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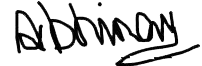
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Assignment Title: Analysis and Interpretation of Financial Accounts

Date of Submission: 4th August 2023\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Word Count: \_\_\_3841\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Signed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Executive Summary**

The report works on the detailed study of real options, analyzing their function as an emerging business development tool. Exploring the positive and negative characteristics of the real options and their functions in the development of the business, the study provides in-depth research on them. An analysis has also been done of the reports suggested, and data has been stated based on the research done before. The study considers real options to be a significant, well-developed business tool that is beneficial for entrepreneurs and organizations.

# Introduction

# Real Options are an economically valued right that enables a company manager to have the option to pursue or forgo a particular decision that involves business endeavors or investment prospects. The term "Real" stands to explain the initiatives using tangible assets like equipment, real estate, buildings, and inventory rather than financial instruments. In detail, Real Options grants a company's management the right but not the obligation to pursue particular business investments or opportunities. Real Options consider projects that include physical assets rather than financial instruments. Corporate managers and financial analysts use economically worthy real options to guide their judgments (Machiels, Compernolle, and Coppens, 2021). The report will provide a complete analysis of Real Options, exploring the insights of its functions as a business tool and analyzing different studies to provide authentic reports about it.

# Discussion

1. ***The idea of using Real Options as a tool for business decision-making. A discussion of the advantages and disadvantages of Real Options should be included as part of your assessment of their utilization.***

While evaluating and managing flexibility and uncertainty in investment initiatives, businesses employ real alternatives as a strategic decision-making tool. Real options offer a framework for evaluating managerial decisions that goes beyond the scope of conventional financial metrics like net present value (NPV) and internal rate of return (IRR) (Kumar, Tiwari, and Alam, 2022). Financial options, which are contracts that grant the holder the right but not the duty to buy or sell an asset at a defined price within a given timeframe, are the basis for real options theory.

Real options give management the flexibility to modify their plans and investment choices in response to shifting market conditions, advancing technology, competition activity, and other unpredictable factors (Felin *et al.* 2020). Businesses can more effectively capture the potential value of their assets and reduce risks by including real-time option analysis in their decision-making process.

An analogy between financial options and managerial opportunities in the actual world serves as the theoretical foundation for the use of real options as a tool for business decision-making. The extension of financial options theory, known as real options, is used to appraise an investment's or project's flexibility and potential upside in addition to its fixed cash flows (Morozko, Morozko, and Didenko, 2020).

Managers analyze projects based on anticipated cash flows and then discount them using a fixed discount rate to determine the project's current value using traditional investment evaluation methods (such as Net Present value, or NPV). But these approaches frequently ignore the importance of managerial adaptability, including the capacity to respond to shifting market conditions, technical developments, and competitive dynamics.

According to real options theory, managers have the option to change their course of action in response to evolving conditions. Many business decisions entail a succession of interconnected choices across time. These options are comparable to financial options, which grant investors the right—but not the obligation—to buy or sell a financial asset at a specified price within a predetermined window of time (Craighead, Ketchen, and Darby, 2020).

The Real Options theory explains the component listing as follows:

Underlying Asset: A financial item like a stock or commodity serves as the underlying asset in financial options. A real-world investment or project, such as a new product launch, research endeavor, or expansion initiative, with unpredictable future cash flows serves as the underlying asset in the case of real options (Danylyshyn *et al.*, 2019).

Contracting Option: A financial item like a stock or commodity serves as the underlying asset in financial options. A real-world investment or project, such as a new product launch, research endeavor, or expansion initiative, with unpredictable future cash flows serves as the underlying asset in the case of real options. (Fernández, 2019).

Investment and Expanding Option: The most typical real option is this one. It speaks to a company's capacity to invest in a project with a positive net present value when the market is favorable. The option to invest enables the company to start a project when it becomes profitable, just like a financial call option offers the holder the right to buy an asset at a certain price (A., 2023).

Option Interactions: Real-world investing decisions sometimes involve a variety of options, some of whose values may be correlated. Understanding a project's overall worth requires taking these interactions into account (Machiels, Compernolle, and Coppens, 2021).

Switching Option: A real option grants a company the ability to shift its course of action during the course of a project. For example, a company may begin with a project, taking the initiative to develop a product, but later change the course of the original plan if it does not seem promising.

These tools enable managers to assess the importance of managerial flexibility, take uncertainties into account, and develop more thorough strategic plans. However, implementing real-options analysis stands to be a complex process and requires a core understanding of the concept.

