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FINANCIAL VALUATION OF NEW GROWTH INITIATIVES

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MASTER THESIS BUSINESS ADMINISTRATION

FINANCIAL MANAGEMENT

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UNIVERSITY OF TWENTE.

Financial valuation of new growth initiatives.
Case study at Power-Packer Europa B.V.

MASTER THESIS BUSINESS ADMINISTRATION – FINANCIAL MANAGEMENT

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Rick Bramer

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Executive Summary

The findings in this report are the result of an internal- and external research study conducted in support of the business development department of Power-Packer Europa. In light of the developing diversification strategy meant to carry the organization to more lucrative future, identifying new growth opportunities has become part of every-day business activities. From the standpoint of efficient resource allocation, the demand for an effective system to value and rank growth opportunities has become salient. This study is therefore meant to provide Power-Packer with such a system in the form of a financial valuation framework to guide investment decisions in the future. In addition, to test the validity and usefulness of the proposed system in corporate practice at Power-Packer, it is implemented in a case study of a running business development initiative. In this executive summary, the findings, conclusions and recommendations are briefly presented. It must therefore be remarked that any issues concerning the source or logic behind any findings should be sought after in the actual report.

The structure of this thesis, as described in the first chapter, is roughly based on five elements;

1. An internal analysis of the organization to identify strengths and weaknesses relevant to the target market.
2. An external analysis to map out the target market in terms of size, future outlook and overall attractiveness.
3. A financial analysis to determine the theoretical input for the design of the valuation framework.
4. An implementation of the proposed framework to give an outline of the financial characteristics of the project and an estimation of overall project value.
5. An assemblage of all findings to construct overall conclusions and recommendations for any further steps in the project.

The financial potential of marketing the modular Electrical Drive Unit as a cargo box lift in the global utility task vehicles industry is chosen as the case of study. The goal of this case study is to provide Power-Packer with recommendations regarding investment decisions through use of a financial framework with input from internal- and external data collection.

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When designing the financial framework for valuation of projects in markets similar to the case study elucidated here, the distinction is made between three factors that can have high impact on the estimations of financial value. Financial risk, concerned with cash flow volatility in relation to an investor's required return, is addressed through applying the capital asset pricing model, which uses betas in combination with market return characteristics to value project cash flows by accounting for individual risk characteristics. Market risk, concerned with the embedded risk of fluctuations in the market environment, is addressed by exploring the input variables through a sensitivity- and a scenario analysis. Managerial flexibility, in which the proposition is made that a project's investment life is segmented in different decision points that have a positive effect on

the overall value, is included by introducing decision tree models alongside fixed cash flow statements.

List of abbreviations

AAR	Average Accounting Return	**M**	Million
AC	Alternating Current	**MM**	Millimeter
AIM	Acquisition and Integration Management	**NAFTA**	North American Free Trade Agreement
APAC	Asia and Pacific	**NPV**	Net Present Value
AR	Average Return	**OEM**	Original Equipment Manufacturer
ATV	All Terrain Vehicle	**PESTEL**	Macro-environmental factors
B	Bonds (debt)	**PII**	Polaris Industries Incorporated
BMW	Bayerische Motoren Werke	**PP**	Payback Period
CAPM	Capital Asset Pricing Model	**PPE**	Power-Packer Europa
Cov	Covariance	**PV**	Present Value
CRM	Customer Relationship Management	**r**	Return rate
DC	Direct Current	**RFMEA**	Risk Failure Mode and Effective Analysis
DCF	Discounted Cash Flow	**Risid**	Residual
EBIT	Earnings Before Interest and Tax	**RPN**	Risk Priority Number
EDU	Electrical Drive Unit	**RTV**	Rough Terrain Vehicle
EMEA	Europe Middle East and Africa	**S**	Shares (equity)
FCF	Free Cash Flow	**SAM**	Serviceable Available Market
FY	Financial Year	**SGM**	Sales Gross Margin
g	Growth rate	**SOM**	Serviceable Obtainable Market
IDP	Initiative Development Process	**SQA**	Service Quality Assurance
Init	Initial	**SV&E**	Special Vehicles and Equipment
Inv	Investment	**SWOT**	Strengths Weaknesses Opportunities Threats
IRR	Internal Rate of Return	**SxS**	Side by Side vehicle
IT	Information Technology	**TAM**	Total Available market
IUV	Industrial Utility Vehicle	**Tc**	Corporate Tax rate
JCB	Joseph Cyril Bamford	**US**	United States
K	Thousand	**UTV**	Utility Task Vehicle
KG	Kilogram	**V**	Volt
kN	Kilo Newton	**Val**	Value
KYB	Kayaba	**Vf**	Value of the firm
LEAD	Lean Enterprise Across Disciplines	**WACC**	Weighted Average Cost of Capital

List of figures

Table of content

Chapter 1: Research design

This report contains the findings of a research study conducted on behalf of Power-Packer Europa B.V. The first chapter is meant to inform the reader of the nature of the study, how the research is conducted and through what means the data is collected. Furthermore, the structure of this report that supports efficient solving of the research problem is described. Firstly, this problem is elucidated in the sections below.

1.1. Research background

Power-Packer Europa B.V., with its headquarters situated in Oldenzaal, the Netherlands, is an international manufacturer of hydraulic actuation systems. As part of the 'engineered solutions' segment of the parent company Actuant, its core business is providing customers with customized hydraulic solutions.

Power-Packer is active in a variety of markets in a global context. However, throughout the years, the company has become increasingly dependent on a small number of markets. Serving the automotive- and trucking industry with customized products accounted for half of the sales in 2012[1], indicating that a drop in these markets would have severe consequences for Power-Packer's future revenues.

As a result of this realization, Power-Packer established a 'Growth & Innovation' department to lay the foundation for a more diversified focus of the company's products and markets. The main objective within this department is to develop a substantial database of new solution-market fits and to pursue attractive new ideas towards commercialization. The department builds on the fundamental assumption that there ought to be windows of opportunity in other industries and market segments that Power-Packer could be able to pursue.

1.2. Research problem

To distinguish attractive ideas from unattractive ideas and to determine the feasibility of pursuing attractive business opportunities, proper (market) research has to be conducted for multiple reasons. First of all, because of the technical nature of the product, it would be costly to develop prototypes and conducting physical tests on them. If the demand then turns out to be minimal, a large amount of resources will be lost. Secondly, from an economies-of-scale view, a substantial amount of sales will be needed to achieve a competitive cost-advantage. This assumption lies in the fact that an assembly chain has to be developed to efficiently produce the desired product. A production method of this kind asks for a certain amount of conversion to be able to compete with competitor prices while keeping a positive gross margin. Finally, conducting external and empirical research will result in a useful network of key players in the market that helps in building brand awareness and visibility in other markets.

When this initial market research has been conducted, the focus of this study shifts towards valuating the proposed project. In this context, a framework is designed, based on a variety of financial theories and other data, that aids in deciding whether or not to pursue business opportunities and initiate new projects.

As for the initial market research, the focus will lie on one of the industries that receive interest of the business development department: The (global) special vehicles and equipment (SV&E) industry. This industry includes vehicles that are (mainly) used for off-road activities. Many of

[1] Retrieved from Company Profile Presentation 2012

these vehicles have actuating components that require systems to power them. Consequently, Power-Packer is in the process of attaining a clear picture of the possibilities in this market. Some descriptive work has been done and a broad list of the possible applications has been established. As one can imagine, the SV&E industry provides Power-Packer with a great amount of possibilities for marketing actuation systems. In this study, the focus is narrowed down to a smaller segment within this market to assure a valuable outcome with operational usefulness on the short term. The market segment that is analyzed in this study exists of utility vehicles, and more specifically hydraulic actuation in the cargo bed component of these vehicles. Through this research, an assessment is made of the target market attractiveness and the constructed valuation framework is used to estimate the financial value of the proposed project.

1.3. Research questions

The study will consists of designing a project valuation framework and an implementation of this framework in a case-study of a business development initiative at Power-Packer. The proposed framework will be used to answer the two main research questions below:

1. *What financial valuation elements should be used to design a framework that aids in answering the following question?*
2. *Will it be financially valuable for Power-Packer to market a modular electrical drive unit in the global utility vehicles industry?*

Throughout the study, the following sub-questions will be answered to aid in answering the main research question. With each question, a list of subjects is given to describe the thesis structure:

- *What are the internal characteristics of Power-Packer? (chapter 2)*
  - *Hard elements*
  - *Soft elements*
  - *Resources*
  - *Strengths & weaknesses*
- *What are the characteristics of the targeted market segment? (chapter 3)*
  - *Market definition*
  - *Market analysis*
  - *Market assessment*
- *How should the financial value of new growth initiatives be quantified? (chapter 4)*
  - *Value definition*
  - *Valuation methods*
  - *Risk analysis*
  - *Option theories*
- *What conclusions can be made from implementing the framework? (chapter 5)*
  - *Sales and cost forecasting*
  - *Estimating project's financial value*
- *Should Power-Packer initiate or abandon the project? (chapter 5 and 6)*
  - *Invest or abandon*
  - *Entry strategy recommendations*
  - *Recommendations for further research*

The underlying goal of this study is to provide Power-Packer with a model for the financial valuation of new initiatives. By using a theoretical framework alongside empirical findings, the shape of this framework can be determined. The model is then used to answer the research question, which contains a particular product-market-fit. The designed framework should therefore be suited for generalization in other future projects.
To create a structured answer to the research question, the sub-questions and their corresponding subjects are addressed.

What are the internal characteristics of Power-Packer?
Analyzing the internal characteristics is important because it gives a clear image of the strengths and weaknesses of the internal organization that should be exploited or circumvented when entering the target market. This sub question is the first to be addressed because it functions as an introduction to the internal organization of Power-Packer which is used to form conclusions in further chapters. The internal analysis will be partly conducted through use of the McKinsey 7s model to describe the organizational hard and soft elements and their interaction. Using this framework will lead to an understanding of the development of strengths and weaknesses. In addition to this framework, the organizational resources are described to map out operational freedoms and constraints.

What are the characteristics of the targeted market segment?
The characteristics of the target market are important when contemplating a possible market entry. This issue is addressed by first defining the actual target market, which is important to determine the focus of the market analysis. In this light, the product ideation and the product application are described, followed by an analysis of the related market of this application. This market is mapped out in terms of market players (i.e. customers and competitors), market size and market trends. These three elements form an image of how the market is now, as well as what can be expected from the same market in the future. The findings in the market analysis can be used in the market assessment, which is the last issue to be addressed when answering this sub question. In this assessment, conclusions are made from earlier findings that describe the overall attractiveness of the market and the feasibility of achieving competitive advantage.

How should the financial value of new growth initiatives be quantified?
When the internal organization and the target market are analyzed, the focus shifts towards financial valuation. This sub question is answered through the eventual construction of a framework. Firstly, before setting up the elements of the framework, financial value in theory is defined to explain the criteria of a valuable project. In addition, calculative methods widely used in corporate practice are discussed to explain what companies focus on when valuating business opportunities. The above issues form an introduction to project valuation. Secondly, the focus will lie on the analysis and the quantification of a project's risk characteristics, as this is an important, and in practice often not sufficiently addressed, part of the process of project valuation. The methods for quantifying risk, including a real options analysis, are discussed in this part of the report. Conclusively, the framework is constructed by using the theoretical findings.

What conclusions can be made from implementing the framework?
After having completed the proposed framework, it will be implemented through use of the data retrieved from the internal- and external analysis. In this part of the study, cash flow forecasts, estimated through using this data, are subjected to all the elements of the proposed framework to determine the project's expected financial value. If implementing the framework will lead to practical problems, revisions should be contemplated.

Should Power-Packer initiate or abandon the project?
By analyzing the financial value figures from the last part of the study and subjecting them to investment criteria, conclusions can be made whether Power-Packer should invest in, or abandon the project. In addition, some emphasis is put on recommendations concerning project initiation or rejection, as each of these two decisions will bring along operational issues. Furthermore, remarks concerning research limitations and assessment will conclude the report.
Eventually, Power-Packer is provided with a well-founded answer to the research question as well as a framework for financial valuation of new business initiatives.

1.4. Theoretical framework

To support findings in this study, scientific literature will have a central role in the process.
By using a well founded financial framework, the link between theory and practice can be studied and through existing theories and concepts, the foundation is developed from which conclusions can be made.

What are the internal characteristics of Power-Packer?
To map out the internal characteristics of Power-Packer, the McKinsey 7s model is used (for an elaboration see Appendix I: The McKinsey 7s Model). The central idea behind this framework is that organizational effectiveness stems from the interaction of operational factors (Waterman, Peters & Phillips, 1980). The model is used in this thesis because every component of the internal organization can facilitate or impede its innovativeness and it is this innovativeness that drives the business development department towards achieving organic growth in the future. Furthermore, as Power-Packer, and especially the growth and innovation department, is trying to increase market orientation and organizational learning, the 'soft' elements of the McKinsey model will be compared to the organizational learning model of Narver and Slater (1995). This model lists elements of the climate and culture of an organization that together facilitate positive outcomes in terms of profit, sales growth and customer satisfaction. As these are parameters that the Power-Packer is striving for, using this model will provide important insights.

What are the characteristics of the targeted market segment?
In order to assess the characteristics of the targeted market segment, the PESTEL analysis method is used alongside the market assessment framework. The PESTEL analysis is a technique for identifying relevant environmental factors that could affect the decision making process of the organization (Boddy, 2008). It is used because it is the most complete framework for determining macro-environmental factors. The market assessment framework is used to summarize the findings in this chapter into overall conclusions. These conclusions will be used as input when financial variables are estimated and different scenarios are contemplated.

