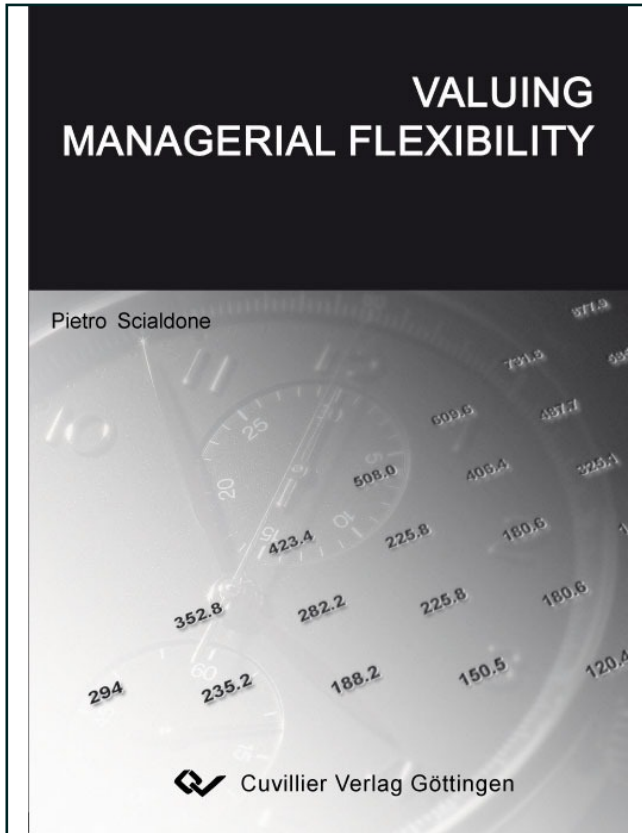




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**Valuing Managerial Flexibility**



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*"It is not the strongest that survives, nor the most intelligent.*

*It is the one that is the most adaptable to change."*

*Charles Darwin*

*(English naturalist and author of the theory of evolution by natural selection. 1809-1882)*

# ***1 Introduction***

## **1.1 Outline of the dissertation**

Value creation is the company's main objective. Giving the right value to an investment can determine the success or failure of a firm. Viewed from this perspective, valuing "possibilities" in a management environment has become an important topic to master. Investment decisions are ubiquitous - the purchase of a new machine, the exploitation of an oil field, the acquisition of a firm - these are all investments. Today the central paradigm for valuing investments and making budgeting decisions is the net present value (NPV).<sup>1</sup> Unfortunately it is based on expected future cash flows, thereby failing to account for the value of managerial flexibility inherent in many investment projects. The value of operating and financing flexibilities, e.g., the options to expand the scale of a project, defer it, or abandon it; or the option to externally fund a project, can be extremely important. First, because without accounting for this potential additional values investment opportunities are being systematically undervalued and second,

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<sup>1</sup> See for example Graham and Harvey (2001), p. 9ff or Vollrath (2003), p. 354ff.

because taking into consideration the value of flexibility can show that a negative net present value project, which per definition would be rejected, can be worth undertaking because it may open up the way for profitable future investment opportunities, an exercise that is not possible under the traditional discounted cash flow methods.<sup>2</sup> Today's economy is marked by uncertainty, competition and rapid change. The question arises whether the fair value of a business can be determined without accounting for flexibility to act in this fast-moving environment. For these reasons, valuing managerial flexibility is important.

But how can flexibility be valued? In a seminal paper, Myers (1977) valued growth opportunities, i.e., the investment to gain the flexibility to growth, as a real call option, while considering the existence of growth opportunities as given.<sup>3</sup> This was the starting point for the theory of real options. As yet, only few corporations are beginning to employ the real options paradigm derived from the classic financial option pricing paradigm of Black-Scholes and Merton.<sup>4</sup> This is surprising, especially when we take into consideration the high relevance of top managers for strategic capital budgeting decisions and the real options' broad appeal, not only to the financial economic community, but also to the strategic management field.<sup>5</sup> The skeptics are questioning above all the complexity of the real options method and the fact that not all assumptions hold in practice.<sup>6</sup> Furthermore, many of the required input parameters are not readily available.<sup>7</sup> Finally, the perception that the real options methodology has been misused to justify excessive valuation propositions of internet companies has contributed to the stagnation of interest about real options by market participants in practice.<sup>8</sup> Chapter 3.6 of this dissertation discusses these issues, examining further difficulties with the practical implementation of the real options method, and presents possible alternative ways out.

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<sup>2</sup> See Gibson (2004).

<sup>3</sup> See Myers (1977).

<sup>4</sup> As documented by several surveys on the topic, see chapter 4. For the Black-Scholes paradigm, see Black and Scholes (1973).

<sup>5</sup> As we will see in the following thesis, the real option theory is placed between financial theory and strategic management theory insofar as it is a method which is able to account for the value of strategic actions, i.e. managerial flexibility. Assigning a value to these strategic actions is of great interest in business life as also seen in the survey carried out in Swiss companies. See also the results of the survey in chapter 4.5.