***Positive Characteristics of Real Option:***

Real Options are a useful tool for business decision-making since they have several appealing qualities. These favorable traits include, among others:

Flexibility: Real Options acknowledge and evaluate the need for managerial adaptability. Businesses frequently operate in unstable and dynamic contexts, and Real Options give decision-makers the flexibility to modify their plans as new information becomes available (Lawrence, Bell, and Stroombergen, 2019).

Enhancing Value: The estimated value of a project or investment can be raised by including Real Options in the investment appraisal. Real Options take advantage of potential upside prospects that conventional valuation methods can miss by considering the potential future strategic decisions the company can make based on market circumstances and performance (Borum and Vittrup, 2021).

Risk Management: Real Option considers the inherent risks included in business investment. Identifying the different options and their potential results helps managers develop strategies to reduce risks and improve the overall image of the project (Choi and Kwak, 2022).

Innovation and Creativity: The Real Option helps in creative and innovative thinking in evaluating many strategy options by emphasizing managerial flexibility (Morozko, Morozko, and Didenko, 2020).

Decision Support: Real Options Give decision-makers useful data on the best times to make investments and in what order. Better resource management and capital allocation may be made possible by this knowledge (Kinnunen and Georgescu, 2019).

Competitive Advantage: Real Options can assist companies in gaining a competitive edge by spotting and seizing on special possibilities. Being adaptable and responsive to market developments helps differentiate a business from rivals (Griffith, Baur, and Buckley, 2019).

Strategic Insights: Planning and thinking strategically are encouraged through real-world option analysis. To better grasp the strategic value of the project and potential future growth paths, managers must carefully examine a range of prospective outcomes and their ramifications (Chi, Trigeorgis, and Tsekrekos, 2019).

Long-term Perspective: Real Options encourage decision-making from a longer-term perspective. Managers think about the prospects and long-term consequences of their decisions rather than just the short-term financial indicators (Chi, Trigeorgis, and Tsekrekos, 2019).

Improve Capital Allocation: By enabling businesses to postpone or drop projects that might not produce favorable returns while giving priority to those with more potential, these options aid in making smarter investment decisions (Gao and Yu, 2020).

It's crucial to remember that while Real Options have many advantageous qualities, they also have complexity and difficulties. A solid grasp of financial concepts and the capacity to appropriately evaluate uncertainties and potential future scenarios are prerequisites for proper execution. Real-options analysis may not be appropriate for all project types and is particularly pertinent when decisions made in the future have a big impact on how the project turns out.

***Negative Characteristics of Real Options***

Considering all the valuable insights, Real Options also brings certain challenges in constructing negative characteristics. Some of them are:

Complexity: Implementing real-options analysis can be difficult and complex, especially for projects with several interconnected alternatives and unpredictable variables. Because of the complex mathematical and analytic models required, some firms may find it challenging to apply (Chi, Trigeorgis, and Tsekrekos, 2019).

Subjectivity and bias: Real options valuation can include subjective parameters and assumption assessment, which could result in bias in the results. Decision-making may be impacted by the diverse values that many analysts may assign to the same option (Tiberius, Schwarzer, and Roig-Dobón, 2021).

Data Requirements: Particularly when evaluating uncertainty and projecting probabilities of future events, real option analysis largely depends on correct and pertinent data. Finding trustworthy data can be difficult, especially for new or novel projects with scant historical data (Ioulianou, Leiblein, and Trigeorgis, 2021).

Overvaluation Risk: Real Options Analysis runs the danger of overvaluing a project by considering speculative future scenarios that might not come to pass. Overly relying on the flexibility value could result in inflated hopes and rash investment choices (Setyabudi et al.,2022).

Time and Complexity Trade-off- Comprehensive real-options analysis could take longer and use more resources than conventional investment appraisal techniques. For some judgments that must be made quickly, the increased complexity and requirement to weigh numerous possibilities and situations may not be feasible (He *et al.*, 2019).

Difficulty in Communication: It might be difficult to explain Real Options analysis and its ramifications to decision-makers and stakeholders who are unfamiliar with the idea. Real Options may not be accepted as a decision-making tool due to misunderstandings or resistance caused by the analysis's complexity (Fernández, 2019).

Lack of Market Liquidity: Market liquidity in financial options enables simple purchasing and selling of options. In Real Options, some options may not have a thriving market, making it challenging to practically realize their worth (Keller *et al.*, 2020).

Uncertainty and Assumptions: Assumptions regarding upcoming market conditions and managerial choices provide the foundation of real options. Accurately predicting the future is inherently difficult, and relying on ambiguous assumptions might make the analysis more risky (Chi, Trigeorgis, and Tsekrekos, 2019).