If the characteristics of the organization and its environment have been mapped out, the SWOT framework will be used to determine the fit between organizational- and target market characteristics. A SWOT analysis is a way of summarizing the organization's strengths and weaknesses relative to external opportunities and threats of the environment (Boddy, 2008).

How should the financial value of new growth initiatives be quantified?
Academic research has been conducted in the contemporary past to determine best practices in valuing a new business project. The underlying goal of these theories is adequately calculating the value of future project cash flows by accounting for all possible risk- environmental- and operational factors. Academics have been trying to find a valuation model that would best approach the true value of a project. However, mainly because of long lead times of projects and volatile market environments, true project value is difficult to calculate because of many uncertainties and risks.
To answer this sub question, scientific theories and methods are pooled together to find their strengths and weaknesses and determine a critical path towards finding a quantification framework that best aids Power-Packer in making managerial decisions concerning investments in growth opportunities.

What conclusions can be made from implementing the framework?
The conclusions that are made to answer this sub question are based on the factors below:

- The project's expected financial value
  - The impact of the project on the value of the firm
  - The impact of cash flow volatility on the project value
  - The impact of managerial flexibility (i.e. options) on the project value

By using the framework that is constructed in the latter part, the project's expected financial value is estimated. By forecasting cash flows and determining the net present value of these cash flows, estimations can be made as to what is expected to be financially gained or lost when initiating the project. Addressing the impact of factors like cash flow volatility and managerial flexibility is important for justifying the findings and is done in this process through different methods (e.g. scenario analysis, sensitivity analysis, decision trees and real options valuation). Eventually, the project is expected to have a negative or positive impact on the value of the firm, which leads to answering the last sub question.

Should Power-Packer initiate or abandon the project?
The answer to this sub question is based on all the theories and findings throughout the study. In addition, recommendations concerning the entry strategy will be backed up by existing theories.

1.5. Methodology

Along with the theoretical part of the study, it will also be based on exploratory and empirical research. To attain the amount of data needed to build towards a well founded conclusion, the theoretical framework mentioned above offers the foundation for further external research. To define the practical characteristics of the organization and the target market more explicitly, empirical data is gathered. First of all, as not all knowledge on business characteristics that are relevant to this research (i.e. project management, financial structure, existing market data and current activities) are contained within the business development team, inside information is gathered by conducting separate interviews with specialized personnel. Second, to obtain valuable and reliable information about the market characteristics and customer expectations, trade shows are chosen as the most suitable source, as they offer a pool of information from different sources in the target market. Subsequently, the retrieved data is used alongside data from desk-research to strengthen the external analysis and to back up conclusions. These conclusions are used as input for the financial valuation in chapter 6 (e.g. for starting cash flow projections).

As can be seen in the figure below, the study is divided into five phases. In the start-up phase, the background and the shape of the research are studied to determine the overall scope. This is done by assessing the current situation and defining the problem. Based on this problem, the research strategy and the research goals are determined in the second phase. Thereafter the internal and external analysis will be conducted based on multiple data sources. The first will be used to assess the overall organization and to map out strengths and weaknesses relevant to the goal of the study. The external analysis is meant to first describe the scope of the study in terms of product and market segment. Subsequently, this product-market link is analyzed in detail to determine opportunities, threats and overall market and product characteristics. By means of a SWOT analysis as concluding tool of the external analysis, internal and external characteristics are linked together to map out positive- and negative relationships and their impact on the business case. The input for the financial valuation is partly accounted for by the conclusions from this preliminary analysis and partly retrieved through internal data input in the context of specific financial variables. The latter is necessary because market and organizational assessment alone cannot provide you with financial variables specific to the project under scrutiny.

By pooling all data into the valuation framework, decisions and recommendations in the context of investment, abandonment or scope-alteration can be provided.

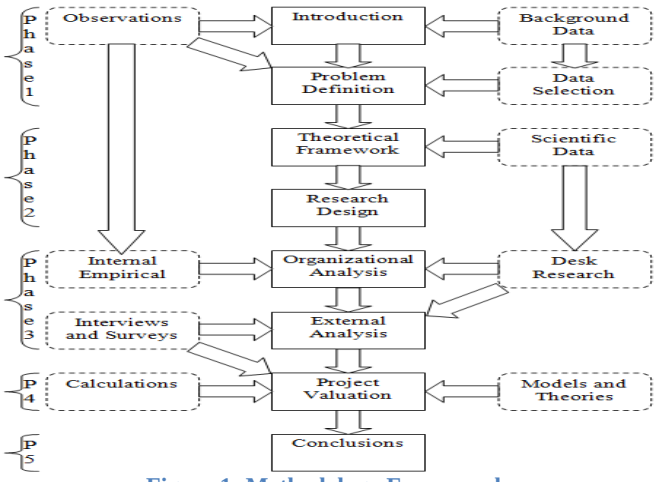

Figure 1: Methodology Framework

1.6. Data collection

Data will be collected both internally and externally. In the first phase, data collection will be mainly based on desk-research and theoretical research as well as internal communication. At the end of the first phases the product-market fit will have been described. Consequently, a focus shift towards the market is possible and an elaborate view on market characteristics, possible customers and competitor profiles will be established. If a clear picture has been created, the targets for external empirical data can be listed. Considering the nature of the product, targets for data retrieval should include the entire value chain ranging from OEMs, wholesalers and retailers to end-users. Communicating with these targets will yield a good picture of market size and needs, product potential, possible technological thresholds and cost/price indications. With the entire base of data gathered in the above phases, the potential project shape can be determined in terms of investment needs, production costs, expected revenues and growth potential. Additionally, with a clear picture of the proposed project, it can be valued by means of different valuation methods.

In short, the data collection method in this study is based on an exploratory design with external interviews at trade shows with different actors within the value chain, as well as interviews with key internal professionals. To determine these key players, a knowledge foundation is built based on scientific research, desk research and empirical observations. By using different research methods (i.e. convergent methodology), the judgment accuracy is increased. In practice, findings from one data source validates findings from the other, creating a more complete and well-founded image of the unit under scrutiny.

The sources of data include:

- Observations
- Empirical data from interviews at trade shows (key customers, competitors and professionals)
- Empirical data from internal departmental sources (finance professionals, engineers, etcetera)
- Empirical data from sister companies
- Empirical data from corporate meetings and trade shows.
- Statistical data from financial materials
- Statistical market research data

Chapter	Research Question	Data source(s)
2	*What are the internal characteristics of Power-Packer?*	Observations, internal empirical data collection, meetings
3	*What are the characteristics of the targeted market segment?*	Market research data, external interviews, tradeshows, engineers
4	*How should the financial value of new growth initiatives be quantified?*	Scientific research: Articles, books and theories
5	*What conclusions can be made from implementing the framework?*	Internal communication and existing financial data
6	*Should Power-Packer initiate or abandon the project?*	All of the above

Figure 2: Data source alignment

Chapter 2: Internal analysis

What are the internal characteristics of Power-Packer?

Power-Packer Europe B.V. is an independent subsidiary of Actuant, a multinational corporation listed on the New York stock exchange. Actuant delivers sustainable improvement products that can be categorized in four segments, namely: Industrial, energy, electrical and engineered solutions. Power-Packer is part of the latter segment, which accounts for almost 32 percent of the 1,6 billion revenues of Actuant[2]. In this chapter, the internal characteristics of Power-Packer are analyzed to determine strengths and weaknesses relevant to the target market. To guide this analysis, the McKinsey 7s model is used (see Appendix I: The McKinsey 7s Model). The central idea behind this framework is that organization effectiveness stems from the interaction of several factors (Waterman, Peters, & Phillips, 1980). The structure, strategy and systems are the 'hard' elements of this framework, and these factors will be addressed by looking at the entire corporation. The style, staff, skills and shared values are the 'soft' elements which will be addressed in the same section by looking at the business development department in particular. In addition, organizational resources are briefly discussed in support of the above elements to avoid missing critical weaknesses not revealed through the McKinsey model. The eventual output of this analysis is a summary of weaknesses and strengths detected throughout the sections. This data will be used as input for the SWOT analysis at the end of the next chapter.

2.1. Structure

With over a thousand employees, Power-Packer has become a worldwide player in the hydraulic actuation industry. According to Fan et al. (2012), the organization needs a structure which facilitates the delegation of decision rights within the organization and increases efficiency by giving divisional managers decision rights with respect to local activities. In the past, the company's operations were almost entirely situated in the Netherlands. However, after globalization of the world's markets and throughout the international growth of the company, a realization emerged that regional markets should be served by regional organizations. This assumption finds its roots in the fact that regional market characteristics and trends are better understood by regional players. Moreover, these regional business units were needed to keep sales- and supply chains short and efficient. Power-Packer developed into an internationally structured firm divided into three geographic regions with their own business leaders.

- NAFTA – North America
- EMEA – Europe, Middle East and Africa
- APAC – Asia and Pacific

Power-Packer Europe (PPE) has a structured hierarchy, as can be seen below. Every department has its own hierarchical structure as well. The internal structure shifts from mechanistic to organic between departments and across hierarchical levels.

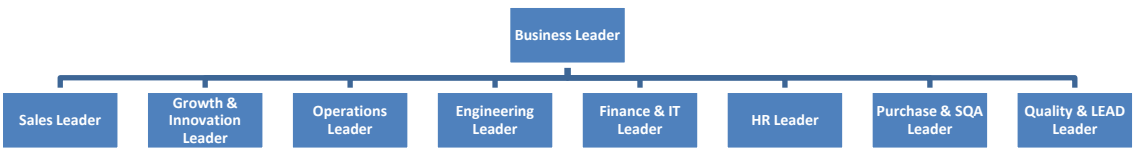

Figure 3: Organization chart Power-Packer Europa B.V.

[2] Retrieved from the Actuant annual report 2012

Organizational structure, conceptualized as the decision-making structure among a group of individuals, is shown to affect the number of initiatives pursued by organizations (Csaszar, 2012). This divisional structure aids the pursuit of region-specific growth ideas. In theory, the structure of Power-Packer can be viewed as hierarchical. However, in practice, especially in organic departments, cooperation is more important than hierarchical power. The hierarchical tree is effective when trying to avoid discussions between employees or internal entities about the end-voice in corporate decision making. The organic and cooperative nature within internal teams is effective in reducing decision time (bureaucracy), decreasing workload because of early identification of activity overlap, and increasing overall accessibility/clarification of information.

2.2. Strategy

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2.3. Systems

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2.4. Soft elements

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2.5. Resources

A firm's resources are the backbone of the organization, as they generate the necessary output to assure strategic capability. In this section, the relevant organizational resources are described to determine the organizational feasibility of actually initiating growth initiatives.

2.5.1. Supporting assets

Power-Packer has over a thousand employees worldwide and around 400 at its headquarters in Oldenzaal. Throughout the last years, reorganizations of human capital have been necessary to account for an overall decline in turnover and as a consequence, employee density has decreased. However, when fluctuations in production numbers occur, temporary human resources are allocated. In other words, should a growth opportunity reach the production phase, the necessary arrangements will be made to ensure timely completion of production lines, prototypes and sales-products as well as adequate communication with customers and suppliers.
The facility is equipped with a laboratory to test robustness and other characteristics of new products. Whether the criteria of a project in terms of production space, inventory capacity and available workforce can be met at the same facility should be investigated during the research phase of the project.

2.5.2. Access to financial capital

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2.5.3. Product portfolio

A product portfolio of PPE is a relevant part of the internal analysis, as it describes the output of the organizational themes described above. PPE serves a variety of core market with its motion control systems. In addition, PPE is responsible for a number of business units with their own brand that have a particular focus towards one or more of these core markets. All of these business units are part of the Actuant group. In Appendix III: Power-Packer Europa product portfolio., a shortlist of the portfolio can be found.

2.6. Strengths and weaknesses

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Chapter 3: External analysis

What are the characteristics of the targeted market segment?

This chapter includes an important part of this study, as it is focused on the target market. Firstly, the product-market ideation is introduced and subsequently the market is defined and analyzed. The findings in this chapter provide an answer to the above sub question and support the process of quantifying the value of the growth initiative by providing data for estimations of financial variables. This chapter is structured as follows:

1. The market is defined based on the product characteristics and its application. Consequently, the focus of the market analysis is determined.
2. The defined market is analyzed based on its key players (i.e. customers and competitors), its size and its future trends and outlooks.
3. Based on the findings in the market analysis, the defined market's attractiveness is assessed based on the market structure, the growth outlook, the existing risks and hurdles and the competitive strength of the product.
   This section is concluded with a SWOT analysis and a confrontation matrix.

3.1. Market definition

The main objective of this study is to determine the financial value of entering an adjacent market with a new product. The growth and innovation department has been focusing on a variety of these markets. Currently, the top 3 growth initiatives include:

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The latter will be the subject of further study and will be elaborately discussed in this section. First, a rough picture of mechanical actuation will be sketched, followed by a technical outline of the product designed by Power-Packer. Subsequently, the application of interest is elucidated. By using this information, the target market can be segregated as input for the analysis in further sections.

3.1.1. Actuation systems

In the world of mechanical actuation, a distinction can be made between three main types of systems. An actuation system is powered by a source of energy, which is converted into a desired motion. The source of energy is an important aspect of the system, as different sources bring different advantages and disadvantages. The three main types of actuators are briefly described below.

Hydraulic actuators, which include the products of Power-Packer, are actuation systems powered by hydraulic fluids (oil is the most commonly used hydraulic fluid). These fluids are highly incompressible so that pressure applied can be transmitted instantaneously and precisely. The original power source for the hydraulic system is a prime mover such as an electric motor or engine. Because of its characteristics and components, the hydraulic actuator has some substantial competitive advantages as well as some disadvantages. Firstly, because of the high pressure capabilities, hydraulic systems are capable of producing much more power than other actuating systems, especially compared to the weight and size. Secondly, by varying pump delivery, the actuator speed can be quickly and substantially adjusted, which is not possible with

electrical actuators. In addition, reversing the motion is instantly possible. Finally, hydraulic actuators can be stalled without damage when overloaded.