<sup>6</sup> For an overview of the critics on the real option theory, see chapter 3.6.

<sup>7</sup> See Bowman and Moskowitz (2001), p. 775.

<sup>8</sup> See, for example, Rice and Tarhouni (2003), p. 15ff, who noted that after the years of the e-bubble (around 2000) many internet companies used the real option theory to justify high future revenues which, however, were not real, as many proposed future managerial actions on which these revenues were dependent, were simply not implementable in reality.

Since the idea of applying option pricing theory to capital budgeting decisions was published, there have been a number of publications in which researchers and practitioners are trying to seize and measure the value of flexibility within a project using the Real Options Analysis (ROA), some solving methodological problems, others focusing on selected niche applications, but in general concentrating on the detailed execution of the real options approach.<sup>9</sup> However, neither the academic nor the more practical-oriented publications attach much value to the preliminary decision, whether or not the real options method is relevant for the valuation of a particular project. Mostly the efforts and difficulties in applying the Real Options Analysis are not trivial. Firms are only interested in undertaking these efforts if they can gain as much advantage as possible out of them. For this reason, an important first step before implementing the real options approach is to analyze whether or not a real options valuation is worthwhile for the given specific valuation problem. This thesis wants also to shed light on this problem.

## 1.2 Objectives of the dissertation

The overall aim of the thesis is to study the application of the real options theory to the valuation of investment project in practice. The five main objectives of the dissertation are:

- *to show why valuing flexibility is important for a manager's decision.* This includes disclosing the various business activities where valuable flexibility can be hidden and to demonstrating why, without accounting for flexibility, the value of many projects is being underestimated.
- *to demonstrate how flexibility can be valued.* Nowadays, in academic domains, “valuing flexibility” is used almost synonymously with the idea of real options valuation.<sup>10</sup> In that sense showing how to value flexibility and explaining how to apply the ROA to project valuation will lead to nearly the same result.
- *to establish a comprehensive overview of ROA application areas discussed in literature and point out the critiques of the application of the ROA in real-life projects.* Besides application problems which could arise in practice the

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<sup>9</sup> An overview of the application of the ROA in different industries, specific project types and even macroeconomic questions is given in chapter 3.7.

<sup>10</sup> However we want to be precise that in practice this is far from being the same. In fact, in practice, the value of flexibility is assessed in other ways than with the Real Options Analysis, as we will show in chapter 2.

overview will also focus on the theoretical critiques of the ROA, as theoretical critiques and practical problems are in part associated. Additionally, the relevance of the different critiques is briefly discussed, and arguments or solutions that can mitigate theoretical and practical problems are proposed.

- *to analyze how Swiss firms treat the value of flexibility within their project evaluation process.* More precisely to find out if Swiss firms account for managerial flexibility, and if the real options method is being used for this purpose or whether alternative approaches are preferred.
- *to develop a method which systematically permits the decision of whether a Real Options Analysis application is relevant or not for the valuation of a given investment project.* Focusing on the three constitutive characteristics of a real option, namely irreversibility, flexibility, and uncertainty, a method will be presented to assess the relevance of the application of the ROA to a given investment project.

### 1.3 Structure of the dissertation

Reflecting the main objectives formulated above, this thesis is divided into six chapters.

*Chapter 1* is represented by this introduction outlining the major objectives of this thesis and presenting its structure.

*Chapter 2* explains what we mean by “flexibility in investment decision” and gives the definition of managerial flexibility which we will use through the dissertation. Moreover, several alternative methods to the ROA are presented, which are also used to assess the value of flexibility and its importance for a practical investment decision.

*Chapter 3* outlines the fundamentals of the real options theory and emphasizes the basics needed for the further development of the thesis. Moreover, a comprehensive description of the theoretical and practical critiques of the real options approach is laid out, and the relevance of these critiques is discussed. Finally several application areas of the ROA are presented in order to give a comprehensive overview of the different industries or project types where implementation work has already been examined in the academic literature.

*Chapter 4* provides a survey investigating how Swiss companies treat managerial flexibility in project valuation. The survey focuses on the importance that Swiss firms assign to the valuation of flexibility and whether or not the companies are applying the

real options approach. Additionally, basing our findings on the data gathered on uncertainty, irreversibility, and potential of real managerial flexibility, we highlight the main application industries and present the most frequently occurring real option types for the specific industries. Finally, some broad guidelines are given for showing in which cases of our data sample might other applications of the ROA could be of major benefit.

*Chapter 5* describes the relevant framework about the preliminary decision of the practical implementation of the real options approach. We show that without too much complexity and with already existing information about the specific project, which can normally be found within a standard investment proposal, a quick judgment about the relevance of the application of the ROA can be made. The decision will be based on a rough approximation of the level of the uncertainty, irreversibility, and flexibility inherent in the single project, without necessitating advanced mathematical skills and knowledge. A case study will be discussed in order to exemplify the application of the concept and clarify the definitions presented in the framework.

