumptions concern predominantly technical aspects, which include CAPEX, variable costs, and possible production volume, and

economical aspects, like exchange rate, WACC, inflation, and commodity prices. During the process, valuators exchange information and opinions with all levels of hierarchy concerned with a project internal and externally. Yet we can observe a higher involvement of the decision makers when dealing with external assets because they are leading the negotiations. The information gathering continues, once the valuation model is build and first numbers are available, if the project needs to be adjusted to fulfil basic acceptance threshold. Building the assumptions is challenging, because information is uncertain and the people involved compromise the process either because of their poor knowledge of the valuation or their politically motivated biases that unnecessarily compromise the valuation.

4.2.2 BUILDING THE VALUATION MODEL

Out of the vast amount of techniques available for modelling a valuation (Copeland & Tufano, 2005), only four are used by the interviewees. Primarily, all of them use some DCF model.

4.2.2.1 DCF

In nearly all valuations the NPV method is being used. Less common is the IRR. Its usage is increases when the asset is in negotiation between two companies.

> “The final measure is NPV.” (Participant D)

> "I told you, to the shareholders, to the board meeting just the NPV but when we talk to the banks we do not only do the NPV but also the IRR and the multiples valuation." (Participant H)

On top of the NPV, most interviewees undergo a sensitivity analysis to determine the main uncertainties in terms of their impact on the asset's value. Then, with these uncertainties, they build mainly two scenarios (base/best case and worst case) or rarely three scenarios (best, base and worst case). Only one interviewee reported that he or she goes occasionally beyond this and works with probability distributions. Sensitivities and scenarios are a way to deal with uncertainties. Therefore, both will be discussed in the section “dealing with uncertainties”.

> "This is the main tool of decision. They really base their decision on that. Without the NPV they, OK, start to understand the investment thesis, the strategy, how does that fit with the company but the NPV is the main. They do also the sensitivity analysis, they build up some scenarios but the NPV is really important." (Participant H)

> “... we try some extreme scenarios. OK, what if ... prices were dead low, are we able to survive? This is

> something I do for myself. This is not required by the board."

In order to apply the DCF methods the interviewees need a discount rate. They all use something they call WACC (weighted average cost of capital), but we can find two groups. The first one, representing 7 of the interviewees, applies the CAPM (Capital Asset Pricing Model) to calculate WACC (Weighted Average Cost of Capital) and calculates it specifically for each asset, which follows the advocated practice of text books. Some go as far as to calculate input parameters such as the beta from historical raw data, while most rely on predetermined inputs. The second one, representing 3 of the interviewees, does not believe in the accuracy of the CAPM anyway and prefers to use a simplified rate, that they also call WACC, to discount the cash flows.

> "We don't put uncertainties in the WACC because we try to use the same discount rate for everyone." (Participant B)

> "Since we are a public company we rely a lot on CAPM because CAPM, like somebody said, [...]: Everyone complains but nobody has something better. And it's something proven, well known. So when we use this methodology we can explain why we used 15 for A 14,5 % for B, 13% for C. It checks if the discount rate makes sense. [...] I'm not so dependent on CAPM but I have to be." (Participant G)

Clearly, the NPV is the valuation method of choice for the interviewees because it provides high comprehensibility for several reasons. First, all clients and valuators are familiar and comfortable with using the NPV because they are educated and experienced in working with it. Consequently, the clients easily understand meaning and implications of the NPV analysis results, which makes them, demand the DFC methods for the valuation.

> "[The] benefit is straight forward, people know it." (Participant D)

> "I think that DCF is actually is something that from us here management is really familiar with, [...] also DCF is not simple, it's been there for a while, so people understand it better. [...] When for instance with a DCF, people already know in a mining company the levels for that value it will be commodity price, currency exchange. So people know already how to ask. [...] I also think people get used. It's the way, if we try to use anything much different than that they go: '. OK, nice but let's see the DCF'" (Participant E)

> "It's simple. Everyone knows. It's quite simple. For example, I have to apply for a different position in [company name]. And sometimes it's important to keep it simple. Someone can see it, understand it, and plug and play. OK, I can run this valuation model very quickly." (Participant F)

The NPV by its process helps to understand details and value drivers of the valuation object. Alternatively, as one interviewee put it, shows "what is happening". Hence, it allows building

a transparent and logic model, which shows the dynamics and tendencies of the project. Thus, the value obtained can be argument because the clients understand the method and its logic can withstand critical analysis. Moreover, it supplies indication where a project can be improved to increase its value for the company.

> “Of the DCF for instance, I think that the values in DCF are actually the able to get the fundamental value of the asset and you can actually break down this value to every value level. So it allows you to do any sensitivity that you want and I think that the DCF at this point is very well known for the decision makers.” (Participant E)

> “The cash flow methodologies is at least the one that tries to capture operational details for each asset. So the benefit is that we can really adjust and build a value that is, all the amount of information that we have.” (Participant J)

> "I think this, the benefits is to show to shareholders a proxy of the value of the project. We can't valuate the project or the firm with certainty but this kind of techniques is a proxy of the value. And they are very important to show to the shareholders the tendency of the project, to decrease or increase. I think this is more important than the exact value. Because this number has uncertainties but tendencies are important in this kind of valuations." (Participant A)

Thirdly, the NPV does not only allow detailed analysis but also is easily expandable and combinable with other tools such as sensitivity analysis, scenario building and statistical modelling. This allows the valuators to smoothly add these tools and increase the scope of analysis to provide a more complete view on the valuation object.

> “Benefits, anyone can work on it and things that you have to highly to someone it's that simple sometime you have to build some side models to deal with more complex situations.” (Participant F)

Fourthly, the NPV, once the model is build, can be easily manipulated and adjusted, which allows a flexible and adoptive valuation process in which new information can be obtained and implanted with respect to new project developments.

> “That depends. If the NPV is close to zero they go back to the project. Let's try to analysis it again and reduce the CAPEX, increase the revenues, decrease the costs to reach a better NPV and to get a better IRR." (Participant H)

Furthermore, we can detect some hunch in the argumentation of the interviewees that goes beyond the factor of comprehensibility. It appears that using a well-established method gives security and certainty. For one, we will see later that decision makers yearn for certainty, so it is natural that they want to use a method that promises certainty. Secondly, using the method that everybody uses puts the valuators out of risk being blamed for using the wrong method, when the decisions based on their valuation had a negative outcome.

> “It's an approximate. And it's also the same test that other people in the market are doing. If we are wrong, I mean everybody is wrong too, so it's not that wrong.” (Participant J)

4.2.2.2 Others

Some of the interviewees used multiples when evaluating an external asset with a lack of information available and/or at the beginning of price negotiations to form an early opinion in a short time. Only one interviewee made use either of DCF or of multiples depending on the nature of the business and not on the information available or the clients of the valuation. Nevertheless, the interviewees do not consider it a reliable method for a final valuation. It is more a necessary means that if used in the final valuation is due to the pressure from the financial markets.

> "And then multiples help you to see if everybody is on the same page. If nobody is very off, if we are not very off. Then we go to DCF usually five to ten years and then we discount." (Participant G)

> "I don't believe much in multiples, but you have to acknowledge that a lot of people uses them. […] we have the DCF, which is the one we actually believe in the fundamental behind it. With the DCF, we can say this has these and that assumption behind and see if the value at multiples is in the same range. The value at multiples in the end is a good rule of thumb and is something that the market uses a lot." (Participant E)

> "I told you, to the shareholders, to the board meeting just the NPV but when we talk to the banks we do not only do the NPV but also the IRR and the multiples valuation." (Participant H)

> "Especially when we have an acquisition target where we want to have a sense of level of valuation and we don't have all the information to build DCF, so we use a lot the comparable multiples and the transaction and trading multiples. Then when we do have information, when we use public information for example, then we build the DCF. The DCF is the main one. But we usually build a chart, football field like chart, to compare the results among these methodologies and also building some sensitivities around the discount rate," (Participant J)

> "Because there are a lot of factors that can change the value of the company that the multiples and the peers will not capture like the life of the reserve. So there might be a lot of explanations and we try to tackle them and see the differences." (Participant J)

In very rare cases, the real option method has been used. In total, only two of the companies have reported use of RO. One of which is an irregular user and only one is a regular user. Consequently, only one of the interviewees had actual experience of applying RO in the corporate practice. Because of their rarity, RO will be discussed in the separate section "usage of real options".