Electrical-Mechanical actuators use an electric current to power a motion. In linear actuators, electricity is used to turn a screw that drives a rod in an up and down motion. This type of actuator has some advantages as well. First of all, electricity is easily routed to the actuators, as cables are simpler than hydraulic pipes. Moreover, it can be easily controlled by electronic units. In addition, in the environmental context, electricity is cleaner than oil or other hydraulic fluids. However, the speed of motion is inferior compared to a hydraulic actuator, as is the power to weight ratio.

Pneumatic actuators use compressed air to produce motion energy. Air pressure within a cylinder creates a force that drives a diaphragm in a desired direction. The advantages of pneumatic actuators are that they are highly cost effective and have low energy requirements. They also generate less noise than a hydraulic actuator. On the other hand, the motion cannot be controlled as precisely as with a hydraulic engine, and the output force is substantially lower as well.

3.1.2. Modular electric drive unit

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3.1.3. Target market and application

As could be concluded from the above product description, the unit of study brings along a variety of market opportunities. The product characteristics allow it to fit in several applications in different markets. However, given the extent of this research study, a choice has been made in terms of a specific target market segment to ensure a valuable and useful outcome that can lead to short-term activities. This market segment will be discussed in this section.

The utility vehicles industry, which is the choice of study, is a broad industry with a substantial amount of vehicle types with different uses and specifications. Keeping the well-known SUV out of the picture, these types can be classified into two groups. The ATV, or All-Terrain Vehicle, is a quad, quad bike, three wheeler, four wheeler or even six wheeler that travels on low-pressure tires[3]. It is an off-road, single-rider vehicle intended for use as a recreational vehicle, racer, or transport over rough terrain[4]. A UTV, or Utility Task Vehicle, is slightly comparable to the ATV, as it is also intended for transport over rough terrain. However, the UTV (also called side-by-side) is normally equipped with a rear cargo box for hauling and transporting materials, which makes it interesting for Power-Packer. UTVs find their use among, for example, farmers and landowners, as they are used to facilitate in day-to-day activities.

It is seen as a plausible idea that the EDU could provide UTV manufacturers with an advantageous product for cargo box-lifting, which is why this research study will focus on this product-market fit. The idea is drawn below.

[3] http://www.atv.com/features/choosing-a-work-vehicle-atv-vs-utv-2120.html
[4] http://www.wisegeek.com/what-is-the-difference-between-an-atv-and-a-utv.htm

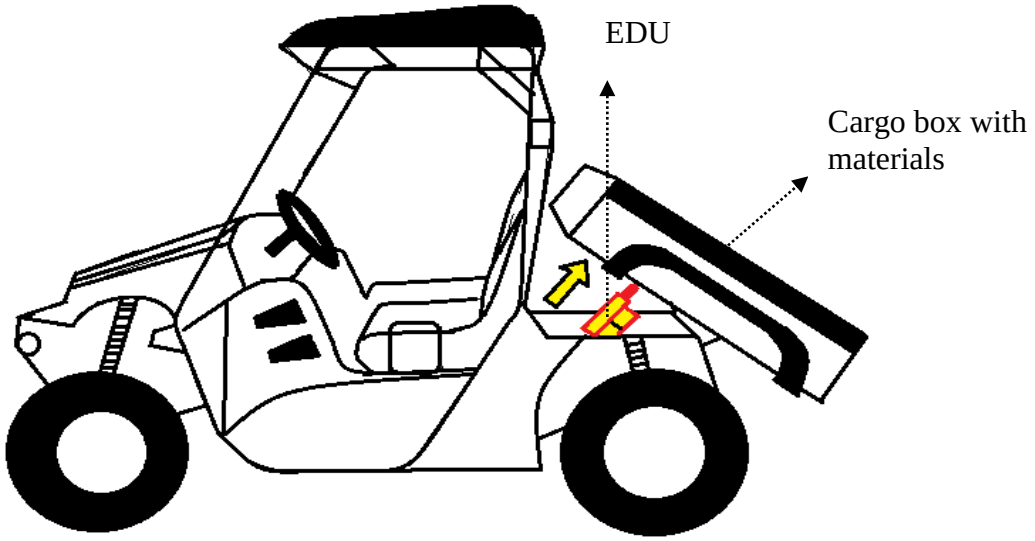

Figure 4: Product-Market Idea

The figure above gives an idea of the application of the EDU in a UTV. The main advantage of using a hydraulic system is its power, as tilting a bed filled with raw materials like sand or bricks requires a substantial amount of power. However, to determine whether Power-Packer will be able to retrieve financial benefit of serving UTV manufacturers with this product is dependent on a lot of factors. In the next section, the market is explored and the key players, forces and trends are mapped out. It is the basis from which assumptions concerning sales and costs can be made. The latter process will be part of further chapters.

3.2. Market analysis

In this segment, the target market described above is analyzed based on both data retrieved through means of desk research as well as external data from market players. In the first section, interesting market players are identified based on market share and product specifications. This will be the basis for the external empirical data collection. Furthermore, the competitive landscape is mapped out and the future trends of the market are elucidated. This chapter is used as a fundament for the market assessment in the next section.

3.2.1. Market players

The market of the utility task vehicles, or side-by-side vehicles, is mostly led by big OEM's that use their brand awareness, consumer confidence and quality differentiation to market their vehicles and achieve a big market share. According to the annual report of Polaris Industries Inc. (listed PII) in 2012, the side-by-side off-road vehicles market can be segmented as follows:

Figure 5: Market segmentation

The side-by-side market, from which around two-third is considered utility/commercial, is led by Polaris, which considers its main competitors to be (in unit sales):

- Kawasaki (#2 market share)
- Kubota (#3 market share)
- John Deere (#4 market share)
- Yamaha (#5 market share)
- Arctic Cat (#6 market share)
- Honda (#7 market share)
- Can-Am (#8 market share)

The global utility side-by-side vehicles industry should account for around 1.7 billion dollars with an expected compound annual growth rate of around 23 percent in the next 5 years[5] until 2017. Typical customers for these vehicles are graphed in the right chart.
Based on this information, it should be worthwhile to further investigate these key market players and their product characteristics.

Polaris Industries Inc.

Polaris is a recognized leader in the power sports industry with annual 2012 sales of $3.2 billion. Polaris designs, engineers, manufactures and markets innovative, high quality off-road vehicles, including side-by-side vehicles[6]. The prices of the vehicles interesting for this study start at around $9000 and rise with different models and added accessories to around $30.000.
The Ranger vehicles are equipped with a gas-spring to support manual lifting of the cargo box. This spring is capable of lifting 100KG without manual support.
Polaris offers an optional lift kit for cargo box actuation for a sales price of $600. According to Marco Hainz, a business unit director at Polaris Germany, the company achieved its leading

Figure 6: Lift kit Polaris

[5] Polaris Industries Inc. Annual Report 2012
[6] http://www.polaris.com/en-us/company/press-releases.aspx

position because it has a strong focus on this product segment, while most OEMs have UTVs as a supplement to other products in other segments.

Kawasaki

Figure 7: Hydraulic lift kit Kawasaki

Kawasaki Heavy Industries, Ltd., is a multi-national corporation with more than fifty holdings (manufacturing plants, distributions centers, and marketing and sales headquarters) in most major cities around the world. Business interests include environmental control and energy plant engineering, machinery and robotics, ship building and marine engineering, power plant engineering and steel structures, rolling stock, aerospace, and of course, ATVs, motorcycles, Side x Side vehicles and personal watercraft[7]. Their Mule series of side-by-side vehicles are particularly relevant for this study and prices also start at around $9000. A cargo bed hydraulic lift kit is optional in most models for an additional $900 and an aftermarket price of $970. This lift kit is self-contained hydraulic and has a weight capacity of around 400 kg. According to the online catalogue, the supplier of this unit is Kayaba (KYB)[8].

John Deere

Figure 8: Lift kit Deere

John Deere is an American corporation based in Moline, Illinois, and one of the largest manufacturers of agricultural machinery in the world. Products sold under the John Deere name include tractors, combine harvesters, cotton harvesters, balers, planters/seeders, sprayers, and UTVs. The company is also a manufacturer of construction equipment and forestry equipment. Additionally, John Deere manufactures equipment used in lawn, grounds, and turf care[9]. The UTVs are considered crossover utility vehicles and John Deere's Gator XUV series have realized growing sales throughout the last years. Prices start at $8000. Just like the Kawasaki Mule models, Gator XUV has an embedded option for an electro-hydraulic power-lift kit with a price range from $770 to $860. This unit should be able to actuate around 445 kg. Other Gator models, like the traditional series and the high performance series have single-cylinder and double-cylinder electro-mechanical actuators respectively. Prices for these electro-mechanical units lie around $650. Like the Kawasaki Mule, the supplier for the factory installed hydraulic actuator is KYB.

Kubota

Figure 9: Kubota RTV

With the RTV series of side-by-side utility vehicles, Kubota is one of the big market players. Interesting about the portfolio of Kubota is that most of the relevant vehicles have

[7] http://www.kawasaki.com/OurCompany/khi.aspx
[8] http://issuu.com/echodesign/docs/2013_kawasaki_mule?mode=window
[9] http://en.wikipedia.org/wiki/John_Deere

a standard hydraulic cargo box lift-kit[10], while most competitors offer such a kit only as an additional accessory. According to Michael Klug, a product manager at Kubota, the bigger models are all equipped with a kit that is manufactured by Kubota itself. The smaller vehicles however are still in need of a suiting actuator.

Yamaha

Yamaha Motor Company Limited is a Japanese motorized vehicle-producing company. Yamaha Motors is part of the Yamaha Corporation and its headquarter is located in Iwata, Shizuoka. Just like the companies above, Yamaha Motor produces a variety of motorized vehicles including motorcycles, all-terrain vehicles, boats, marine engines including outboards, automobile engines, personal watercraft and snowmobiles[11]. Yamaha currently offers 4 models of side-by-side utility vehicles, which is a small number compared to the above manufacturers. Furthermore, the cargo box of their Rhino series can be lifted to lose the content, though this is done by hand rather than by a hydraulic kit. This assumption is also supported by Daniel Harzog, a sales executive of the Yamaha Rhino. According to him, the Yamaha cargo boxes are simply too small for an actuation kit to be valuable.

Arctic Cat

Similar to the above, Arctic Cat produces side-by-side vehicles for recreational and utility purposes. As can be seen from the vehicle portfolio of Arctic Cat, the emphasis lies more in the sport and recreational section of the UTV market. Arctic Cat does offer hydraulic lift kits for the cargo box for a sales price of $500. Furthermore, Arctic Cat offers actuating accessories for a snow plow. Such a kit offers electrical actuation of the plow.

Figure 10: Hydraulic lift kit Arctic Cat

This section is meant to briefly introduce the important market players and their current situation regarding the proposed product applications. In **Error! Reference source not found.**, similar products of competitors are listed. The first conclusion that can be made from these findings is that both the EDU in its nature as well as the application is not new to the market. This has operational and strategic implications, as market share has to be achieved through product- and organizationally inherent advantages such as cost, quality, reliability and service.
To determine the strategic focus and the opportunities to achieve competitive advantage, the market has to be analyzed more thoroughly. This matter is centralized in the coming sections.

3.2.2. Market size

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[10] http://www.kubota.com/product/RTV900XT/pdf/rtv900xt_spec.pdf
[11] http://en.wikipedia.org/wiki/Yamaha_Motor_Company

3.2.3. Market trends

The market as described in the latter sections is subject to a variety of trends and developments. This section is meant to identify major trends in the target market that can either facilitate in, or impede its attractiveness. The forecasts in terms of for instance size, market share distribution or technological developments can either create new opportunities or close existing ones. Consequently, analyzing the market trends is an important part of this chapter.

According to the department of forest resources of the university of Minnesota, the popularity of off-highway vehicles (OHVs) has grown substantially in recent years. Registrations of all-terrain vehicles and off-highway motorcycles surged nationally from 2.92 million in 1993 to an estimated 8.01 million in 2003; OHV participation is projected to increase 42% by 2015[12].
Though the growth rate of the market has taken hits because of the crisis years, the outlook is still positive. Many sources indicate sales increases and industry growth in the UTV segment as well. Though little statistics are yet available for 2013, the 2012 sales of important market players exceeded expectations. From an industry size of around 50,000 units seven years ago, the UTV industry exceeded 200,000 units a year in 2011[13].
Arctic Cat, one of the key market players, expects its UTV sales to increase between 10 and 20 percent in 2013[14]. On a parallel level, Polaris Industries Inc. saw an increase in side by side vehicle sales of over 20 percent between 2011 and 2012[15] and expect the off-road vehicle sales to keep increasing in 2013. The forecast for continued strong sales of side-by-side units for the next several years looks healthy, and sales could exceed 375,000 units (in North-America) by 2015[16].
The above sources indicate that a market decline is not likely to occur in the near future. However, to really understand the market dynamics, one should look at the factor that drive growth or declines. Consequently, the macro-economic factors can provide useful insights into market tendencies. These factors are structured using the PESTEL-model.

<u>Political trends</u>

According to the CEO of JCB, product design decisions and trends for compact and midrange construction equipment will be heavily influenced by exhaust emissions legislation in the coming 10 years. Tier 4/Stage IIIB emissions will demand charge-air cooling, externally cooled exhaust gas recirculation, and exhaust after treatment systems for all engine ratings greater than 75 hp (56 kW)[17]. Emission regulations have led to an increasing focus on green technologies, which has also lead to competition in the field of green brand imaging. Furthermore, on-road restrictions and regulations have been an obstacle to a wider use of off-road vehicles as well. Some vehicles are prohibited on public roads, while others have restricting speeds.