*Chapter 6* concludes the thesis, summarizing all findings and reviewing the single research objectives one by one.

**Figure 1.1: Overview of the structure of the dissertation.**

<b>1 Introduction</b>					
1.1 Outline of the dissertation	1.2 Objectives of the dissertation	1.3 Structure of the dissertation			
<b>2 Valuing Flexibility</b>					
2.1 What does flexibility mean	2.2 Why is it important to value flexibility in project evaluation	2.3 A short overview of techniques addressing flexibility valuation			
<b>3 Fundamentals of the Real Option's Theory</b>					
3.1 Introduction	3.2 Fundamentals of the real option's idea	3.3 Option pricing theory as a starting point for the ROA		3.4 Categorization of real options	
3.5 Real option valuation approaches and their practical implications			3.6 Cutups of the real options approach	3.7 Overview on ROA application areas	
<b>4 Valuing Flexibility in Practice: The Swiss Case – An Exploratory Survey</b>					
4.1 Introduction	4.2 Review on existing studies	4.3 Scope of the survey	4.4 Methodology	4.5 Results	4.6 Conclusion
<b>5 Methodology for assessing the Relevance of the ROA</b>					
5.1 Introduction	5.2 Prerequisites of real option value	5.3 Quick estimation of real option value	5.4 Communication of the flexibility value	5.5 Application example	5.6 Conclusion
<b>6 Summary and Conclusion</b>					

## *2 Valuing Flexibility*

The main goal of this chapter is to outline the reasons why the value of flexibility is important for a firm and for the valuation of a project in particular. First of all, the term “flexibility” will be clarified, and several domains where flexibility can emerge will be shown. We will see that the concept of a flexible plan as having greater worth than one without flexibility is not new to the business world. Additionally, the different ways of accounting for the potential added value given by flexibility will also be presented in this part of the dissertation.

### **2.1 What does flexibility mean?**

For flexibility to be of any use in project valuation, its practical and theoretical aspects must be understood. Only then will management find a support for identifying, creating, managing, and giving a value to flexibility. Different definitions and dimensions of flexibility within companies can be found in today’s literature. For this reason, it is also



important to clarify what types of flexibility are discussed in this work and to define the term flexibility for the purpose of this thesis.

*“In psychological terms, a flexible person is open-minded and adaptable, whereas an inflexible person is unable to deal with ambiguity and uncertainty.”*<sup>11</sup> This is also the starting point for defining flexibility in an economic or a business environment. As already mentioned, the term flexibility appears in many business areas with different meanings, focusing on different points of view. Therefore, various definitions as related to different business functions and business areas are briefly considered at this point before the definition of flexibility as used in this thesis is given.

Starting from the financing structure of an organization, Bernstein (1978) defines flexibility as the ability to raise funds in adverse capital markets.<sup>12</sup> Harrigan (1985) defined flexibility from a broader market perspective; for him, the term strategic flexibility refers to a firm’s ability to reposition itself in markets, change its game plan, or dismantle its current strategies.<sup>13</sup> Carlsson (1989) concluded that flexibility gives a firm the ability to deal with all forms of turbulence or uncertainty in a business environment.<sup>14</sup> In the field of policy formation, Evans (1982) defined strategic flexibility as the capability that aids repositioning when conditions change.<sup>15</sup> Concerning labor markets, Atkinson (1985) distinguished three types of flexibility that are desirable by employers: functional flexibility, which refers to the deployment of employees between activities and tasks; numerical flexibility, which allows work hours to be quickly, cheaply, and easily varied in line with short-term changes in the demand for labor; and financial flexibility, which relates to the possibility of a firm to manipulate labor costs according to the state of supply and demand in the labor market.<sup>16</sup> However, the largest number of definitions of flexibility has come from the manufacturing sector. According to Hutchinson and Sinha (1989), flexibility describes the ability to rapidly introduce new parts and to change the production mix to respond to short-run fluctuations.<sup>17</sup> Verter and Dincer (1992) defined flexibility as the ability of a system to cope with changes effectively.<sup>18</sup> Gunasekaran *et al.* (1993) defined flexibility as the ability of a manufacturing system to cope with changing

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<sup>11</sup> Ku (1995), p. 290.

<sup>12</sup> See Bernstein (1978), p. 510.

<sup>13</sup> See Harrigan (1985), p. 3.

<sup>14</sup> See Carlsson (1989), p. 201ff.

<sup>15</sup> See Evans (1982) in Ku (1995), p. 85.

<sup>16</sup> See Atkinson (1985), p. 11ff.

<sup>17</sup> See Hutchinson and Sinha (1989), p. 51ff.

<sup>18</sup> See Verter and Dincer (1992), p. 13.