> "The usual method that we use is the traditional DCF. It is the traditional, but you know that you can use it in a real option structure" (Participant C)

"Time of return" is rarely used. Two interviewees reported random usage of it.

While most interviewees follow the "traditional" or "text book" techniques of valuation, some of them reported adaptations to these methods mainly to increase the comparability between

different valuations of assets or projects. These adaptations include a simplification of the calculation of the WACC and introduction of new indexes, which made projects comparable on their relative profitability. With respect to the confidentiality, we will not discuss details.

> "My answer will be terrible for your work because what we do is not necessarily what your text books say" (Participant B)

Overall, one interviewee summarized the methods used and the motivations nicely with:

> "When you make a DCF model you understand well the key premises you are using. It's more transparent than multiples, which are just a closed number. You can find the uncertain values in the model. I think that DFC is transparent and you have clarity about the premises you are assuming. So there is not just a value appearing, it is not just pure mathematics. And after we get the value you compare it to the multiples to see if this value makes sense with the market. And we discuss if this value makes for us as analysts sense independent of what the multiples say. I don't know a scientific method which is better or not ..." (Participant K)

4.2.3 REPORTING THE RESULTS

In this step, the valuators present their findings to the clients of the valuation, specifically the decision makers. The interviewees said little about that step that goes beyond of the character of their clients as described in "Clients of the Valuation". The common practice seems to be the delivery of a written report and excel spread-sheets with the calculation in connection with a presentation in front of the decision makers. The presentation gives room for questions and clarifications. With finalization of the report, comes a promptly feedback, which can either be the yes or no decision on the project or the assignment to revaluate the asset under new parameters set by the decision-makers.

4.3 CONNECTING VALUATION WITH STRATEGY

The valuation tries to capture the future value of assets. Yet the value that assets will have for a company depends highly on its future course of action and priorities (Copeland & Tufano, 2004; Trigeorgis, 2005). Of course, they cannot be entirely known today but we can assume that the company's strategy outlines one or some possible scenario (Day et al., 2000, p. 5-10). Hence, the company strategy is an important internal value driver for the assets and as other important value drivers, comparable to the key assumptions, it must be considered in the valuation.

The literature review has shown that the interconnection between valuation and strategy using

the common valuation methods is not as strong as would be desirable for an objective capturing of an asset's value. Therefore, we will examine in this section how the interviewees incorporate the company strategy in their valuations, to see whether the theory applies and RO could provide improvements.

While strategy is a plan for potential success that inhabits several assumptions (Day et al, 2000, p.191). In addition, the nature of assumptions is that they are uncertain. We also have to consider uncertainties in this section. Here research on RO specifically promises that it includes the value of flexibility, which lies in the asset or the strategy and helps to moderate the effects of the uncertainties. Thus, first, we look at the connection between strategy and uncertainties and then we will see how the interviewees deal with uncertainties in their valuations.

4.3.1 STRATEGY AND VALUATION

Among the interviewees, this question took the most time to answer. Their reactions and ways of answering indicates that the idea of a connection between valuation and strategy is a topic of little to no concern. It seems safe to assume that for some of the interviewees it was the first time they thought about it. Therefore, we can constitute that it seems unlikely that valuators by their own motivation would be looking for a tool to improve the integration between strategy and valuation, if it is not a concern for them.

When we talk about strategy here, we need to consider two aspects. One is the overall company strategy and second is the asset or project strategy, that applies to the only to the valuation object. We will start talking about the company strategy.

4.3.1.1 Company Strategy

In the cases of the interviewees, the company strategy comes mainly into play before and after the valuation process. To begin with, the company strategy determines which objects will be evaluated. According to the interviewees, they would only start the valuation on an object that is already in possession or that would be interesting to add to the company in correlation with company strategy. Some interviewees gave the indication that the overall financial strategy influences how profoundly the valuation process is handled. Furthermore, before the valuation process the company decision makers set not only the standard valuation process but also thresholds, limits, indicators and necessary conditions for the valuation in accordance to the company's strategy.

> "... even before the potential acquisition or projects starts it needs to fit the corporate strategy. So if you bring here a wonderful product that is a consumer product that has a huge NPV that doesn't fit the company's strategy so that doesn't even enter the pipeline. […] So the last big cycle, the strategy was: let's bet on China and trade off." (Participant D)

> "In which way because the thing is we have today a strategy of capital discipline. So you won't see any project approved today without a thorough valuation study." (Participant E)

> "So what I can try to answer your question in that the way in that the valuation is in the strategy is that we make sure that whenever a valuation is submitted for approval on a big project it has to gone through [the process] ..." (Participant E)

> "The strategy at that time is that: Let's diversify, […]. But the current CEO has a completely different view. He divested a lot […] and started to focus [...]." (Participant H)

> "I believe that the strategy comes first. I wouldn't, for example there is no, it can happen but it's difficult to see that we buy an asset that is not our strategy because it's cheap, the valuation is low. I don't see this but I cannot say it won't happen, but it's something quite difficult to see. So first comes strategy and then you analyse. We did this strategy what is expensive, what is cheap, what would bring more value" (Participant J)

> "It's difficult because usually the company's strategy drives what you are looking for in an investment and then you evaluate that investment. If it's very in mind of the, you are maybe less risk adverse with that company. Maybe that can be driven by the company strategy." (Participant J)

"Indicators" was a word the interviewees used every loosely and unspecificly. The notion is that it refers to all the aspects of an object that the decision makers consider important for the decision. Even though not all of them are in the duty of the valuators to investigate, they set the focus for the valuators during the valuation.

I

> "We are first developing our investment thesis. Why do I want to invest in ports? Highways? And then start looking for projects. For instance. But we still have those but we are trying to more top down, in a way that we develop our investment thesis, we know what we want to do and then we search the companies that fit." (Participant G)

Thresholds refer hereby to minimum levels of performance that the object needs to deliver. This mainly refers to revenue and profit streams, profitability and IRR. Limits set the maximum level for certain indicators, like maximum costs for various aspects like financial restrictions, maximum time of return or first positive cash flow. In the case of an already ongoing project, limits and thresholds can also include targets for cost reduction or increase for revenue stream.

> "We have the model and base on that we have a certain threshold, below it nothing gets approved and then it goes to our CEO and if he agrees with that he submits it to our board of directors. There it will be compared to any other project we have, if we are looking for projects, if we have financial capacity to undertake this project." (Participant E)

> "... we need to buy a lot of land […]. We have a limit to negotiate these lands. Some people would like to receive more than we are expected to pay and then we need to negotiate, we reached the limits that the shareholders put for us." (Participant A)

> "That depends. If the NPV is close to zero they go back to the project. Let's try to analysis it again and reduce the CAPEX, increase the revenues, decrease the costs to reach a better NPV and to get a better IRR." (Participant H)

> "Good question. After the strategy meeting we have the yearly strategy of the company and then this is disclosed internally, to other directors and managers they have to say that's our strategy and then we have a lot of guidance. Like we have to reduce our costs 10% we have to try to capture more, a better price in the market. [...] I think this is how we try to put the strategy of the company into the valuation model." (Participant F)

Lastly, necessary conditions are indicators that must be fulfilled in order to approve the project, like positive externalities or certain levels of flexibility. Yet, in the necessary conditions as well as in certain indicators we find the aspects of the valuation, which are considered important but cannot be valued in a numerical way.

> "Q: How are these externalities reflected in the valuation or the decision making process?
>
> A: I don't know if they are. Maybe they are in a way, if there is none. I am probably not going to invest. I don't have any tools right now, to pay more or less. There is no ….
>
> Q: So it's a necessary condition?
>
> A: Yes." (Participant G)

The numerically valuable factors and necessary conditions guide the valuation process. If they are inside the set parameters, the valuation will be presented to the decision makers. Here it is interesting to acknowledge that the valuators become in some sense also a decision maker, because if they come to the conclusion that an object will not fit into the parameters it might be cancelled before it reaches the decision makers.