[12] http://www.forestry.umn.edu/prod/groups/cfans/@pub/@cfans/@forestry/documents/asset/cfans_asset_184728.pdf
[13] http://www.atvmag.com/article.asp?nid=2280
[14] Raymond James, *Arctic Cat overview*, March 6, 2013
[15] Polaris earnings result Q4 and total 2012
[16] http://www.dealernews.com/dealernews/article/utv-sales-expected-grow-12-15-percent
[17] http://www.sae.org/ohmag/features/futurelook/03-2005/78.pdf

Economical trends

The international financial crisis of 2008-09 required most countries to run large budget deficits. In an attempt to attack their deficit and debt problems head-on, nearly 5 out of 6 countries slowed the rate of growth of government spending, and 1 in 3 countries actually lowered the level of their expenditures[18]. As a consequence, the world's economy is starting to recover, the global budget deficit is narrowing down and global retail expenditure is expected to grow over the coming years[19]. As the government has a share in the consumer market of UTVs, this forecast can be considered positive. However, the world's economy is still fragile and it is plausible that procurement of new vehicles for governmental use will be postponed or scrapped entirely. On the contrary, in this light aftermarket parts demand could increase because maintenance of used vehicles intensifies in line with its lifecycle.

A fragile economy does not only impede the target market. As buying power has decreased throughout the last years, a plausible scenario could emerge in which a landowner or farmer abandons the idea of purchasing an expensive tractor and instead chooses to acquire a much less expensive UTV to complete everyday tasks.

Socio-cultural trends

The world's population is expected to grow by over a third in the next 35 years, accounting to around 9 billion in 2050. This fact, along with high urbanization rates, brings along a growing demand for food and water that will be difficult to meet, making the agricultural industry increasingly interesting for innovative organizations. One of the end-user segments of UTV consists of farmers and landowners and as these users are primarily focused on the utility purposes of the vehicles, this customers segment is quite important. The fact that the agriculture has to increase its output asks for investments in technology to increase operational efficiency, which offers a window of opportunity for new and existing market players.

Technological trends

One of the trends with the highest impact on the world is the rise of the internet. In the corporate environment e-commerce has become a vital part of most businesses. As for the target market, the effects of this 'new' way of doing business can be seen as well. The internet functions as a large pool of information for customers. Online purchasing has become very popular among UTV users, which can also be seen by the trends in website design of major UTV OEMs, as most websites offer users a complete virtual customization and comparison application. While the option to install a power lift kit becomes more visible, consumer power is increased as well. Easy access to information will lead to a critical view from consumers as they can quickly compare offerings of different vehicle suppliers. Customer retention shifts towards a matter of price-to-quality ratio rather than brand loyalty and blind trust. The intensified competitiveness that rises from this matter should lead to the realization that the product offering has to be of high quality and a relative low price to achieve market share.

[18] CIA world factbook

[19] http://reference.mapinfo.com/software/anysite/english_UK/8_8/UK_Data_Ref_Docs/Retail_Expenditure_Guide_2011-12.pdf

Environmental trends

Each year around 80 million people are added to the world's population. This leads to a severe depletion of non-renewable resources. Oil and fuel prices have been rising throughout the past decades, leading to an increasing demand for electrical- or hybrid vehicles. While these issues do not directly imply a barrier for the electro-hydraulic unit, it should be kept in mind that the use of an oil pump rather than an electrical- or pneumatic drive unit could affect the image of the vehicle as a whole.

Legal trends

In a legal context, the most important factors that have to be taken into account are the legal framework issues attached to becoming a supplier for a large OEM. As can be seen on OEM websites, supplying parts and accessories for commercial and private vehicles is bound to an array of rules and obligations. When initiating a project in the proposed market segment through a cooperation with one or more OEMs, these issues should be thoroughly addressed to avoid misfits and legislative problems because of uncertified products. Jamieson Bergen, an earlier mentioned marketing analyst for Toro, describes a trend in this context that can have consequences for the supplier criteria. As OEMs are increasingly trying to get their vehicles approved for on-road travel, safety criteria of vehicle components becomes a more elaborate issue. Though this trend could make it more difficult to meet supplier criteria, it would eventually lead to a bigger market range as on-road travel is considered important to consumers.

While the macro-environmental trends described above are helpful when explaining market movements, market-specific factors that drive actual product- and focus changes should be addressed as well.

According to IUV magazine[20], there are certain developments in the, as they call it, small task-oriented vehicles market that will either spur or obstruct growth. First of all as mentioned earlier, a fragile economy is likely to last for at least the coming two years, holding back the growth in the market. For the sports- and leisure-users of UTVs the vehicle is considered a luxury product, which are particularly receptive to poor economic conditions. For the utility users, however, a UTV might actually be economically advantageous compared to a more expensive tractor or pick-up truck. Especially because of the continued pressure to develop new models that are low in cost, maintenance and environmental pollution, substituting traditional vehicles with UTVs might be a viable option.

Being successful in the UTV industry depends on differentiation and marketing. All the major OEMs are capable of producing high quality vehicles, but the differentiating factor will be to include product modifications to suit user-requirements. In this context, extra attachments will drive competitiveness. Another key development is driven by the abundance of natural gas. The number of natural gas fuel systems is expected to grow in the coming years. Furthermore, heavy duty electrical UTVs begin to emerge alongside hybrid- and crossover vehicles, all to replace light trucks, compact tractors and automobiles. In general, users are much more hard-headed and calculating when purchasing a utility vehicle[21]. Especially due to the earlier mentioned internet developments, a wide price/quality/functionality comparison can be easily made before choosing

[20] http://www.pageturnpro.com/Publications/201211/2163/45981/pdf/129974024572310000_IUV%20Nov-Dec%202012%20-Green%20IssuePRINTrs.pdf

[21] http://www.pageturnpro.com/Publications/201205/2163/39398/pdf/129816473677716250_IUV%20May-June%202012(final).pdf

your vehicle supplier. From this perspective it can be concluded that the distance between the manufacturer and the end-user has become smaller, as the internet provides the opportunity for feedback and supplier-customer conversation. The market has become more transparent and market needs are easily obtained by manufacturers.

3.3. Market assessment

Throughout this section, the attractiveness of the market is roughly assessed without actually conducting a financial valuation study. In the previous section, data has been gathered to support this assessment. To structure this section, the market assessment framework below is used[22].

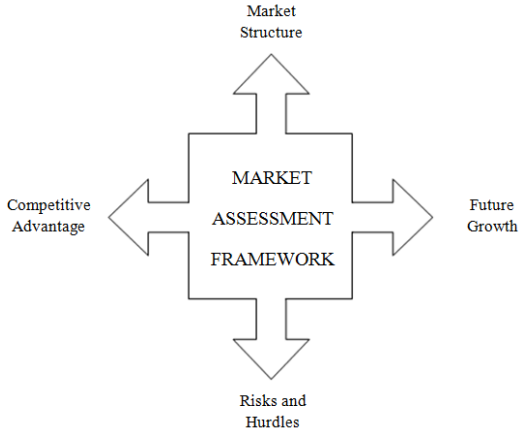

Figure 11: Market Assessment Framework

3.3.1. Market structure

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3.3.2. Future growth

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3.3.3. Risks and hurdles

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3.3.4. Competitive advantage

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[22] http://blog.openviewpartners.com/assessing-new-product-opportunities-a-guide-to-structured-product-assessments/

3.3.5. SWOT analysis

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Chapter 4: Constructing the Framework

How should the financial value of new growth initiatives be quantified?

The focus of this chapter lies on analyzing financial theories to construct a valuation framework suited for practical use at Power-Packer. Understanding the fundamental idea of financial value is important when linking the concept to corporate decision making. The first section is therefore dedicated to explaining the nature of financial value. In addition, organizations often have certain criteria when it comes to project initiation. These criteria are based on financial and non-financial figures (e.g. net present value, internal rate of return or payback period). The organization's individual valuation practices are therefore designed to retrieve the figure of focus. The nature of these figures and how they can be calculated will therefore be explained in the first section as well because it introduces the possible managerial perceptions of project value. In further sections, practices to improve the validity and reliability of these figures are discussed based on three areas of focus: Financial risks, market risks and managerial flexibility. By addressing these focus areas, a more complete/justified answer to the sub question above can be formed. This answer will be structured in the form of a phase-framework in the last section of this chapter. The framework is established by using a selection of the theories mentioned in this chapter.

4.1. Defining financial value

The primary objective of a corporation is value maximization. According to Brigham & Ehrhardt (2010), this value depends on the size of the firm's free cash flows[23], their timing and their risk and can be defined by the following formula:

$$V(f) = \frac{FCV_1}{(1+WACC)^1} + \frac{FCV_2}{(1+WACC)^2} + \cdots + \frac{FCV_n}{(1+WACC)^n}$$

Firm value (V_f) is determined by the free cash flows (FCV_n) discounted at the risk-rate or the weighted average cost of capital (see section 5.2) adjusted for the exponent of time (^{n}).

The above formula is particularly important for shareholders and creditors, as free cash flows (i.e. residual cash after payment of all expenses and investment costs) can be distributed among them in the form of dividend.

In financial markets and acquisition projects, the value of the firm is simply the sum of the market value of debt and the market value of equity (Hillier, Ross, Westerfield, Jaffe & Jordan, 2010). This assumption can be expressed through the following formula (provided the firm is levered):

$$V_L = \frac{EBIT \times (1-t_C)}{R_0} + \frac{t_C R_B B}{R_B}$$

[23] A cash flow is the residual money after expenses are subtracted from revenues.

Simply put, this formula[24] shows that the value of the levered firm (V_L) (i.e. the total value for bond- and shareholders) is the value of the unlevered firm plus the value of the tax shield.
A tax shield originates when an unlevered (i.e. no debt) firm issues debt and therewith alters its capital capital structure. Fundamentally, corporate earnings are taxed at a country-specific tax-rate, whereas whereas interest is subtracted from earnings before these earnings are taxed. To put more simply, interest expenses are tax-deductable, which leads to an initial increase in value when debt is issued (for issued (for a more elaborate explanation, see

[24] Midogliani & Miller proposition I: Modigliani, F., Miller, M., (1958), The cost of capital, corporation finance and the theory of investment, *American Economic Review*, *June 1958.*

Appendix VI: Levered- versus unlevered-firm value).

A fundamental 'rule' for this research is that firm value is decomposed into the value of assets in place plus the value of **growth opportunities** (Shin & Stulz, 2000). The value of a project, or growth opportunity, can be described as the expected future cash flows it will generate, adjusted for the risk that these future cash flows will not be achieved, minus the present value of the investment costs. This implies that differences of opinion about asset values are motivated, explicitly or implicitly, by differences in estimated cash flows and/or discount rates (Kecskés, Michaely, & Womack, 2010). Estimating cash flows can be done based on sales and cost forecasting. However, estimating the risks of an investment opportunity is more complicated.
Firms in the corporate environment have different approaches when it comes to deciding whether to initiate a project based on cash flows. In the sections below, a variety of popular valuation methods will be theoretically described as an introduction to project valuation.

4.1.1. Payback period

The (discounted) payback period valuation method is widely used in corporate finance. The underlying assumption behind this method is that an investment should pay off eventually to yield a financial return. Many organizations have pre-determined investment criteria considering the period of payback. The advantage of this method is its simplicity, as it does not require a sophisticated knowledge of corporate finance to be able to use it. Especially when the project cash flows are not discounted at a required return rate (see next section), the calculation is rather simple and is therefore frequently used in the business world. When the cash flows are not discounted, the payback period is calculated by adding cash flows to the initial investment until the outcome is positive. At this point in time, the investment has paid off (i.e. payback period is over). In contrast, by discounting the cash flows, the method includes the presence of financial risk in the calculation, yielding a more practically justified outcome.

An important problem that arises is the fact that an investment decision based on the payback period does not consider cash flows after this period. If two mutually exclusive projects have payback periods of two and three years, respectively, but the latter projects has substantially higher positive cash flows after the payback period, the method would dictate to pick the first project while this project will eventually be less valuable. Additionally, the method does not consider the timing of cash flows within the payback period, while this timing (especially with discounted cash flows) is relevant for decision making. In the last four phases of the framework, the payback period factor will be taken into account alongside other financial value indicators.

4.1.2. Net present value

The net present value method is one of the most effective methods of determining the financial value of investments. This method uses discounted cash flows to determine whether a project should be accepted or rejected. The basic assumptions considering net present value calculations are:

1. Projects with positive NPV should always be accepted.
2. Positive NPV projects benefit shareholders and increase firm value.

As introduced in section 4.2, the net present value method uses discount rates to properly include the financial risks of projects. By using a simple NPV calculation, the importance of discount rates to determine the time value of money can be easily described (Appendix VII: Discount rates). The NPV formula is given below.

$$NPV = -inv + \frac{Cf_1}{(1+r)} + \frac{Cf_2}{(1+r)^2} + \cdots + \frac{Cf_i}{(1+r)^i}$$

Discounting cash flows to account for financial risks will be done in all calculative phases of the framework according to the NPV principle.

4.1.3. Internal rate of return

Internal rates of return are a useful spinoff of the net present value method. Rather than providing a positive or negative number to guide the decision making process, the IRR method generates a number that summarizes the parameters of a project. By looking at the formula above, the IRR can be easily described as the discount rate (r) for which the net present value is zero. In other words, it is the maximum discount rate under which the project yields a (marginally) positive NPV.