Resource Constraints: Even if the option at hand has a high potential value, the organization might not have the resources (financial, human, or technological) to capitalize on it successfully, leading to missed chances (Zhang, 2019).

Real Options are nonetheless a useful tool for strategic decision-making despite these drawbacks, particularly in circumstances where managerial adaptability and flexibility in uncertain contexts are crucial. Organizations must carefully analyze the unique context and applicability of the analysis for each investment choice if they want to employ real options effectively.

1. ***Examine the journal article (Application of real options analysis for pharmaceutical R&D project valuation—Empirical results from a survey by Marcus Hartmann and Ali Hassan) that is linked above and describe the conclusions that the researchers reached on the application of real options in a practical setting.***

According to the journal, the necessity of Real Options Analysis (ROA) was an essential step to achieving more authentic and biased-free results in any survey. There are several stages through which current and expected ROA are measured. However, these processes are not free from challenges. The process of R&D has always been complex, especially in the pharmaceutical industry, because it primarily deals with diseases and their treatments. In many cases, the exact treatments have yet to be found. Besides, it becomes difficult for many pharmaceutical companies to work collectively to **integrate the knowledge**. Competition among firms has become fiercer due to **patent expiration** (Arroyabe, 2021). Therefore, the implementation of the ROA process can further be analyzed by two things: one is real option reasoning (ROR), and the other deals with Real option Pricing (ROP).

In this perspective, ROR aims for philosophical and conceptual clarity rather than pragmatic concerns. On the other hand, With the help of ROR, Real option pricing (ROP) sought to provide a concrete, authentic way. According to a survey conducted by **Bain and Co. in 2000**, only a small number of participants used this ROA process during the **inter-sectoral process**. The data relating to sector-specific usage, especially in the pharmaceutical industry, is limited in many ways (Pérez-Vas, Puime Guillé, and Enrquez-Daz, 2021). To have a clear view of the survey conception of ROA, researchers have conducted a survey based on the questionnaire. The survey was conducted among the pharmaceutical and biotech sectors. The participants were asked about the internal processes of the R&D wing of their respective companies. Along with this, researchers have also considered the additional viewpoints of external agencies such as auditors and consultants. The majority of participants were from Europe, the USA, and Japan. The survey results revealed that there are two types of auxiliary methods: **auxiliary method I and auxiliary method II**. This survey has also clarified that the importance of ROA lies more in the clinical phase than the research stage.

Therefore, according to the researchers, the importance of NPV valuation approaches cannot be denied. Apart from that, the emerging importance of the human genome and drug development have also been mentioned. The survey also discussed the future potential of ROP. Therefore, this journal has discussed that ROA has to pass through many more stages to bring about the **real option revolution** (Perrakis and Sixma, 2021). However, the contribution of ROA to the holistic development of the project can never be understated. Both NPV and ROA have their advantages and disadvantages, though implementing the appropriate alternatives can easily increase the productivity of the two processes.

Analyzing the findings of the survey made by Marcus Hartmann and Ali Hassan, it could be concluded that the real options revolution is not expected to hit by the mid-term as anticipated by Coy in 1999. Along with that, in the pharmaceutical industry, real options do not stand obsolete, as suggested by some inter-sectoral surveys. The empirical research suggests that real options serve as an auxiliary tool. In the clinical phase, pharmaceutical businesses apply the real options method with the greatest emphasis; in contrast, financial firms observe the highest values in the pre-clinical and clinical phases I and II. The capital market sector believes real options are more likely to convert to common valuation tools in 2010, even though pharmaceutical companies report usage the most than the rest. The NPV strategy won't lose its hegemony, though, because short-term application won't rise to the point. The introduction of tailored medicine may provide additional support. The judgment, particularly from the pharmaceutical sector, may signal a considerable change in the actual approach used for R&D project value, even though the specific effects are currently unpredictable.

Another result of studying the survey is that using ROA as a concept is considered to be becoming more popular because it allows for a more comprehensive project analysis without fundamentally altering present valuation techniques (Kusuma, 2021). In comparison to that, financial service businesses claim that the pharmaceutical industry appears to have slightly more awareness of the theoretical underpinnings of real option analysis. Observing the outcome, it could be stated that in most situations, assuming the complexity of the tool, customers do not embrace its usage. This is likely because of the negative image portrayed by researchers while explaining the working potential of the tool (Akron, 2020).

In the case of the different pricing techniques of real options, the obvious statement would be that standardization has not taken place in R&D pharmaceuticals as different case studies implement different approaches to reach a solution. The research finally stated the particular environment for ROA for further studies to understand the sectors to elucidate during evaluating a situation.