If the valuation is handed to the decision makers, they also include into their evaluation the indicators that could not be valued in a numerical way or that are not communicated to the valuators. This can include the reaction of the competition, stock market reaction, company politics, synergies or access to new markets. The interviewees refer to them as "strategic considerations" or "strategic value", which is controversial. Some accept that there are characteristics of an asset that cannot be numerically captured, while others consider it a way to get projects whose indicators are weak.

> "When you say the valuation is the main driver for the decision....It is the necessary driver. There might be others. But there are strategic considerations, which are not taken into consideration in the valuation. Some options might be in the valuation consideration." (Participant C)

> "... sometimes this value has strategic value and whenever you here that: OK the DCF is not that good but the strategic value is bullshit. When people start saying that you start actually being a little bit sceptical itself because the DCF is something we know that assumptions can be biased." (Participant E)

> "... we have a huge amount of projects and the main point is to try and find out if the new project has a complementary feed with the current assets. When you look at some complementary in terms of foot print, geographic foot print, in terms of business complementary. […] we tried to find out if this new company would have a great fit [...] with the current assets. If we have a lot of overlap, we discard this one. And the best companies at that time is what adds new business value that is complementary to the current portfolio." (Participant H)

> "Competition, premiums that you might need to pay to get the asset. Or even discounts if you are not so sure about certain assumptions that you have included so you pay less. I would say it is, you know, it's the top three of the information they need to make a decision. So together with strategic rational and a kind of cos and pros qualitative issues that we can not measure and the valuation that are the three main aspects of any decision, if it is M&A or something else... Market perception, for example, if you make an investment, it could be a green field project or an acquisition, that will bring you some diversification and the market will see you in a different way, if it is a transitional investment you cannot predict how it will affect the share price for instance. You can change groups, you can change sectors, it can affect the value but you never know unless you do it. "(Participant J)

Only the interviewee from the company that uses RO on a regular basis reports that some of these strategic considerations are also put in numbers.

> "I can be quite sure that we evaluate strategic value to compare, which is not merit of the project but merit of the company. See, the project might be not so good when compared to another, but for the company it has a value much bigger than for another company because my strategy is different from the others guy strategy. […] Strategy due to the synergies which brings, which usually is associated with flexibility." (Participant C)

> "Q: And sometimes you are able to put a number?
>
> A: We in certain situations we do that. I'm sure of and for sure in many other situations we deal with another kind

4.3.1.2 Asset strategy

When talking about the asset strategy we need to differentiate between the same two classes of assets that we used earlier: external equity investment and internal project. For external equity investments the assets strategy is important for the valuation, but not as numerical component. The valuators are investigating thoroughly whether the strategy of the asset is promising in its current market position or not. Consequently, a strategy perceived as "good" is a necessary condition for a positive investment decision.

> "And then during all those years we were able to gauge if things were going in the positive direction or in the negative direction. And with that we were able to say, O.K. with that our positive scenario is more

> the base case and when things were going bad, oh maybe we should weight to that negative scenario there then we are not that attracted and we sell partially. "(Participant B)

When talking about internal projects, there is much less to say about the asset or operational strategy then about the company strategy. The interviewees made hardly direct references to it. Only in the cases of equity investment the interviewees are particularly concerned about the assets strategy and if it was fitting the market environment. In the cases of an internal asset, it seems as if its strategy is a result of the indicators set by the decision makers. We know from earlier, that the characteristics of the assets are adjusted until they fit all the indicators before they are presented to decision makers. Therefore, we can assume that the valuators together with the key internal information providers set the key points of the project strategy in order for it to fit the requirements of its market and the decision makers

In already running projects, the executing managers adjust the strategy if it does not develop as planned or indicators change. Yet there is no indication that, beside the one RO user, the long-term asset strategy is valued in a numerical form. We can only assume that the decision makers in non-numerical or "qualitative" indicators consider some asset strategic issues.

We can conclude that strategy is hardly of concern in most of the valuation. Some elements of it might be unconsciously included in the valuation. But strategic flexibility is, if at all, only valued in limited cases. Techniques, which are common in strategic planning, like scenario planning are not reflected in the valuation.

4.3.2 DEALING WITH UNCERTAINTIES

We are going to examine here the views and approaches of the interviewees that do not regularly use RO. As we discussed earlier, the decision makers determine the objectives of the valuation. First, we are looking at the objectives behind the handling of uncertainties. Then, we will recapture the main uncertainties. Lastly, is a summary of the methodologies used to handle the uncertainties.

4.3.2.1 Objectives

Among the interviewees we are focusing on here, the common notion was that the decision makers wanted certainty. Hence, uncertainties are undesirable and should be eliminated. This resonance with the human nature of risk avoidance (Kahneman, 2011, p. 344-350) and the cultural tendencies of Brazil (Hofstede, 2015). Yet, it opposes the nature of business because uncertainties are inherent in all business decisions (Block, 2007 and Trigeorgis, 1996, p. 33).

Moreover, if there would be a certain business everyone would do it and there would be no profit in it. Hence, uncertainties are an important factor to profitable business. Consequently, they cannot be avoided or eliminated. What can be eliminated is the risk inherent in them by creating options that limit possible losses.

Nevertheless, in the interviews it appeared that the only approach to uncertainties was to get certainty by obtaining the best information about the subject. The decision makers reflect this in the request for simple numeric answers.

> "And normally the shareholders need to consider this risk in the valuation. But in Brazil none of the shareholders that invested in [industry] considered this risk during the valuation for bit. Now this is a big problem." (Participant A)

> "Because we are talking about uncertainties. To evaluate the cash flow with risk techniques like valet risk or additional valet risk and then we don't have a value but values with certainty degrees. And the people that make decisions that make decisions in the companies that invest in this sector don't like to use or understand how to use this kind of technique. They would like to: "Oh, I like to have a value, one value." OK, one value, this is the one value a medium value or a probable value, but we have a probability that the value is not happening. It is difficult to understand. You need to invest in education for the shareholders in Brazil to understand this kind of technique." (Participant A)

> "So at these three gates you reduce the uncertainties. On each on you have valuation but more and more refined, detailed valuations in terms of the alternatives." (Participant D)

> "[...] we make sure that whenever a valuation is submitted for approval on a big project it has to gone through all the gates to assure that you have reduced much of the uncertainties on that valuation at that time." (Participant E)

The handling of uncertainties follows a somewhat common pattern. First, the interviewees try to obtain the best information possible on the subject. Based on that, they build the DCF valuation model. Then they run on top of this model a sensitivity analysis, through which they can determine the uncertainties with the most influences on the value. They build scenarios for these in the DFC model, which as a minimum includes a worst case and a base case scenario; some also do a best case. These scenarios help them to understand to which risks they are exposed. Yet, they do not know the probability for them to occur. Although, these sensitivity analyses and scenarios are part of the valuation presented to the decision makers their impact seems to be limited. These scenarios are not related to the detailed process that is know from scenario planning (reference). They only incorporate a modification of the most impactful variables, as determined by the sensitivity analysis, to either their best or worst expectable values at ones.

> "So all the time we have these two scenarios going. Oh, this is a scenario where things work out right and this is a scenario where things work out wrong." (Participant B)

> "And then during all those years we were able to gauge if things were going in the positive direction or in the negative direction. And with that we were able to say, OK with that our positive scenario is more the base case and when things were going bad, oh maybe we should weight to that negative scenario there then we are not that attracted and we sell partially." (Participant B)

> "So what we do, we try some extreme scenarios. OK, what if [product] prices were dead low, are we able to survive? This is something I do for myself. This is not required by the board. In one specific year we doing a lot of contingencies plans because we were not expecting this price we have a loss that's tremendous. And it is time to rerun the valuation model to see how we can survive in this adverse condition." (Participant F)

We can see a clear tendency for risk avoidance. If uncertain information needs to be put into the valuation model, the valuators prefer conservative numbers if no consensus can be reached or an increase of the discount rate. In addition, the focus on a consensus can be seen two sided. We can argue on the one hand that the more educated opinions are gathered the more reliable becomes the guess. On the other hand, the consensus is a way to avoid responsibility because many people are involved and all are equally to blame for an imprecise forecast. As result, nobody is blamed. Furthermore, when building scenarios the focus is on the worst-case scenario. With the risk avoidance and the lack of knowledge about the probabilities for bad or good scenarios to occur, the interviewees tend to underrate opportunities, which can lead to the objectively unnecessary rejection of a project. A phenomenon that is well discussed in the literature (Cohen et al, 2013; Gong et al, 2011).