In a practical sense, if the cost of capital/required return/discount rate is known, projects with an IRR that is higher than this figure should be accepted, for they will generate a positive net present value. In projects from which the cash flows are positive, the IRR is a useful figure to determine project value. However, as one can imagine, if the cash flows within the project time span fluctuate from positive to negative, the method would provide multiple internal rates of return, which makes them invalid and the method therefore useless. Furthermore, if a firm has to choose between two mutually exclusive projects, the method does not provide justified guidance for the investment decisions. In the description phase of the framework, multiple values for IRR will be provided.

Above, the most frequently used methods of project valuation are discussed in a simplified form to introduce the issues in investment decision making. Although these methods would provide managers with figures concerning the financial value of an investment, in practice, they have calculative flaws that could lead to irrational decision making, especially when the focus is narrowed to the use of a single method.

There are three major issues when valuating investment projects. While some of the above methods partly address these issues, they should all be taken into account when making an investment decision.

1. Accounting for financial risks when calculating the value of future cash flows.
2. Accounting for market risks by contemplating different project scenarios (i.e. fluctuations in sales and costs) and estimating their probability.
3. Accounting for managerial flexibility within the time frame of the proposed project.

To justify the valuation framework that is used in this case-study, the issues above must be addressed. The following sections are dedicated to explaining the importance of these issues and their implications on the design of the framework.

Financial risk is related to the volatility of the asset (or project) value. If money is invested in whatever asset (e.g. plants, equipment, share portfolio or production line), it requires a return that is greater than the return that would be received if the money was not invested. When choosing investment opportunities, a balance must be found between the expected return and the volatility of this return. Accounting for this volatility can be done by using a proper discount rate to determine the present value of cash flows. This issue is addressed in the next section and will be exercised in the classification phase of the framework implementation.

Market risks are related to the risk of losing money because of fluctuations in market factors (e.g. demand, price, material costs, etcetera). Accounting for this risk can be done by 'playing' with the variables that determine the size of the forecasted cash flows. Practices in this context are explained in section 4.3. The exploration phase finds its roots in this section.

Managerial flexibility is an important part of a project timeframe because it decreases the risk of a complete depletion of the project value. Even with managerial flexibility risks remain an issue, however possibilities to alter the path of investments can have effect on the expected value of the project, which is why this factor is addressed in this chapter. A discussion on this subject can be found in section 4.4. and an implementation in the extension phase.

4.2. Financial risk

Fundamentally, investment projects are subject to multiple factors of uncertainty. Market environments are volatile, sales are difficult to forecast and operational costs tend to fluctuate. Te determine the expected financial value of a project, these factors of risk have to be taken into account. Proper risk management can assist the project manager to mitigate against both known and unanticipated risks (Carbone & Tippett, 2004). Especially when contemplating a project in a new market, as is the case in this study, risk assessment is particularly difficult because of the lack of experience with target market factors. Typically, to try to account for finance risks, in many projects expected project cash flows are discounted at a higher rate than the risk-free market rate (i.e. the required return rate R). One way of approaching the required return is using the weighted average cost of capital, which is described below.

4.2.1. The Weighted Average Cost of Capital

The cost of capital can be defined as the required return needed for an investment to be financially valuable. Determining these return rates is a complicated process with much room for interpretation. A fundamental basis from which determinations can be made is the assumption that the cost of capital can be measured by the sure stream of interest cost from bonds. Simply put, the cost of capital is equal to the interest rates on bonds. Consequently, a firm, acting rationally, will tend to push investment to the point where the marginal yield on physical assets is equal to the market rate of interest (Modigliani & Miller, 1958). Both profit maximizing and increasing market value will be pursued if the expected return rate exceeds the interest rate.
Using merely the interest rates in determining the cost of capital is only justified in a world without uncertainties and with sure returns. However, in practice, the rate of return is dependent on many other variables that explain for the uncertainty of future returns in the market. As a result, the market rate of interest is too low because it does not include the uncertainty of real life investments of organizations. A risk premium should therefore be added to account for the investment risk. Below, the formula for the weighted average cost of capital is given.

$$WACC = \left(\frac{S}{S+B}\right) R_S + \left(\frac{B}{S+B}\right) \mathrm{R}_B(1 - \mathrm{T}_C)$$

Investment risk is typically seen as the variance (σ^2) or fluctuation of the returns of the investments. If an investment is risky, it should only be considered if the expected return will be high enough. The problem that arises in this study stems from the nature of the proposed investment project. If an organization has a series of projects that are similar to each other and to projects in the close past, the parameters and risks of these projects are easier to predict. In these cases, the WACC provides a good viewpoint to account for the risk of the project because it is the calculated summary of past projects. However, initiating a new-to-the firm market with a product that is quite new to the firm as well, using the WACC to account for investment risk is practically unjustified because of the absence of comparable projects. The risk of this new project can therefore not be accounted for by simply using the cost of debt and equity. As a consequence, risk management in such a project should be approached in a more structured way.

4.2.2. Failure mode and effects

Project risk failure mode and effects analysis, or RFMEA, is a relevant example of such a structured approach to risk management (Carbone & Tippett, 2004). This method assesses risks in an individual way and fundamentally ascribes three factors to them:

1. Likelihood of occurrence
2. Impact on project objectives
3. Detection ability

Each of these factors can be quantified on a scale from 1 to 10 with increasing harmfulness to the project, as can be seen in the tables below (Carbone & Tippett, 2004, redesigned):

Value	Likelihood	Impact	Detection
9-10	Very likely to occur	Schedule: >20% impact on critical path Cost: >20% increase Technical: End item is rendered useless	No detection method available to plan for contingency
7-8	Will probably occur	Schedule: 10%-20% Cost: 10%-20% Technical: End item may not be usable to client	Detection method unproven or unreliable
5-6	Equal chance of occurring or not	Schedule: 5%-10% Cost: 5%-10% Technical: Will require client approval	Detection method has medium effectiveness
3-4	Will probably not occur	Schedule: >5% Cost: >5% Technical: Effect on scope minor	Detection method has moderately high effectiveness
1-2	Very unlikely	Schedule: Insignificant Cost: Insignificant Technical: unnoticeable	Almost certain that risk will be detected with adequate time

Figure 12: Risk value guidelines

Multiplying factor 1 and 2 yields the risk factor, whereas multiplying the three factors yields the risk priority number (RPN). Below, an example is given of how risk values can be scattered.

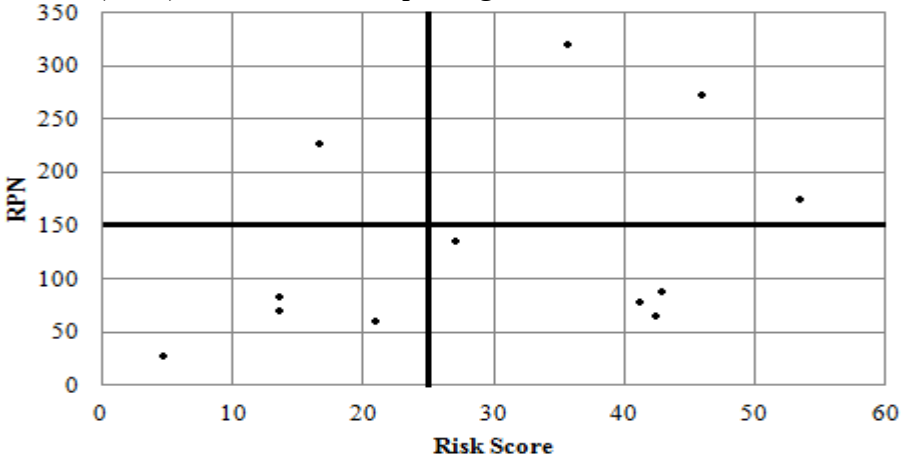


Figure 13: Risk scatter chart example

Every project has unique characteristics and should be viewed individually. In this particular example, the critical value for the risk score and the RPN were set at 25 and 150 respectively. These values, however, are subjective to the nature of the project, the possible impact of the project on the organization's financial health and the management team's risk tolerance and can therefore be altered by the project team. In this project, there are 3 risk factors that exceed both critical values. Whether these findings would lead to a rejection of the project due to critical risks is again a matter of the manager's opinion.
The RFMEA methods aims to support the project team to get a more elaborate view on the project's risk characteristics in early stages. It helps identifying the issues that should be monitored closely and reveals critical elements of the project that should be backed up with a contingency plan. Such an approach to risk management does not lead to monetary figures, but it can be very valuable in certain situations, which is why it will be included in the framework as the first phase.

4.2.3. The Capital Asset Pricing Model

From a financial point of view it would also be useful to use risk assessment in cash flow discounting by calculating the risk adjusted discount rate. This issue has been addressed in a wide variety of scientific literature and many models and formulas have been established to best quantify risk factors. However, investment decisions can never be made with absolute certainty, as risk must always be estimated (Butler & Schachter, 1989). Large institutions are increasingly relying on sophisticated statistical models to evaluate risk and allocate capital across the organization (De Fontnouvelle, Jesus-Rueff, Jordan, & Rosengren, 2003). Determining the present value of future cash flows while accounting for the project's risk factors has proven to be a difficult theme. In the corporate world, financial managers often use the capital asset pricing model (CAPM) to evaluate typical investments. The CAPM uses the firms beta (β), which is the covariance of the stock returns with the returns of the market. The CAPM formula is given below:

$$\bar{R} = R_F + \beta \times (\bar{R}_M - R_F)$$

With the formula of β being:

$$\beta = \frac{Cov(R_i, R_m)}{\sigma^2(R_m)}$$

The *expected* return on a security, or the risk adjusted discount rate for project cash flows ($\bar{R}$) is the risk-free rate plus the beta of the security (i.e. the covariance between the return on the security and the return on the market portfolio divided by the variance of the market) times the market risk premium.
The market variance can be described as the expected value of $(R - \bar{R})^2$, whereas the covariance is equal to the expected value of $[(R_i - \bar{R}_i) \times (R_m - \bar{R}_m)]$.
Variance and covariance calculations are often used on the financial capital market to hedge against portfolio risk (i.e. to increase expected return while keeping risk on a similar or lower level) by investing in securities that negatively correlate. However, as can be seen in the above calculations, these financial indicators are also used to measure the responsiveness of a ventures return to movements in the market environment (i.e. the firms beta).

To determine the discount rate of the project through using the capital asset pricing model, the three variables (risk-free rate, market risk rate and the project's beta) have to be estimated. The risk-free rate (R_F) is basically the return on a security with no risk or variance. In practice, financial managers often use treasury bills or government bonds that are assumed to be riskless (i.e. interest will always be paid). As mentioned earlier, business project's are (almost) never riskless, because they are receptive to changes in the project environment. The next step in determining the discount rate would therefore be to add the market risk premium, which is the difference between the expected return on a market portfolio (R_M) and the risk-free rate[25]. The return on a market portfolio is often calculated by using available historic financial data. Determining what rates should be used therefore depends on the country's financial status and the market characteristics itself. Furthermore, individual firms normally express a certain responsiveness to changes in the market, which is why using R_M should be multiplied by a certain responsiveness factor. This is where the beta comes in. To give an example, assume the smart-phone industry faces a decline in turnover because of poor economical conditions (i.e. R_M decreases). Expected returns of worldwide corporate organizations like Apple or Samsung would not change accordingly to the R_M decrease but would stay steadier, whereas a new entrepreneurial venture would face a more rapid decrease because it is more receptive and vulnerable. The latter firm would have a beta >1, while the first firms would have a beta <1.

Using the CAPM with equity betas builds on the assumption that the proposed project bares the same risk as the assets of the overall venture do. However, as mentioned earlier, a new-to-the-firm project should not be subject to the same risk quantification as the rest of the firm. The question still remains as to what risk quantification the proposed project should have. Especially because investment projects are not traded securities and thus do not have directly observable betas (Bernardo, Chowdhry, & Goyal, 2007). One could start with stating the following rule:

The discount rate of a project should be the expected return on a financial asset of comparable risk (Hillier et al., 2010).

In other words, project risk cannot be estimated directly but must instead be inferred from a set of comparable traded securities (Bernardo, Chowdhry & Goyal, 2012). According to the latter authors, the steps in the process of calculating/estimating the project beta are threefold:

Figure 14: Estimating project beta

The betas of companies whose risks are judged to be comparable to those of the project are often used to refine the estimate of risk (Bernardo et al., 2012). Furthermore, because in practice most corporations typically calculate the cash flows of a project under the assumption that the project is financed only with equity, the betas of companies must be unlevered to adjust for the differences in financial leverage. As mentioned earlier, leverage could increase the value of a

[25] http://www.investopedia.com/terms/m/marketriskpremium.asp

firm because of a tax shield. However, increasing the amount of leverage has an effect on the firms risk (i.e. too much debt brings financial distress). To obtain the asset (or enterprise) beta, company betas are therefore unlevered in most instances. In addition, as is elucidated in the next section, a firm's growth opportunities often include embedded 'real options'. Embedded real options can be seen as leveraged positions as well, which is why the asset beta should again be unlevered to undo the effects of growth options leverage and to obtain the project beta. Calculating the asset beta is done by the following formula:

$$\beta_{asset} = \beta_{equity}\left[\frac{1}{1+\left((1-t)\frac{D}{E}\right)}\right]$$

Wherein D represents the firm's market value of debt, E the firm's market value of equity and t the firm's tax rate. The beta can then be used in the CAPM to retrieve the rate of return, or discount rate (r), which is inserted in the NPV formula given earlier:

$$NPV = -inv + \frac{Cf_1}{(1+r)} + \frac{Cf_2}{(1+r)^2} + \cdots + \frac{Cf_i}{(1+r)^i}$$

One scenario that should be kept in mind is the fact that a project might have a cash flow stream that has no end in the foreseeable future. Consider a customer that will purchase a fixed number of hydraulic systems each year for the coming twenty years or longer (which is not completely implausible). The value of such cash flow streams should rather be estimated by using a perpetuity calculation in which:

$PV = \frac{Cf}{r}$,and in case of cash flows with a constant growth factor: $PV = \frac{Cf}{r-g}$

Estimating the beta of a project has theoretically justified implications for the value of cash flows. As said, using the CAPM leads to a rate by which cash flows should be discounted, keeping in mind the component of time. This model will be centralized in the second phase of the framework. However, according to many academics three fundamental limitations of these discounted cash flow (DCF) methods are the fact that (1) they are based on a set of fixed assumption related to the project payoff (a deterministic approach), while the payoff is uncertain and probabilistic, (2) DCF does not consider contingent decisions available throughout the project and the managerial flexibility to act on those decisions and (3) the volatility or risk of a project is only considered as a downside while it can bring rewards as well (Kodukula & Papudesu, 2006).
In short, the financial value of a project should not only be estimated by designing a cash flow stream and discounting them to account for the negative effects of risk. The DCF method should still be used when determining cash flow value, however the gaps and limitations should be filled by supplementing different theories. This issue will be addressed in the next sections.