Analyzing the technical complexity, it could be concluded that Real options require a significant amount of technical and financial scrutiny. It is believed that working with complicated calculations overkills small and medium-sized businesses. There is a significant importance to real options.

The research also stated the obstacles faced while using real-options analysis. Considering the wide range of possible reasons for including real options for further employment, a sample study was conducted, showing the differences between both groups and comparing them separately. The alleged complexity of the real option analysis and the lack of support from the decision makers and customer supply require further patient components. The financial services and pharmaceutical industries hardly differ from one another. The two sub-groups of the study consist of a lack of openness and ignorance in the pricing option and are likewise evenly distributed, with a little tendency for the pharmaceutical enterprises to be significantly more critical while considering the analysis.

The real options approach's alleged complexity and the lack of support from decision-makers and customers supply the far more pertinent components. The financial services and pharmaceutical industries hardly differ from one another. Within the two subgroups, lack of openness and ignorance of options pricing are likewise almost evenly distributed, with a slight tendency for pharmaceutical enterprises to be more critical. Pharmaceutical companies stand to be more satisfied with the ongoing procedures, whereas organizations like financial services are considered to be worried by the real option pricing’s non-standardized methods. The industry tends to emphasize reliability and model integration as additional factors. Additionally, financial service organizations consider avoiding implementation costs as they are considered to be quite high. More case studies are particularly desired by the pharmaceutical division.

The variability of the real option pricing approaches that have been implemented and published thus far appears to be the cause of this. Additionally, the quality of the case studies that have been offered so far is completely unsatisfactory given the complicated situation in the pharmaceutical environment, such as the various scenarios with their own features and modeling issues. Comparing organizational issues with questions about methodical points of view has received considerably less attention. The study showed the scientific basis of the standing real options where pricing was put three times, along with considering the difficulties of determining the challenges of the volatility that comes under scrutiny.

Providing a comparison of the real options approach to the method of NVP opens another end of the study. As reliance was identified as the significant issue with the real options calculator findings, there was a predictability that was rated on a scale based on the assumption that 0 would be poor and 10 would be excellent. The pharmaceutical sector, analyzing the facts, clearly stated their favor of the NPV strategy with a score of 6.4 to 5.4. Considering this, however, the financial service firms observed essentially no differences in the predictability of the two stated approaches of 5.8 (NVP) and 5.6 (ROP). The interesting fact lies in noting that the value of NVP is significantly lower than that provided in the pharmaceutical area and that the variance of the answers to the RO value is larger than NVP (Hartmann and Hassan, 2006).

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Figure: *Methods of real options pricing for company valuation.*

Source: (Hartmann and Hassan, 2006)

The study also explains the future of real option pricing while dealing with considerable questions. The majority of the capital market and pharmaceutical sectors do not consider beginning or broadening the implementation of ROP. Understanding the clinical phase, there could be a modest rise that stands to be noticeable for the pharmaceutical companies.

The study also reflected the future of real option pricing at the sector level in 2010, when the situation dramatically changed. With time, the pharmaceutical industry's perception has not changed, considering the movement stated by them. But financial service companies have a significantly more desirable view of ROR in terms of its potential future significance. The clinical stages I and II were shown to achieve a peak of 26%, and around 19% of R&D was consequently spent on the other active stages. Alongside, it is important to note the significant blank responses collected by the study to analyze the given situation.

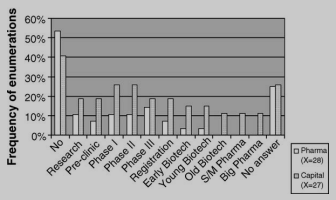


Figure: *Judgement if ROP will develop into a standard method for different valuation tasks by 2010.*

Source: (Hartmann and Hassan, 2006)

# In contrast, the overall study showed both the advantages and disadvantages of real options, especially as the tool is put into the context of the real business world.

# Conclusion

Concluding the study, it could be said that real options are most considerable as an economically valued right, especially enabling an organization’s manager to be equipped with options to engage in the development of business involvement and investment prospects. Real options stand to be one of the most efficient business-making tools. Although it consists of a part of negative impact, carefully working on those can bring a huge amount of resource savings and development to the business. Entrepreneurs consider it to be one of the most useful tools, especially when spreading a business. The studies done on the real option analysis highlighted its future endeavors and efficiency with the gradual upgrade. In short, it could be considered an influential tool that helps grow a business while exploring a huge site of development and sustainability.

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