> "But my personal believe about prices is that nobody knows what is going to happen. You better have a very conservative scenario for your cash flow to be sure that you are not going to have a high leverage in your balance sheet, that you are not going to be in a bad situation in the end of the day." (Participant F)

> "Competition, premiums that you might need to pay to get the asset. Or even discounts if you are not so sure about certain assumptions that you have included so you pay less." (Participant J)

> "Like if people tell me they are not so sure about something, I ask them: Please, give me your best guess, I you are, or let's be conservative and assume this will increase." (Participant J)

4.3.2.2 Key uncertainties

We already look at the key uncertainties or key assumptions in the section "gathering inputs for valuation". Therefore, we will touch on the subject here only briefly. The uncertainties concern mainly future costs, productivity, and revenues. The first two belong to the technical assumptions, which are less problematic for the interviewees because their impact on the cash flow is limited. Their development is better to predict and less extreme. They can be influenced and managed by company decision and in some cases, reliable information in form

of tests, quotes or, contracts can be obtained before investment.

> “So on this side, the project the technical uncertainties there is a strong method to get to them. On the other side, on the commodity assumptions we're still working on that. So there is no structured way to get on that.” (Participant D)

Critical for the interviewees are the economic uncertainties: prices for commodities, inflation, WACC and, exchange rates because they are market made and not under control of the companies. Thus, these should be the uncertainties, which the valuation would be concerned with most.

> “With costs we are very good in the estimates. CAPEX we used to be very bad, I mean seven to five years ago we caged our methodology for CAPEX estimation. We're getting good at it. Prices we are awful. We are extremely bad at estimating prices and that has a huge impact on our cash flow. We are in a price driven market.” (Participant F)

4.3.2.3 Techniques for uncertainties

Even though, the key uncertainties in these cases would be ideal for probabilistic modelling (Dias p.142), in most cases there are no other techniques involved than the sensitivity and the scenarios as descried above.

> "This is a big problem in this project because we are only working with sensitivity analysis" (Participant A)

> “With sensitivity analysis mainly. Manly we will have a base case. The thing is: the biggest uncertainty that we have is commodity prices in the end. We will basically deal with that on a sensitivity analysis. Not much of a statistical analysis linked to these uncertainties, not much. So wouldn't tell you that for every project we see we would do a statistical analysis on what is probability of my investment increasing by x percent. So on a project-to-project base it is something that can be done when we actually make the decision. But in the end you take your sensitivity and the worst case and your best case and mainly choose a base case and that is what you take to the decision makers.” (Participant E)

Some interviewees have reported the use of simulation software like @Risk to simulate probabilistic distributions for some uncertainties. The use of these techniques was sporadic but growing in their companies, as the experience with the techniques is increasing and users are becoming more familiar and comfortable using them. Yet the probabilistic simulation techniques like Monte Carlo are far from being common because users seem to lack training.

> “For [company] at a whole we actually have a very detailed cash flow model that we put all the risk factors, commodity, currencies I think even operational once, to define what is our probability of loss in a given years because that actually drives our insurance and hedging strategy. But not at the project level. We do that we actually use a lot of statistical analysis to analyse uncertainties at the [company] level. There might be areas and I would say that we had a time when in [product] the guys used a lot of

> statistical work to actually cope with uncertainties. But when comes to [company] as a whole it is not something that is used on a project by project base." (Participant E)

> "I think how we deal with them … the discount rate we add a premium. We still don't do that on a regular basis, we start to use Monte Carlo simulation, because instead of just one or three scenarios there will be thousand. So I don't know how it is in other markets, but we are using more and more Monte Carlo. I think we are not using more because it's a very powerful tool and you need to know how to use it. It's like baby steps. We are learning, then we are more comfortable and with that we use it some more." (Participant G)

> "We make scenario analysis, optimistic and pessimistic scenarios. And we work with sensitivity of the values. And in some cases but not all, we use probability distributions in @Risk inside the valuation, but it's not a general rule. It depends a lot on the market. So basically we make a range of values and if we think that the investment is worth, to know if things go bad how much we could lose" (Participant K)

Others report that they do not use such techniques because they cannot communicate the results adequately to the decision makers.

> "We don't use the Monte Carlo simulation because it is, most part of that, and I faced this problem in [company], we spent a lot of time explaining how we did modelling instead of discussing all the variables. Forget it. It doesn't work often, because often when we use normal distribution, log normal, exponential it doesn't matter it's a team work, it's a not the mathematicians work. Team work we talk to the strategic guy, we talk to the operations guys, the market guy, then we have the team consensus about the scenarios then we run them all and show to the board: look as the view of the company the value is that, the worst case is this and the best case this." (Participant H)

Furthermore, some interviewees reported that in some cases their central department, which sets the values for all or some key uncertainties, uses these techniques as well. Yet it appears that they do not provide these probabilistic models to the valuators. On the contrary, they supply a precise value or maximum a range. Futhermore,the use of centralized values for a big organization can result in a backlash regarding the values. Interviewees reported that the centralized values are not always up to date, especially when we are talking about short-term valuations of three or less years.

> "Inputs, in all valuations it's the inputs. We know that the macroeconomic area at [company] is very institutionalized. So there some variables that they update only very rarely. So there is a gap between the market and the institutionalized values. […] Because we as analyst often see that, for example inflation, it takes very long to update to the real values, because it's an institutionalized area, that only makes these values. But we are obligated to use them. This is a problem, many times the market already calculates with an inflation of six but we still have five, because they didn't do this economic analysis. I think that's, the general input data. We found this problem." (Participant K)

We have already observed that the valuators do not systematically control their valuation results. The same is true for their assumptions. The controlling is random. They assume that if

centralized departments supply values that such controls should happen regularly. We can observe a small pattern that the valuators, who purchase information from consulting firm, tend to control these but only these information. This suggests that they want to prevent wasting money on purchasing unreliable information. Yet, it is safe to assume, given the size of the projects, that the amount of money spent on buying information is far less than the amount that could be lost with a strong misevaluation, which depends on far more inputs than the information purchased. Consequently, valuators should be at least equally concerned about the internal assumptions as they are with external. Their lack of doing so indicates that they hold no or limited responsibility for the assumptions. It appears that their responsibility is limited to ensuring the reliability of the source of information, which internally is given by a consensus or a specialist department and externally by using reputation and some controlling, and the technical issues of the modelling.

> "Not much, not much, I think people do that but from time to time we review our project to see that the projects we have approved how it is trekking compared to what we envisioned. But there is not a formal review process. What we actually do: every year we redo the valuation of each project. So what we do every year. But not looking at the past, not looking at the sunk cost. What we actually do is project looking forward. It is not that we take a project approve it and never see it again. Every year on our strategic planning cycle we actually review all projects, all projects and all businesses." (Participant E)

> "Like a back test. We make this for the consulting firm that we use, to see how good they are, because in general this consulting firm overestimate the values. So that we have the notion whether the number we put there is optimistic or pessimistic, so maybe we need a discount on the number. And for us we do that, but not in all cases, that you look back what you did. That depends a lot on the chef of the investment department. Some chefs like these kind of analysis." (Participant K)

It is obvious that the mentality and the methodologies for handling uncertainties is not up to date with the recent developments in the academics. Furthermore, interviewees observe that their methodologies are no longer fit to cope with the growing uncertainties of our times. We have to take into special consideration that the Brazilian economy enjoys strong protection by its government from foreign competition, which is only slowly opening up (Hansen, 2013). Hence, the element of international competition is in some areas of the Brazilian economy a novelty and adds further uncertainties for the local companies.