4.3. Market risk

As mentioned earlier, one of the issues in project valuation is the volatility of the market and the difficulties in cash flow forecasting as a consequence. The deterministic approach to cash flow calculation could lead to serious biases in the estimation of project value because of imperfect forecasting of costs and revenues. This issue can be addressed by 'playing' with the input variables (i.e. altering the financial parameters).

4.3.1. Sensitivity analysis

To account for the variance in project cash flows, the sensitivity analysis method can be used. In a sensitivity analysis one examines the sensitivity of the NPV calculations to changes in the project variables. A 'bop' approach is common with this method. This approach assigns best (or expected), optimistic and pessimistic values to certain variables in the project (market size, market share, sales price, production costs and investment). Standard sensitivity analysis calls for an NPV calculation for all three possibilities of a single variable, along with the expected forecast for all other variables (Hillier et al., 2010).

This approach has an added value to the overall project valuation framework, because it helps a project manager to detect certain areas of the project that require more research. It will therefore be addressed in the exploration phase. If three different values for a certain variable yield a big variance in the NPV of the project itself (i.e. from highly negative to highly positive), this area needs more information to achieve a smaller distance between pessimistic and optimistic values and therefore more certainty in the cash flow calculations. In addition, the manager can see which input variables have the highest impact on the projects value and should therefore be closely managed.

4.3.2. Scenario analysis

To account for the fact that variables are often interrelated (e.g. ineffective project management would drive up both production- and investment costs), the scenario analysis method is often used. Through this approach, different scenarios with a confluence of factors are examined. As Duinker & Greig (2007) put it, scenario-building does not focus on making predictions or forecasts, but rather on describing images of the future that challenge current assumptions and broaden perspectives. Following this assumption, scenario-analysis is an important aspect of corporate investment decision making and will therefore be addressed in the exploration phase of the proposed valuation framework.

4.3.3. Monte Carlo simulations

Scenario- and sensitivity analysis methods have limitations when it comes to simulation of a large number of scenarios. In practice, many practitioners use computer software to simulate a large amount of scenarios and determine their NPV. On such method is the Monte Carlo simulation. Although this method involves the use of computerized calculations, it is worth mentioning because of its wide acceptance and implementation in practice. In the Monte Carlo approach, a random value for each input parameter (project variable) is taken and the DCF method is used to solve the NPV. For every input variable, the probability distribution is defined by identifying the average value and the standard deviation. One value is then drawn within this distribution based on which the NPV is calculated. This process is repeated many times (through running software) to retrieve a probability distribution of the projects net present value.

Monte Carlo simulations are often impractical because of the required sophisticated computer software and the required knowledge of probability distributions to estimate averages and standard deviations.
In practice, the most common approach in the context of this section is to first determine the NPV based on deterministic estimations of cash flows, second to conduct a sensitivity analysis to identify high impact input variables and third to conduct simulations by focusing on those variables.

4.3.4. Break-even analysis

If designing different scenarios and calculating net present values through a sensitivity analysis does not yield a satisfying outcome in terms of usefulness and reliability, managers often use a break-even analysis to determine minimal sales volume or price to clear investments and productions costs. If the parameters of project costs and the sales price are known, simple math could provide you with an (estimated) break-even sales volume:

$$C_i + C_p \times X = S_p \times X$$

Conversely, if the sales volumes is known along with the project costs, break-even analysis provides you with an estimate of the break-even price.

$$C_i + C_p \times S_v = X \times S_v$$

A closely related method is the earlier mentioned payback period calculation, in which a break-even point in time is determined based on established cash flow estimates.
Although this method is widely used in practice, it does not provide a manager with an indication of the actual financial value of the investment project.

4.4. Managerial flexibility

During most investment projects, managers have the possibility to delay and adjust investment and operating decisions over time in response to the resolution of uncertainty (Triantis, 2005). According to Trigeorgis (1993), academics and practitioners alike now recognize that standard discounted cash flow (DCF) techniques (e.g. IRR, NPV, DPP) when applied improperly often undervalue projects with real operating options and other strategic interactions. Fundamentally, an organization's investments are often multi-staged (Copeland & Tufano, 2004) and an investment project has a certain managerial flexibility. During the life cycle of the project, managers have options concerning the further investment characteristics of the project. These options include the choice to delay or defer investments, to expand the investment in later stages when favorable outcomes are observed, to adjust production schedules with fluctuating prices, or to abandon the project in an early stage when outcomes are unfavorable. If an investment project has options in its life cycle, the risk of, for instance, a worst case scenario are decreased because a rational manager would abandon a project if the prospects in the middle of the project's time frame are negative. Consequently, managerial flexibility in an investment project will increase the project's financial value. The matter is therefore taken into account in the framework.

4.4.1. Decision trees

Investment options during the life cycle of the project can have high financial impact, which is why this theory should be addressed when valuating investment projects. A simple introduction of options thinking is given below.

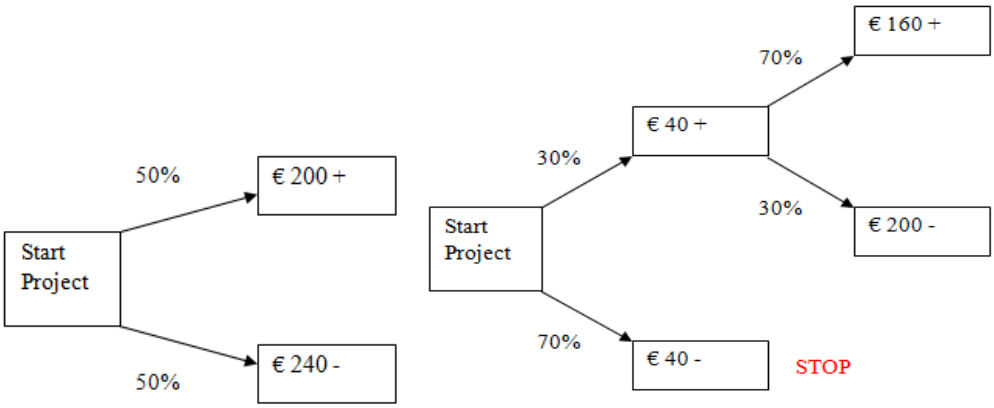


Figure 15: Decision tree example

With future cash flows scenarios of either €-200 or €240 and with a probability of 50 percent each (figure left), the expected value of the project will be negative (0.5*-240+0.5*200= €20-) and it should therefore not be considered (left figure). However, if the project is divided into two phases with the managerial option to stop investing in the middle, this could yield the figure on the right.

Accounting for the manager's option to abandon the project after the first phase (i.e. when first cash flow is negative) would probably change his or her view on starting the project in the first place:

$$V = (0.7 \times -40) + (0.3 \times 40) + (0.7 \times 160) + (0.3 \times -200) = 36$$

With the value of the option being the difference between the expected project value without the option and the expected project value with the option.($V_{option} = \Delta_v = 56$)
This is off course a simple projection of a practically complicated issue, as corporate investment opportunities tend to have many different scenarios, stages and decision points.

The scenario above is an example of a *decision tree analysis*, in which the project is divided into different decision points. The NPV is calculated through assigning probabilities to outcomes, yielding the expected value of a certain decision. By calculating back to the beginning of the project (or the first decision point), one can determine the most valuable path and align the strategy accordingly. A major problem that occurs, however, is the difficulty of making estimations of the probabilities of certain outcomes.
To jump back to the previous section, some considerations should also be made in terms of the appropriate discount rate when using a decision tree analysis. Because risk considerations are embedded by probability numbers, one could say that cash flows should only discounted by the risk free rate (R_F). However, using the WACC could be more justified because the risk free rate does not account for all the risks involved. Conversely, because throughout the project the

probability of success increases and the risk decreases, using only the WACC rate on all cash flows might lead to an underestimation of their present value. The balance should therefore lie between these rates, but the consensus has not been made in academic financial theory (Anderloni, 2011).

Although this analysis method has its limitations, it does imply that a project is not a fixed set of cash flows but rather a multi-staged process of contingent decision making, which is the first step towards real options analysis.

4.4.2. Real options

In financial markets, options give an investor the right, but not the obligation, to buy (call option) or sell (put option) the underlying asset (e.g. an amount of shares) on a predetermined cost at/before a predetermined time. The amount paid for the option is the option price and the price at which the option is exercised is the strike price. The call option value (C) at expiration is the maximum of two values, namely zero and the difference between the underlying asset value (S) and the strike price (X) and vice versa for put option value (P):

$$C = \max(0, S - X)$$
$$P = \max(0, X - S)$$

Call options are (rationally) exercised when the value of the underlying asset exceeds the strike price, whereas put options are exercised when the strike price exceeds the value of the underlying asset.

In theory, viewing an investment project as either a call- or a put option could lead to a more precise estimation of its financial value and is therefore practically justified if the project characteristics allow for such an approach. For instance, if a project has an embedded option to abandon when expected payoff, or the value of the underlying asset, drops below the project salvage value, or the strike price, the project can be viewed as a put option. If the uncertainty of the cash flows clears and the project is unattractive, the option to abandon in early stages of the project minimizes the losses. The value of the project is therefore higher at the start than it would be if abandonment was impossible.
The issue that remains is calculating the actual value of the option. Fundamentally, the value of real options are positively related with the volatility of the project cash flows. In other words, if uncertainty is high, option value is high as well.
By looking at a projects characteristics, you can establish whether real options would create value. The next step would be to determine the present value of the cash flows using DCF methods mentioned earlier. Subsequently, you determine investment costs for the project (which can be viewed as the strike price of the option) and the value added by contingent decisions due to uncertainty.

Option pricing, in theory, can be done by multiple models and formulas. Perhaps the most famous method is the Black & Scholes model (Black & Scholes, 1973) in which the value of a call- and put option can be given by the following formulas:

$$C = N(d_1)S_0 - N(d_2)X^{(-rT)}$$

$$P = N(-d_2)X^{(-rT)} - N(-d_1)S_0$$

In which:

$$d_1 = \frac{\left[\ln\left(\frac{S_0}{X}\right) + (r + 0.5\sigma^2)T\right]}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

S_0 is the current value of the underlying asset, X is the strike price (or cost of investment), r is the risk free rate of return (mentioned earlier), T is the time to expiration, σ is the annual volatility of future cash flows and $N(d_i)$ are the values of the standard normal distribution at d_i.
This model is widely used to price financial options, but with projects and their embedded real options, its use is limited. Firstly, because of its complexity, it is difficult to explain the intuition behind the model to managers without a mathematical background. Secondly, the model uses a fixed exercise date which is not justified for practical projects where options can be exercised at any moment. Furthermore, assuming that cash flows and the underlying asset value are normally distributed is unjustified with real assets as well.

4.4.3. The binomial tree

The Black & Scholes model is worth mentioning because of its wide use in the business world. However, the design of this framework should keep its simplicity to ensure user friendliness across the department, which is why the model will not be elaborately explained.
The decision tree model presented earlier shows an understandable view on real options, which is why one could better extend this model than engage in complicated linear functions and logarithms. Consequently, the *binomial tree* model should provide better insight into option pricing theory. Consider the following figure:

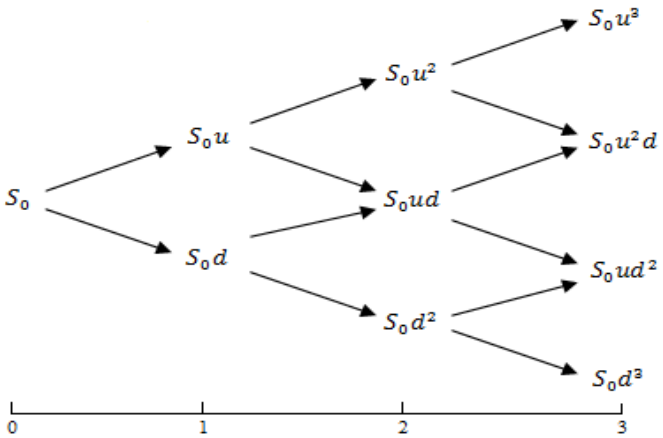


Figure 16: Binomial tree

A binomial tree provides a lay-out of the evolution of possible values of the underlying asset (project) throughout the option life. At the start, where the asset value is S_0 (as calculated by the DCF method), the value of the asset can go either up or down towards the next time increment. Subsequently, from this time increment to the next, the value goes either up or down again, leading to a web of possible pathways towards the end value at expiration. An upward movement is represented by a u factor (>1), whereas a downward movement is represented by a d factor (<1). The range between these factors finds its origin in the volatility (σ) of the underlying asset. Solving a binominal tree to retrieve the option value can be done by the risk-neutral probabilities method, which discounts the cash flows throughout the tree by the risk-free rate (r). The upward and downward movement factors are calculated by the following formulas:

$$u = e^{(\sigma\sqrt{\delta t})} \quad d = \frac{1}{u}$$

Wherein δt represents the time associated with the time steps of the tree (i.e. one in the tree above). The risk-neutral probability (p) is calculated as follows:

$$p = \frac{e^{r\delta t} - d}{u - d}$$

If all the input parameters are calculated, the binomial tree can be filled out from left to right to determine the asset values at the terminal points. Subsequently, the risk-neutral probability is used for backward induction (from right to left) and determine the option value at point S_0. To calculate backwards, the following formula is used:

$$Expected\ asset\ value\ at\ point = [p(Option\ value\ at\ next\ upward\ point) + (1 - p Option\ value\ at\ next\ downward\ point * e^{-r\delta t}$$

Recursively using this formula will eventually yield an expected asset value at S_0, which should be compared to the net present value obtained by the DCF method to determine the additional option value.
Important to mention is that the volatility of the underlying asset can be determined by forecasting cash flows, calculating relative returns ($\frac{Cf_t}{Cf_{t-1}}$), retrieving the natural logarithm ln of each relative return and calculating the standard deviation[26] of these logarithms.