> "In the same way just recently [company] stop being an [product] company and became a commodity company. So the uncertainty of commodity prices is a new reality for [company]. It's something for the last six/seven years. So we are still coping with that and as the current point for the last two years we are no longer doing acquisitions we are no longer approving major new projects. […] there started to be a discussion on how to improve the valuation method, review the WACC and do different ways for different commodities. [...] I believe the learning from the last years of how volatile [commodity] can be at all. Being exposed to the volatility of the other commodities there will be discussions on better ways to evaluate. But nowadays and in the past, [these discussions were] not the case. The market changes but the

company takes a while before the company actually changes its practices to fit the market.” (Participant D)

4.4 USING REAL OPTIONS

In the following section we will examine the use of RO in the interviewees' companies. To do so we will first look at the individual experiences of the interviewees with RO. Then we will focus on how they use the RO in their current jobs and companies. Finally, we analyse the challenges of using RO.

4.4.1 EXPERIENCE WITH REAL OPTIONS

All of the interviewees are familiar with the term Real Options and had an idea of the basic concept. Most of them had been exposed to RO in their master programs. Nevertheless, only three of the interviewees actually performed RO valuations outside the classroom themselves, of which two did their thesis about RO. Two more reported that RO valuation had been done under their supervision. Consequently, the knowledge of the others is superficial. In their perception, RO is reduced to a complex mathematical model for special applications. This also holds true for the two supervisors. Due to companies’ lack of experience with RO, we can observe some misconceptions about them, which we will see hereinafter. The participants can be divided in two groups: one with three expert users and another with seven inexperienced users. Nevertheless, even of the three expert users, only one is currently performing RO valuations.

4.4.2 USAGE OF REAL OPTIONS

With only one expert currently using RO we can only report very limited usage of RO. Of the seven companies interviewed, only one is a regular user of RO. Two companies identified themselves as sporadic users of RO. Only in one of them, the interviewees are themselves involved in the RO valuation. Hence we will hereinafter examine how the sporadic user and how the regular user apply RO.

4.4.2.1 Sporadic Usage of Real Options

We are going to discuss the practice of the sporadic users of RO and the opinions of the inexperienced users because they are congruent. Users in this group consider RO too complex for various reasons, which we will examine, in the next section. Therefore they use or would use RO only in special cases. A main attribute for such cases is high uncertainty about one or several inputs. Yet, these high uncertainties are, in the eyes of the interviewees, uncommon in their business. Hence, RO would only apply rarely.

Cases in which the inexperienced interviews use or would use RO are the valuation of a distressed company where the turnaround is uncertain, or pre-exploration valuation of a mine. They also reported the utilization, when there is not sufficient information available to either conduct a multiple valuation or build a DCF model. Yet, it is questionable whether a proper RO valuation can be done, when a DCF is not possible. Some also stated that they would like to use RO when they do not have the time to build a detailed DFC model or when they do not know, in long-term projects, for how long to discount. We can see here clearly a misconception that the RO is an independent valuation model and that the probabilistic determination of variables substitutes for a detailed analysis and model building. Herein lies the biggest misunderstanding. Expert users understand the RO as an add-on to the DCF model (Copeland & Tufano, 2004).

> “But nowadays it is already it is already kind of established that for a developing asset or closed mines, you know things that are not producing that we can't have revenues and costs it is an option and sometime we use.” (Participant K)

> “We used in the past for example real options for deposits that are not operating, but we would need to know the value of holding that, without extracting. So we used this methodology. The benefit was that it solved our issue of not having any comparable because it's not under development so there were no [...] business comparable. We couldn't use comparable and we couldn't build DCF because it would be too far away, we didn't know the information precisely in terms of investment costs. So we decided having this kind of financial methodology of real options would work. It's a theoretical number but at least it gives us an average” (Participant K)

Others report that RO are used when the question arrives whether or not to execute an existing option. These options are not evaluated earlier when starting the project but only during their execution, when in a special case the divest or hold decision has to be made. RO are also used to evaluate guarantees that the companies give to their contract partners, in order to determine the risk they are exposed to.

> “What I've seen are lot of real options being valued when we actually have to make a specific decision on the option. Let's say if I'm going to do a valuation of a [production facility], of course it can add into the valuation of the [production facility]: look, if I buy this [production facility] now that can I defer the

> development of x years and so on. So I don't see people actually building this into their models. But when we get to a point when we are confronted with an option. Let's say we are obligated to invest in x years and somebody comes to us and says let's negotiate an extension then we will go and evaluate that option to see if that makes sense. So we would use that a lot to value the real options that we actually face not to find real options embedded into the asset. But we do that in very specific situations." (Participant E)

We can see that the application or the wish of applying RO is not going beyond the level of mathematical valuation model. Yet, we also find evidence that the RO logic is used without the applications of the RO valuation when we read statements like:

> "[...] but in [company] we have already started some project that were not with good NPV barely positive in their NPV, or IRR was not better than our WACC. Just because we knew that the next step, the first expansion of the project would be a better one." (Participant H)

In conclusion, for inexperienced users, RO are a complex purely mathematical model that they use not even once year. They lack the full understanding of the method and even show misunderstandings, which hampers the use of RO. The fact that the answers on RO from this group of interviewees are particularly short and general, makes a more detailed analysis impossible and stands as evidence for their limited practical experience.

4.4.2.2 Regular Usage of Real Options

To clarify we are here discussing the point of view of only one interviewee. An interviewee that is clearly an advocate of RO and whose company is currently in a difficult business situation. Therefore the interviewee is very secretive about details on projects and practices and he has a clearly positive posture towards RO and the processes in his company.

In this company, RO has reached the final application stage (Dias p.72). It is embedded in the company philosophy. The term RO option is replaced by thinking in flexibility, having flexibility in projects as an aim for the project planner. Therefore the option point of view is always in the back of the mind when engaging in a new project or challenge throughout the ranks of the company.

> "Yes it is. I think one of the most important things about real options and how we apply in [company], and I think in other companies too, is that the basic concept of flexibility is in our veins. And when you start discussing a project or a different method in a financial expect, when we say: yeah I want to have more flexibility, it's easy to understand." (Participant C)

> "My point of view real options are a good concept to evaluate any kind of project and in a way or another we always use the concept in the background. Usually we do not make it explicit; we do not describe it in a framework: real options. But we use it in the background. So we use the strategic point

> of view of it." (Participant C)

Nonetheless, for the interviewee it is clear that the RO methodology is too comprehensible to use fully all the time. Depending on the project aspects, it can range from a qualitative/logic modelling of the options to a full scale mathematical modelling using for instance the Black and Scholes model. Besides time and available data, the nature of the project determines the degree of modelling because, according to the interviewee, some things are easier to capture in numbers than others are. It supports the idea that the specific number, even though important, is of less importance than the qualitative understanding of the options and its implications.

> "In any kind of negotiations we will use it but we don't put it in numbers because we may put it, but we don't call it real options I believe. Except for some for evaluations, some specific evaluations when we see that real options is what we can get to make value, then we can make the value explicit in the typical frame work." (Participant C)

Especially for the communication of the valuation, a qualitative view is more appropriate to ensure comprehensibility. Focusing on technical details only confuses and distracts for the important issues. The method of choice here for the interviewee are tree diagrams. Morever, it appears that his company is consciously or unconsciously using a method of thinking that reminds of scenario planning (Day et al., 2000). The interviewee seems less concerned with exact numbers than the other interviewees, stating that the strategic value is not just a phrase but also an important value adder for a project. He even admits that sometimes hunches need to be considered, given that never all information is available.

> "Again you don't have to say to the people that you are arguing with Black and Scholes formula, that you are using the standard deviation, you don't have to use the math with these guys. You use the concept. If you safe the option for when the uncertainty is already put aside you make value. It's easy to understand and to show that." (Participant C)

Yet you have to be able and willing to react upon new information and possibly correct your actions. This thinking and flexibility is the embodiment of the RO philosophy. Using the RO methodologies more qualitative than quantitative, the interviewee considers RO a good tool to communicate value and strategy of a project, quite in opposite to the inexperienced users.