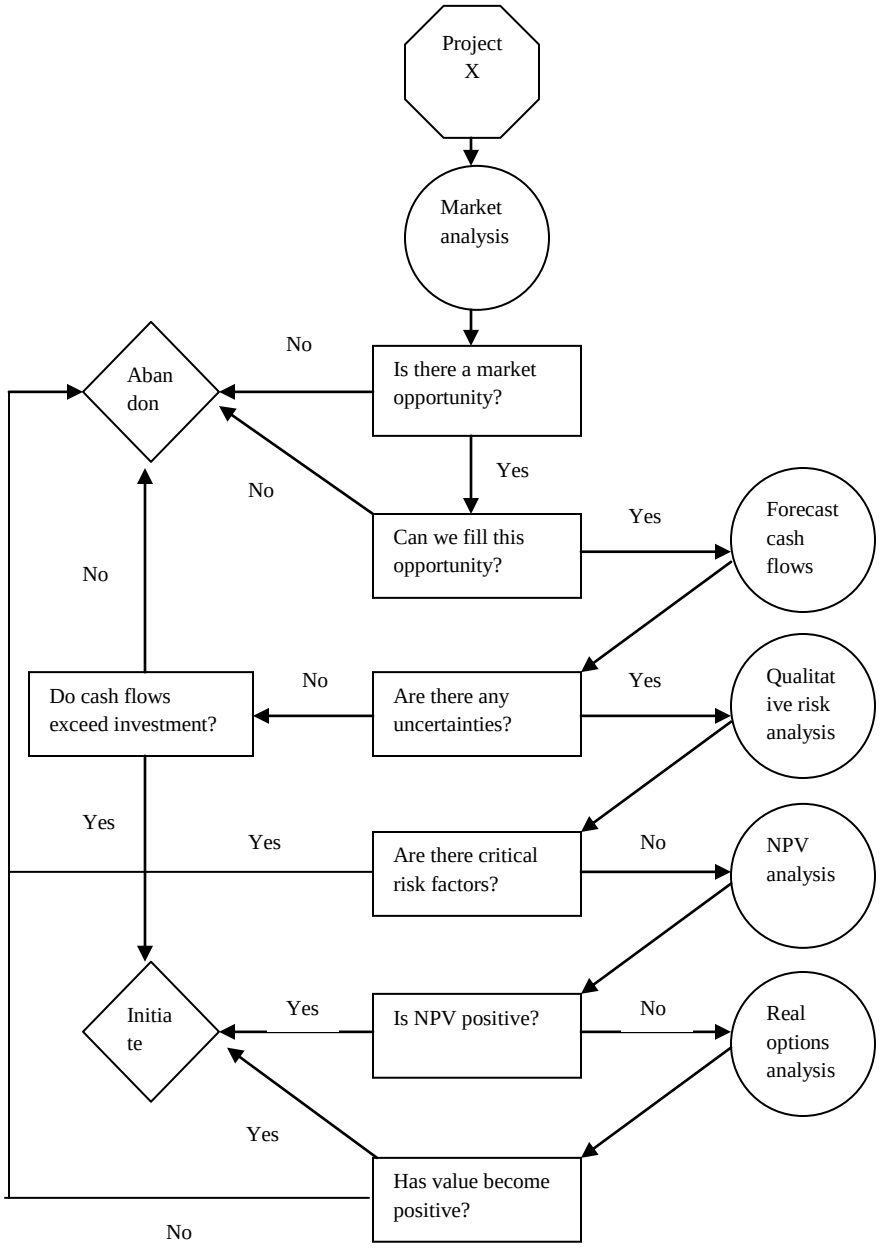
As explained here, this method seems like a lot of work. However, if the necessary parameters are known, the calculations are rather simple.
If the financial value and/or feasibility of a new investment project have to be estimated at an early stage, risk assessment and net present value analysis might give you a fundamental first insight in the attractiveness of the initiative. In addition, if the NPV turns out to be highly positive or highly negative, real options analysis will probably not lead to a different investment decision. However, if the NPV is marginally positive or slightly negative, the method could tip over management's decision to either invest or reject. Moreover, if multiple projects are compared, real options can make a difference as well.

[26] $STD = \sqrt{Variance}, Variance = [(R_1 - \bar{R})^2 + (R_2 - \bar{R})^2 + \cdots + (R_1 - \bar{R})^2]$

4.5. Establishing the framework

Throughout this chapter, a variety of approaches to estimate a project's financial value have been described. When the attractiveness of a new business opportunity has to be determined, it is recommendable to keep the theoretical fundaments of these approaches in mind. Off course, every project has its unique characteristics that ask for consideration when choosing a valuation method. To summarize the theories that are mentioned in the previous sections, the following projection is made:

Figure 17: Investment decision projection



Before jumping into financial calculations, one should first consider the market itself to determine if there actually is an opportunity to sell the product or service. There has to be a market need (or gap) that can be filled by using the resources available inside the organization. This market need can range from the use of a new technology to increase efficiency to a simple cost advantage because of the effective allocation of resources (i.e. expertise, economies of scale, different materials, etcetera). If this gap is non-existent and the organization is therefore not capable of achieving a competitive advantage, the project should be abandoned right away to avoid unnecessary expenses. Conversely, if there is a market need that can be answered by the organization, it can start valuating the business opportunity and determine its attractiveness.

The first input for a financial valuation is a forecast of the project's cash flows, which are comprised as follows:

Sales revenue
- Operating costs
- Taxes
Cash flow from operations
- Total cash flow of investment
Total cash flow of project

Cash flow forecasting is a complex issue and incorporates all the project's entities/players. For instance, at Power-Packer, every department (engineering, process engineering, logistics, purchasing, quality assurance and sales) hands in an estimation of their expenses and revenues during the project's life to the finance department, which in turn calculates the expected cash flows. Through this approach, the reliability of the forecast is maximized.
Sometimes, especially with repetitive projects (e.g. same product with different customer), there are no uncertainties because the costs are known and the sales volume is agreed upon. In this case, the project should simply be initiated if the cash flows exceed the investment and abandoned when they do not. However, in most cases, there are both internal as well as environmental uncertainties that lead to an embedded project risk (as discussed earlier). Consequently, the management team should conduct a (qualitative) risk analysis to reveal the risk characteristics of the project. An example of such an analysis is given in section 5.2. If there are critical risk factors, which are risk factors that have a high probability of occurrence, that have a high impact on the project's financial state and that cannot be easily evaded, the team can choose to abandon the project. If the decision is still to conduct a quantitative valuation of the project, the team should commence a net present value analysis. Importantly, the team has to set financial criteria that have to be met for the project to be even considered. Depending on the information the team desires, this analysis could include:

- Payback period analysis
- IRR analysis
- Sensitivity analysis
- Scenario analysis
- Break-even analysis

Throughout the analysis, the team should keep in mind the discount rates to properly value cash flows, as has been elaborately discussed throughout this chapter.
If the analysis yields a positive result compared to the before-set criteria, the project should be initiated. If not, the team could consider reflecting the managerial flexibility through a real options analysis. This analysis could range from a simple decision tree towards a more

complicated lattice (or even Black & Scholes) approach. On occasion, a real option analysis could positively change the managerial attitude towards investing in the project.
When every financial aspect of the project is analyzed, a well founded investment decision can be made.
What valuation method will provide the project's manager with the most constructive and utilizable result depends on the nature of the project and the managers perspective towards risk, return and overall analytics. Furthermore, corporate investment criteria might be based on certain figures that would favor an aligning valuation approach. For example, if decision makers are focusing on the IRR and have set the criterion to be 25 percent, projects that have IRRs way below this point would not need to undergo complicated real options analyses. Nonetheless, an extensive scenario analysis would provide valuable insights.

By using the findings throughout this chapter, the framework on the next page is established to structure the process of financial valuation of new growth initiatives at Power-Packer.

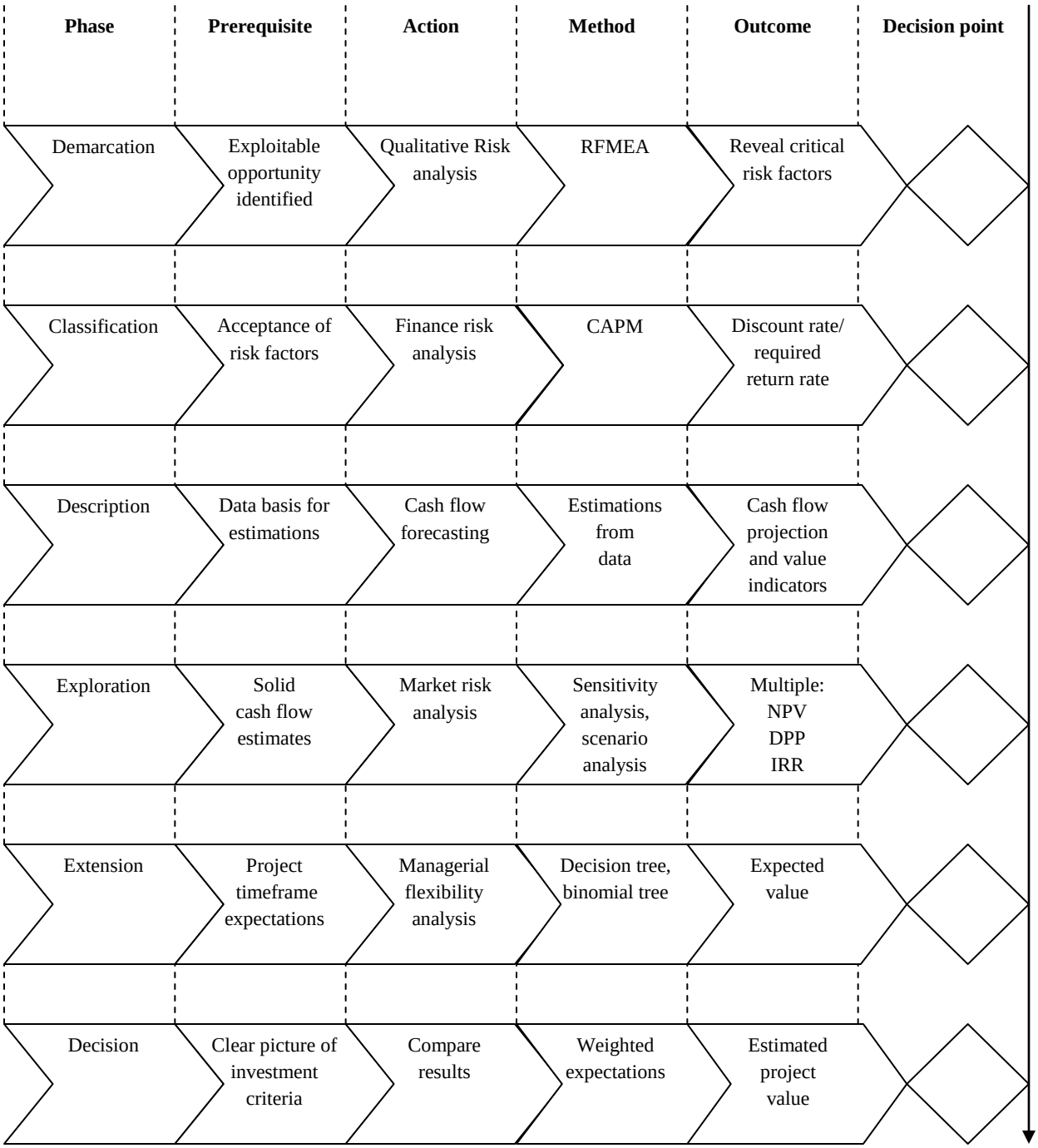


Figure 18: Valuation Framework

This model should be read from the left to the right (starting at 'demarcation') and from the top to the bottom (ending at 'estimated project value'). A phase is one horizontal chain of arrows leading to a decision point marked by a diamond-shape. To go from one phase to another, a **prerequisite** is needed, described in the second column of arrows. Furthermore, completing a phase requires an **action** through means of a **method** that will lead to an **outcome.** If this outcome is positive enough and management has not completely lost faith in the project as a whole, the choice can be made to initiate the next phase, ultimately leading to the last decision point at the bottom right corner. At this point in time, a decision is made whether to initiate or abandon the project based on the findings throughout the entire process.