> "In other occasions, as I said we worked with the regulators. Working with the regulators real options is a good way of arguing with them. Therefore, I believe it is a very structured way, understandable way of making your point. It is very useful for that also." (Participant C)

We can also see some differences in the institutional set up between the experienced users company and the ones of the inexperienced users. As literature suggests the timely and objective execution of an option (Copeland & Tufano, 2004) is crucial to harvest its potential

value. To ensure the objectivity the company as a so-called portfolio manager that overlooks the several executing manager to ensure that business decisions are taking in objective manner. In addition, this portfolio manager is involved in the planning of the project, hence bringing valuator and executors closer together. Furthermore, to close the communication gap between the planners/ valuators and thank to the nature of the business, each project is written down in a contract in which the options are clearly stated and their logic becomes accessible to people not involved in the valuation process. Yet, it is questionable if these elements are consciously placed to mitigate the challenges of the RO usage, because upon being asked for specific process the interviewee can not identify such and stated that things happening automatically due to the mind-set of the company.

> "It makes sense, if you thought about the instance of the project and then you write everything down in a contract and then that's it. When the uncertainty happens and you have something that could cause certain loss to you, you are kind of protected with the real option embedded and you write it down" (Participant C)

> "That is interesting, because I feel that is automatic. The best way is to put it in a contract when it's in a contract it is automatic. Unless people are completely blind to the contract that they are managing. I cannot suppose that. I think that it is automatic." (Participant C)

The same is applicable to a possible incentive system to motivate managers to make decisions that are often perceived negatively such as divesting or closing operations. Here he can not point to a specific system just the fact that for a manager it would be of more severe consequences keeping a bad asset than getting rid of it, especially giving that the portfolio managers is looking over his shoulders. The interviewee also indicated a strict firing policy for managers that do not execute options in the company's interest. That seems questionable however, given the company's past record.

4.4.3 CHALLENGES OF REAL OPTIONS USAGE

Given that RO are only rarely used, we need to question why. The common answer among the interviewees is that RO valuation is too complex. In details, that touches three areas: education of decision makers, education of the valuators and institutional factors.

Education of the decision makers does not necessarily concern formal education but the familiarity with the method and its basic concepts. From the point of view of our interviewees, the decision makers lack these. Hence, they do not understand the valuation. In addition, a valuation that they do not understand they do not trust.

> "Most part they do not understand, they do not have the refined finance studies, and they don't know

> enough about options.” (Participant H)
>
> "It is very difficult to introduce other kinds of valuation techniques because the people in Brazil, principally the executives, in Brazil are very used to NPV and IRR” (Participant A)
>
> “Why? I will give you my opinion. I think it's to complex for you to explain to a top manager. So one thing you have to take into consideration: A number is only as good as your ability to explain that model [...]. Sometimes with real options it's not that tangible to convince your top manager. Look that there is this extra value in it because there is the optionality in here, here and there. Although it's right and the value is there, this is my experience when I saw people trying to use real option, it doesn't have much traction when actually explaining that to your top management.” (Participant E)

Yet, we are here not only talking about education specific to RO. As we discovered earlier, decision makers want certainty, which stands in the opposition to the flexible range of values that a build the fundamental of a RO valuation. With this mindset, a RO valuation will not attend their needs. Consequently, as the interviewees report, trying to communicate a RO is rarely successful. Results that cannot be communicated are worth nothing, so they do not use the method and rely on DCF. The conservative attitude of decision makers towards new valuation methods in general discourages the use of more elaborate tools.

> “First of all you must convince the executive and the directors and the board that every project has options embedded in it. You can expand, you can reduce, you can sell the company. But the point is that they are not comfortable with that. There mathematics and also statistics embedded in that and they are not confident in that statistics.” (Participant H)
>
> “Yeah, when I say the top management is the CEO of the company or the board of the company. And I've seen some areas here like to use real options. But depending on the project when you add real options you have much more value in the end. But whenever they used that they saw that the decision maker was sceptical if that value was there.” (Participant E)
>
> “Nowadays we are very strict to this method we are not looking outside of the box to see, OK we can do something different.” (Participant F)

Some interviewees report that the RO have been used as a political tool to make certain projects look more promising. This tactics has made decisions makers even more careful to trust RO, especially in tough economic times like today.

> “The usual answer for that is: “this is just a way to improve a bad project.” You should look at a project bad or not and say: look this are the options you can exercise or not and this is the total project.” Participant H)

In addition, the technical education of the valuators plays a crucial role. Interviewees report that the amount of employees familiar with the method in their companies does not allow the usage of RO as a standard method. Furthermore, we have already observed some misconceptions about RO that result from maybe insufficient training even of the ones using

it.

> "But with real option in this case the complexity of that require much more savvy analysts. You wouldn't have this let's say technology in every area of [company]. This is one drawback of real option." (Participant E)

Another common misunderstanding is that building the assumptions for RO is harder than for a standard DCF because it has to be volatility or probability distribution. Yet it is hard to believe that finding one certain value is easier than developing a range of possible values. It appears that the old thought patterns in combination with lack of familiarity with RO result in these misconceptions.

> "At least from my point of view there are some variables that to use in the model that is hard to come up with them in real life. I don't know what people think about that but for me is this. It is very hard to come up with this estimates of risk and probability. So I like the idea. Maybe in the near future we don't." (Participant G)

Yet there is no doubt that the model building is more complex and needs higher software and mathematical skills than a standard DCF model. This results in a more time consuming process, which some interviewees state they do not have the time to undergo. Therefore, interviewees fault user-friendly support software.

> "I know it's a real good option to make some scenario for the business. I could run some statistics analysis. We have this price but we have the statistics distribution, how would be the NPV into this. But I don't have time to run the statistics analysis." (Participant F)

> "Now I can't use this kind of techniques because I know that I don't have software that we can produce the valuation with real options." (Participant A)

> "I have never seen a real good tool for business valuation. Any. We are always working with some models, with some software for business valuation but they are not flexible or user friendly or even sometimes they are very heavy to work with, our computers we would need better computers to work with. Would be better to have good software or good IT solution to do business valuation. That would be good for somebody who starts a business." (Participant F)

In addition, interviewees involved in several decades' long projects report that the RO values for such projects become unreasonably high, so high that they do not seem trustworthy any more. Yet it could not be determined whether these high values are due to the nature of the projects or unbalanced valuations. Even though the majority of interviewees considers RO a (potentially) useful tool, some do not see any value added by using RO and claim that they can reach the same scope of analysis by using the more traditional tools we discussed.

> "Well, they are different, but it is getting the cash flow methodology and applying with different tools right? I mean, with a different approach. But, I mean, if you think it rigorously, I mean it's not, the discussion is the same, right? What I'm saying that in practice it doesn't add value that justifies it."

(Participant B)

> "But we hadn't done. Because we thought, nobody would put value into that exercise. But it was something that we could have done, even though the result wouldn't have been positive for us to keep the asset, because we have tested by other means. For example, the level of price we would need to restart. So using the DCF, we rather arrived in the same response in the same result but without using the methodology itself. Because it is not so easy to use and easy to explain." (Participant J)

Lastly, we have to see the institutional issues. The decision makers and the project executives are not connected with the initial project strategy. As the decision, makers are not involved with the project strategy they seem to look for clear, straight projects that are easy to supervise and not complex projects full of options. In addition, because they are not familiar with the projects details they can be doubtful about the relevance and usefulness of embedded options. Hence they do not trust and neglect options.

> "[...] the NPV would be slightly positive/slightly negative but we would have a lot of embedded real options. We hired some specialists in order to help us with that. We had McKenzie, we had PUC and even though the board was sceptical about that: OK, you can do this, you can do that. But they [board of directors] do not believe that you have these embedded options. That's the point you have to convince that the real options, they do have that option and they can exercise these options or not" (Participant H)

So far, all the presented issues prevent the RO method to be applied and affecting the company's decision-making. In addition, it is obvious that in an interviewee group with such limited exposure to RO can hardly provide technical insides into the method. Nonetheless, the local RO researchers and consultants, which are regularly involved in RO valuation, brought to attention that the values of RO valuations are often just of theoretical nature because the options, considered in the valuation, are not efficiently and objectively executed due to company politics interference. This issue has been discussed and acknowledge in academics (Copeland & Tufano, 2004) and it seems specifically probable given that complains about the interference of company politics in the valuation process are common. Yet the regular RO user did not report this as a challenge.

6. FINAL CONSIDERATIONS

This work aims to provide new impulses for professionals and researchers in order to contribute in the development of the field of valuation and RO research. Nevertheless, this work has limitations to its meaningfulness, for one due to the nature of the research, as explained earlier, and second due to the scope of the research. We will first make a general conclusion of the findings, then, we will discuss the specific contributions to professionals and academics, followed with the limitations of the thesis and, last ideas for future research.

6.1 CONCLUSION

We can clearly see that valuation is more than just numerical models that have to be applied on a set of information. Corporate valuation is a lively process embedded in the functions of a company. Hence, we have to expand our scope. What is a good or successful valuation? Damodaran said that a valuation should be more precise than that of the competition. Yet, just having a better number is not enough. The number must improve the decision-making of the firm. In order to achieve that a least three aspects of a valuation must be better than the competition: the gathering of information, the technical handling of the valuation model and, the projection of the results into the decision making process of the company.

There are plenty of works tackling the technical aspects of valuation but the information gathering and the projection of results are neglected. A valuation model is only as good as the inputs. Gathering these takes practitioners most of their time. Considering the time intensity and the importance to the overall result, it needs more attention. We need to know more about firm’s processes to obtain information, how the knowledge, which is spread throughout a company or even market, reaches the valuators and, how the valuators choose out of the bulk of information the inputs for the valuation. The thesis provided insights on which information and from which sources the valuators gather, but more insights are needed to determine best practises and to draw a complete picture of the information gathering aspect of valuation.

We have seen that it is of highest importance that the result of a valuation be meaningful to the decision makers. Only when they understand a valuation, they trust it, and only then they implement it into decision making. Therefore, the choice of a valuation technique is also determined by how meaningfully it can be presented to the decision makers. In order to better comprehend this dynamic we need to understand what decision-makers expects from a valuation and how these results are handed back to them. In this aspect, the thesis is not

conclusive because it is based on the statements of valuators.

On one hand, decision makers demand a clear numerical answer from the valuation. On the other hand, they understand that this number is not complete because they take the value as one of several decision criteria, of which none other is numerical but strategic nature. This appears paradox. It reflects the search for a certain base of decision by demanding clear numbers. But it also shows the need to conserve the influence on the decision-making. By excluding strategic elements from the numerical valuation, decision makers prevent an objective look on "strategic value" and thereby any control of their subjective goals and assumptions. Without such control, their decisions are less likely to be questions. Hence, they keep greater freedom as decision makers.

This already shows that the firm's strategy can only be indirectly reflected in the valuation. The full strategic consideration of the decision-makers are not disclosed to the valuators. The strategy known to the valuators determines which objects to evaluate and which input values are acceptable. Yet, it does not provide much ground to evaluate strategic options to the firm.

Furthermore, the valuation of RO inside a project is hampered by the division between valuator and project executor. Only if they work hand in hand, useful options can be found, valuated and, executed. We cannot observe such a cooperation in the field. Hence, it is questionable how the incorporation of RO into the valuation can successfully work.

Despite the strong theoretical and developing tested evidence that RO can improve the performance of a company because it allows a more precise and realistic valuation, it is rarely utilized. Thereby, companies are missing out on an opportunity to set themselves apart from the competition and develop their valuation process into a competitive advantage.

The symbioses of financial and strategic elements does not occur during valuation. It is open for debate if and where is happens. Nevertheless, it is questionable, how a conclusive and profound strategy can be, if the uncertainties are suppressed. Uncertainties must be known and qualified and quantified in order to develop a strategy with the appropriate degrees of flexibility to react to them. This qualification and quantification is done during the valuation. But if the received results of the valuation is restricted to numbers simulating certainty, it is doubtful that the information about uncertainties is passed on to the decision-makers. Consequently, they miss information for adequate strategy development and decision making.

Earlier we criticised the practitioners and academics in the financial area for an overly strong focus of the risk inherent in uncertainty. Considering the statement of the interviews, it appears that the decision-makers emphasize the element of opportunity. They want a valuation that provides as much certainty as possible and then use the argument of "strategic value" to

find additional value (or opportunity) in a project. This gives the vague idea that risk and opportunity might be equally considered during a decision phase, yet, independent of each other and not objectively qualified or simply insufficiently. RO can be the tool that unifies the two and enables more robust strategies due to more realistic information from the valuation.

Therefore, it is no surprise that the utilization of RO, in the companies interviewed, is far below the results of other studies. For one we can attribute this to the unfavourable cultural traits of Brazil. However, the interviewees provided us with further arguments to explain the rare utilization of the RO method.

Their main argument is the lack of educated work force, which resonances with Block's (2007) findings. On the one side of the spectrum, it is lacking executives that understand and value the advantages of the RO and on the other side; it lacks employees with sufficient mathematical and software skills to apply the method. Considering how little RO are taught in Brazilian MBA programs it seems unlikely that significant improvement can be expected soon.

An aspect that can be explained with the cultural tendency uncertainty avoidance and the lack of education is the top managements fixation on “the right” number. This is reflected in a general corporate culture of risk avoidance and uncertainty elimination, which makes companies turn a blind eye on risks and opportunities surrounding them, instead of preparing itself for them. It is this unwillingness of the top management to except and deal with probabilistic answers that hinders the usage of approaches, which provide a frame of possible answers rather than one “precise” value like RO. With the lack of top management support, it is unlikely that this corporate culture is soon changing. Hence, the utilization of RO is unlikely to significantly increase.

It becomes clear with these observations that a company’s hierarchy, organizational structure, organisational culture, process and, the individual’s motivation influence strongly the valuation process. These are all elements of organizational behaviour. Consequently, merging both research fields promises many important insides.

We earlier raised the question of a successful valuation. It would require an ongoing analysis of past valuations to determine whether they were successful or not. Such a reflection can than serve as a starting point for constant improvement of the process. Yet, we hardly find such institutionalized reflection points. A reason can be that valuators do not feel favourable or unfavourable consequences due to the accuracy of their results.

The valuation process shows its main variation with respect to the nature of the evaluated asset. Whether it is already in the firm’s procession or not and whether it is going to operate

the asset itself or not have the biggest influence. Depending on the situation, different departments execute the valuation. This results in a process variation.

It seem that the following four aspects drive the choice of the valuation techniques.

First, which techniques are accepted in the company and specifically with the decision-makers.

Second, the time available for the valuation – especially comparables or multiples are used for time sensitive valuation.

Third, the resources available – for example, simulations require special software end employees that can operate them.

Fourth, how sensitive the valuation object is to the company – in general, the higher the possible value of a valuation object the more sophisticated techniques and different techniques are applied.

In conclusion, this work raises more questions than it answers. Yet, it became clear that uncertainties and strategy are insufficiently reflected in valuations. For one the latest technique to merge these is hardly used. Moreover, we find a culture in the companies that neglects uncertainties and disintegrates strategy and valuation. This strategy emerges from the top of the companies.

6.2 CONTRIBUTION FOR PROFESSIONALS

The application of the RO logic can improve the performance of companies, which resonates with the idea of valuation as a competitive advantage (Klingbiel & Ander, 2015). Hence, it is in the interest of professionals to apply the RO logic to their valuation problems. The RO logic can be the application of the full RO method. However, it also refers to a mind-set that accepts uncertainties, recognises strategic flexibility as a necessity to successfully deal with them and considers this concept in the valuation process.

In order to successfully apply the RO logic companies need the appropriate culture, structure and, processes. Following we will share the insights that the thesis provides in respect to these.

The education of practitioners must be improved if they want to use the advantages of RO. This includes the education about RO and more. It is not enough to only teach the method of RO in special courses and valuation classes. The basic concepts of strategic and operational flexibility need to be stressed in all courses concerning administration, for all levels of

management in an organization to understand and value the basic principles. This will allow a more global understanding of RO, which expands beyond the general opinion that restricts the view of RO to mathematical models. Of course, it is desirable to increase the offers of RO courses to have more professionals who can actually execute a RO valuation, but only if the organization appreciates the results will it have a positive impact on the organization's success. Furthermore, several authors stress and the interviewees support it that to fully understand and apply the RO method strong mathematical and software skills are needed. It is worth stressing that education is not limited to the university level.

Beyond education, this work provides evidence that RO valuation can only be successful if the organization provides an environment that is open for its impact. That starts with the right mind set as explained above and extents further. The management literature shows that, as for most issues in management theory, the top management support is the key factor for successful implementation of the RO method in a company. This support needs to go beyond lip service and this work delivers indications that it has to effect in particular two areas of the organization: its organizational culture and its organizational structure.

When comparing the one company that regularly and successfully uses RO to the others, we see a major difference in the organizational culture. In the RO, practising company uncertainties are accepted as natural component of business life. Hence, it is not the aim to reduce uncertainties but to reduce the risk associated with them and at the same time to stay prepared to take advantage of the opportunities embedded in them. Therefore, uncertainties are clearly named as such and the valuation process does not try to put a fixed value to them. On the contrary, the idea that valuations only provide a decision frame is appreciated and thus strategic flexibility, which enables to explore the frame, is highly valued.

Furthermore, this work provides evidence that in order to successfully implement RO into the valuation process of a company the organizational structure should fulfil two conditions. Firstly, a strong and mutual information flow between all parties involved in the valuation (decision makers, valuators, and executives) is needed. This ensures that all strategic and operational assumptions are included in the valuation and that at the same time everyone knows which options under which conditions exits and how and when they should be executed. This free information flow might collide with the (information) privileges of higher hierarchy levels, which is identified as one of the main reasons for companies not to use RO. Hence, it seems indispensable that the top management leads by example.

At the same time, all involved need clear incentives to fully cooperate in the RO valuation as well as in the execution of the project. As with all valuations, a RO valuation is only as good as its inputs. However, the information providers and even the valuators themselves might

have conflicts of interest. Therefore, it is desirable that all have clear incentives to be as objective as possible in the valuation. In order for the management to control this, it can implement process to later assess the quality of the valuation in comparison with the actual project data. None of the interviewees can report about clear process in their organization that tried to evaluate the quality of the valuation process. Thus, especially in larger companies, disconnecting the valuators and information providers from possible liabilities of the valuation.

Moreover, implementing a formal review process for finished valuation, would provide a starting point for the constant improvement of the valuation process. Thereby the valuation as a competitive advantage can be further developed.

On the other hand, a RO valuation can be as objective as possible as long as the options embedded are not recognized and executed they are valueless and so is the RO valuation. To ensure the execution of the options the executives need not only clear information about them but also incentives to make hard decision when facing conflict of interest.

6.3 CONTRIBUTION FOR RESEARCHERS

Whilst there has been a fair amount of research on the valuation methods companies use, most of them have been quantitative results. Furthermore, little research has been done on this matter in Brazil and particularly non on the matter of the usage of RO options. Therefore, this work does not only provide a unique inside into the application of RO in Brazil but it also enlarges the limited research about utilization of corporate finance methods in Brazil. More it adds to the global research a rare view on valuation in companies that extends beyond models and statistical numbers.

Therefore, this work is able to find more evidence for Block's (2007) findings on the rejection of RO, proving that the basic principles hold true also outside of North America. Even though lack of education might be, a more dominant factor in Brazil than Block observed in his study.

Thanks to the detailed view that the qualitative research method allows, this thesis goes further. It produces evidence that the topic of valuation cannot be observed from a pure financial perspective. The process of valuation is deeply embedded into an organization. Hence, the success of any valuation is directly linked to the adequate functioning of the whole organization. Thus, we need to understand how the process of valuations works in a company as an interaction of organizational culture, organizational structure and the valuation tools at hand. Thereby a thesis that started to explore the connection between strategy, uncertainties

and valuation went further and shows indication that tools, such as RO valuation, might not be enough to achieve strategic flexibility if organizational behaviour is not included in the considerations.

In order to comprehend valuation in the organizational structures, this work introduces the idea of the valuation as a process. It goes beyond the approaches of the standard textbooks and tries to innate the description of the valuation as an organizational process involving human resources and their interactions. This path of research seems of high interest as practitioners seem to spend considerable more time and effort in gathering information and interacting with colleagues in the course of the decision process than on building the mathematical models.

The interviewees have expressed that in their opinion, the RO might be a powerful tool but in most cases, it appears to them too complex for them to apply in their work. This issue should be tackled with an improvement in RO relevant education. However, it also shows that the development of the method has left out a big part of the practitioners. Especially the latest publications on RO are focusing on improving the methodology. They expand it to new valuation problems, include more factors into the valuation or, improve its mathematical accuracy. This, even though expanding the scope of the method, is increasing its complexity and the need of mathematical skills, which is one of the reasons for practitioners to reject RO. In order to increase the usage of RO, it would be desirable to develop the theory towards the needs of the practitioners and reduce its perceived complexity.

6.4 LIMITATIONS AND DELIMITATIONS OF THE RESEARCH

Besides the limitations due to the choice of research method, the thesis is restricted by its scope of interviewees. Among them are no top executives and only valuation practitioners. Therefore, it is lacking the views of decision makers, information providers and project executives. Furthermore, the interviews exclusively work in Rio de Janeiro or surroundings. Therefore, whether the findings can be expanded to all of Brazil has to be tested. Also, the projects that the interviewees deal with all related to equity purchase, exploration or commodity production. Hence, the thesis provides no insides on technology projects, consumer goods related ones or property related ones.

In addition, the thesis only found one practitioner who regularly uses RO. Therefore, its implications on best practice for RO are very restricted. Among the projects of the interviewees, we have a mixture. The thesis includes the valuation of completely new

projects, the valuation of running projects that are in possession of the company and the valuation of running external projects or assets. Each of which has unique features to its valuation process. These features are not separately scrutinized in this work.

Only a limited set of questions can be asked. Consequently, some issues of interest cannot be touched. Among them the consequences of an imprecise valuation for the valuators and the clear separation between company and operational strategy.

6.5 RECOMMENDATIONS FOR FUTURE RESEARCH

As far as this work goes, it discovered two main areas to explore in future research. One is to improve the usability of the RO method for practitioners and the other is the connection between valuation and organizational behaviour.

To increase the user-friendliness of the RO method it seems desirable to advocate RO options more as a way of approaching decisions than just a mathematical tool. Strengthening such a view will ease the acceptance of decision frames rather than valuations that focus on precise numbers as result of valuations. That would allow to develop the RO method towards an easier usability and understanding with a possible step model in order to adjust the depth of the RO analysis to their and the project's needs. The whole process could be supported and facilitated by the development of appropriate software tools that would help practitioners apply RO.

Secondly, with the evidences that RO needs the right organizational setting to fully perform, it seems pressing to strengthen research, which combines organizational behaviour and valuation, in particular RO. With concern to RO it appears promising to investigate organizational decision-making, incentives programs that influence the individual decision making and the connection between hierarchies and structure on the information flow during the valuation. In general, this direction seems not only interesting to RO in particular but the whole area of valuations in general.

Thirdly, the description of the valuation process needs more details and basis. It would therefore be desirable to conduct ethnographic studies inside several companies to observe the process first hand and fill in the blanks that the interview-based research leaves.

Lastly, to investigate the connection between strategy and valuation further, we require research that reaches beyond valuators. Several approaches seem interesting here. For one, a case study of all relative levels of hierarchy and departments of one company can provide a rich and complete picture. On the other hand, interview series similar to this one with the

different participants of the valuation and corporate budgeting process could produce more representative results. Such results can then be used to develop models to be tested in quantative surveys.

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