Demarcation phase

The first phase of the process is based on outlining the project and is based on section 4.2.2. The opportunity is defined and the operational resources (i.e. technology, expertise, people, etcetera) to pursue the opportunity are available or will be made available when the project is initiated. The demarcation will be done by means of a qualitative risk analysis through the earlier mentioned project risk failure mode and effects model. The value of this phase lies in the identification of critical risk factors that have a negative impact on the projects expected return. If these risk factors are imminent, the decision can be made to abandon the project (and therefore the valuation process) instantly. If such factors are not identified the process is brought to the next phase. Throughout the project, significant risks can be monitored intensively to avoid highly negative impacts.

Classification phase

In this phase, the financial riskiness of the project is classified. The idea behind this phase is elaborated earlier and is based on the fact that an investor needs to know whether the expected returns outweigh the risks. The action in this phase is a finance risk analysis by means of the capital asset pricing model. The CAPM is used because it is more externally focused than the WACC model and it uses both betas and market premiums. Consequently, by altering these variables, a range of discount rates can be retrieved to use in further calculations. The outcomes are rates by which cash flows can be properly discounted to retrieve a net present value of the cash flows that accounts for the finance risks of investing. A decision point is still in place to elucidate the flexibility of decision making throughout the valuation process.

Description phase

In the description phase the focus lies on using retrieved internal and external data to estimate the cash flows throughout the project's life. The presence of necessary data is therefore a prerequisite for this phase. The financial characteristics in terms of revenues and costs are described by establishing a cash flow projection. Through discounting these cash flows with the net present value formula, the first estimated value figures are produced. As has been mentioned, the accountancy for market risks still has to be embedded in the valuation process. The cash flow projections are therefore used as input for the exploration phase. The decision point is based on the possibility to abandon the valuation because of extremely high investment costs or negative gross margins that cannot be overcome.

Exploration phase

The exploration phase lends itself to the exploration of the financial figures obtained in the description phase and finds its roots in section 4.3. Market risks are introduced to the process by means of a sensitivity- and scenario analysis. Through the sensitivity analysis, the significance of the financial variables is weighed by adjusting them individually to determine focus areas or perhaps make recommendations for further data research. Understanding the weight of the variables is important for keeping the focus on critical factors. In the scenario analysis, the cash flows are adjusted based on possible sales-, cost- and investment fluctuations. The result is an assortment of cash flow projections from which value figures can be retrieved. The outcome of the exploration phase will be a table with many value possibilities. By linking each with to certain weight (or probability of occurrence), as scenarios do not all have the same likelihood, an expected NPV can be calculated. If this figure indicates a negative project value, the possibility of abandonment is present.

Extension phase

In this phase the findings from other phases is extended by analyzing the value of managerial flexibility throughout the project timeframe. The idea behind this choice is elaborated in section 4.4. As a prerequisite, an idea of the decision points during this timeframe must be established to build decision trees. Throughout these decision trees, cash flow possibilities with individual probabilities are projected to retrieve new project value indicators. The decision tree model is used because it provides a comprehensible representation of the managerial flexibility during the project as well as a practicable calculation tool. As input for the decision trees, the cash flow scenarios from the previous phase function as basis, except in this phase, managerial options are added. As an additional remark, the cash flows are discounted by the risk free rate because probabilities partly reflect finance risks. As a supplement, the reliability of the outcome is tested by using the binomial tree approach. While the input variables for this approach can be seen as complex and impractical, the method has received credit in theory and practice and will therefore be utilized as a comparison tool. The results of this phase are again value indicators.

Decision phase

Throughout the other phases of the valuation process, value indicators are created through a set of calculative methods. In this phase, all these indicators are compared to each other and linked to the investment criteria to come to a final decision or recommendation to higher management levels. The final decision point should therefore be closed with a go or no-go decision for the project under scrutiny. The decision phase is addressed in the last chapter.

The framework established here will be tested by using the case study of the market segment from the previous chapter. Through using the framework, findings concerning financial project value will be retrieved that are used for investment recommendations. The implementation of the framework is reported in the next chapter.

As a concluding remark, one should keep in mind that sometimes financially unattractive projects are nonetheless initiated because of their strategic value for the organization in whatever sense.

Chapter 5: Implementing the framework

What conclusions can be made from implementing the framework?

In this chapter, the framework that has been established will be implemented by using the findings throughout the rest of the study alongside new estimates of financial variables retrieved through internal discussion. The goal of this chapter is to retrieve enough financial input for well founded decisions, recommendations and conclusions. These will be provided at the end of this chapter and in chapter 6.

5.1. Demarcation

In this phase the project is outlined based on the identification of quantitative risks. The findings in this phase could lead to serious doubt about, or even abandonment of the project, but is mostly meant to urge the project team to think about possible events throughout the projects lifetime and subsequently the actions that should be taken to decrease the harmfulness of these events to the eventual goal of the project, which in the first place is achieving positive financial results. By using the market analysis and the market assessment, the following threats have been identified, that can lead to the events/risks given further below:

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5.2. Classification

In the previous chapter, financial risk analysis was introduced and explained by using (among others) the WACC approach and the CAPM approach. As said, using the WACC approach when quantifying the financial risk of new growth initiatives is practically unjustified because their financial risk cannot by rationally compared to the average risk of all organizational assets. For this reason, the capital asset pricing model is used in this framework to attain discount rates for cash flow value calculations. These discount rates will be used throughout the valuation phases to account for the financial risk of the project. In addition, some attention will be given to the discount rates that are currently used by corporate management at Actuant. Using the capital asset pricing model requires three input variables:

1. The risk-free rate R_F
2. The project's beta β
3. The equity risk premium $\bar{R}_M - R_F$

The risk-free rate is typically approached by using the interest rates on treasury bonds or treasury bills. Normally, investments in government treasury do not carry risks (i.e. the actual return is equal to the expected return)[27]. To determine what risk-free rate to use, one must look at the timing of the cash flows in the project's timeframe. Because this project is expected to have cash flows beyond a year's time, T-bills can be put out of consideration as they mature in one year or less. Typically, a 10-year bond rate is used as an approach for the right risk-free rate[28].

[27] Of course, in difficult economic times even government bonds can be risky (e.g. Greece's default risk).
[28] http://www.kpmg.com/AU/en/IssuesAndInsights/ArticlesPublications/valuation-practices-survey/Documents/valuation-practices-survey-2013-v3.pdf

According to trading economics[29], the current 10-year bond rate in the collection of Euro countries is equal to 1.29 percent, whereas the rate for the US was 1.64 percent over the last year and is forecasted to be 2.0 percent at the end of 2013. Because the project eventually has to meet corporate (i.e. US-based) criteria, the latter two rates, which average 1.82 percent arithmetically, are used in this valuation.
The equity risk premium (ERP), which is the average return on the market minus the risk-free rate, in the US is estimated to be 5.8 percent according to Damodaran (2013), which leads to an estimated average market return of 7.62 percent. According to Hillier et al. (2010), this average market return was estimated to be 12.3 percent over the period 1926 to 2005 with an average risk-free rate of 3.8 percent and an ERP of 8.5 percent. While both sources are reliable, common sense dictates the usage of the most recent source, especially considering the global economical crisis after the sample years of Hillier et al. (2010). The ERP of 5.8 percent is therefore used to multiply with the beta.
As explained in the previous chapter, the beta is a measurement of a company's receptiveness to changes in the market. The ERP is an expected return on the market in excess of the risk-free rate. To obtain the right premium for the project, the ERP must be multiplied with a beta that best reflects the conditions of the organization and the project itself.
In section 4.2, it has been explained that the formula of beta can be put together as follows (An elucidation of this formula is given in Appendix VIII: Beta):

$$\beta = \frac{Cov(R_i, R_m)}{\sigma^2(R_m)} = \frac{\left(\frac{\sum[(R_i - \bar{R}_i) \times (R_m - \bar{R}_m)]}{N}\right)}{\left(\frac{\sum(R - \bar{R})^2}{N}\right)}$$

According to yahoo finance[30], Actuant has a stock (or equity) beta of 1.32, indicating 'high' responsiveness to market changes and therefore, in theory, the need for a higher discount rate. If this beta is used in the capital asset pricing model with the variables explained above, the following discount rate is retrieved.

$$\bar{R} = R_F + \beta \times (\bar{R}_M - R_F) = 0.0182 + (1.32 \times 0.058) = 0.0948 \approx 9.5\%$$

To compare, Yahoo estimates a return on equity for Actuant of 8 percent, indicating that either the ERP or the risk-free rate is assumed to be lower in this source.
Another point of comparison lies in the asset beta. The return on assets for Actuant is estimated to be 6.8 percent. By implementing this figure in CAPM, the asset beta can be theoretically retrieved:

$$0.068 = 0.0182 + (\beta_{asset} \times 0.058), \text{ so: } \beta_{asset} = 0.86$$

The below formula was explained in an earlier section for obtaining the asset beta through the equity beta. By inserting financial variables from practice, the two formulas can be compared:

[29] http://www.tradingeconomics.com/country-list/government-bond-10y
[30] http://finance.yahoo.com/q/ks;_ylt=Aoy1MJ.3SUUPGtL6lWSvx8ALv7gF;_ylu=X3oDMTEybzAxdWQxBHBvcwM1BHNlYwN5ZmlRdW90ZXNUYWJsZQRzbGsDc3RhdHM-?s=ATU

$$\beta_{asset} = \beta_{equity}\left[\frac{1}{1+\left((1-t)\frac{D}{E}\right)}\right]$$

The Actuant annual report of 2012 indicates an overall tax rate of 27.5 percent in 2012 and the balance sheet indicates a debt/equity ratio of 0.94. Inserting these figures would lead to:

$$1.32\left[\frac{1}{1+\left((1-0.275)0.94\right)}\right] = \beta_{asset} = 0.79$$

Comparing the two calculations shows a difference Δ of 0.07 which, considering 0.79 as starting point, is an approximate difference in percentage of 9. If the average of these two betas (0.825) is inserted in the CAPM, a discount rate $\bar{R}$ of 6.6% can be obtained.

Maybe the most important rate for discounting the cash flows, especially because authorization for expenditure is needed from higher corporate levels, is the discount rate used throughout the total organization.

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Throughout the following phases, cash flow scenarios will be subjected to the above rates, which will all lead to different indicators of net present value, payback period, break-even sales, etcetera. By using different discount rates in the valuation of cash flows, a broader range of financial indicators can be retrieved. These figures can be compared and used to build towards a better founded conclusion.

5.3. Description

Forecasting the cash flows of a project is difficult when using only market analysis data and without having actual purchase orders. The outcome of this phase is a cash flow projection that forms the basis for the next phases. This projection is based on a scenario, which in turn is based on retrieved information and data:

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This projection shapes a first image of what the project life span could look like in financial terms. If this (optimistic) scenario becomes reality, even with the discount rate of 20 percent (d) and the entire initial investment, the project has a positive net present value. For some further projections, only the cash flow and the value indicator table will be shown, as the idea behind the cash flow becomes clear in the above table. However, when different scenarios ask for alterations to variables in other columns, they will be shown accordingly. The most important thing that has become clear in this phase is that, if all the pieces fall in the right place, the possibility of making this project a financial success is present. The problem with the above projection, however, are the assumptions that:

1. After initial investment no further investments have to be made
2. The product is assumed to be suitable and to outperform competition
3. Conversion is certain to start at a significant level and increase through the life span
4. Consumers are assumed to accept the sales price
5. Product costs are assumed unchanged throughout the life span
6. The total life span is fixed at 6 years
7. No new customers are expected to engage in conversion
8. Invested capital is assumed to have no residual value and is depreciated linearly

These are some examples of variables that could change the financial course of the project when they are altered. Mainly through the sensitivity analysis and the scenario analysis in the next phase, this issue is addressed. To give an example, consider the cash flows of the above scenario but with half of the starting sales volume:

5.4. Exploration

In the previous part, the first possible cash flow scenario is generated to shape a broad image of the project. In addition, the problems of using one cash flow forecast are presented. These problems can be viewed as input for this phase.

5.4.1. Sensitivity analysis

First of all, by using the above cash flow statement as starting point for a sensitivity analysis, the financial variables that have the highest impact on the eventual net present value can be identified. The current NPVs are given below:

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By changing one variable at a time, the individual impact on the NPVs above can be calculated. The starting values are (from the scenario above):

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Every variable will be changed by a rate of 0.95 or -5%, generating the following table:

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By altering every variable individually and keeping other variables at their starting value, the sensitivity analysis shows which variables have the highest impact on the net present value of the project and should therefore be monitored closely.

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5.4.2. Scenario analysis

Given the 'new-to-the-organization' nature of the project and the many cash flow uncertainties, forecasting the value of the project should not be based on one statement of cash flows. As mentioned earlier, a scenario analysis is a useful tool to look at the project from different angles and different realities. In this section, a series of scenarios is explained and elaborated by using cash flow projections similar to the above. As opposed to the last section, the tables in this section will appear in Appendix IX: Scenario analysis tables.

Scenario 1

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The above scenario is probabilistic in terms of demand fluctuations, but is rather imprecise. Mostly because probability indicators can be viewed as subjective and arbitrary. To give a scenario more practical value, a real course of events can be contemplated and computed in financial figures. Nevertheless, probabilities should always be taken into account as very optimistic and very pessimistic scenarios in general have a lower likeliness of occurring. The coming scenarios have a more 'real' nature.

Scenario 2

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Scenario 3

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Scenario 4

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Scenario 5

Confidential

Scenario 6

Confidential

This scenario analysis provides different angles from which the project can be observed, which leads to different conclusions concerning both value and management priorities. These conclusions are explicated in the decision phase in the next chapter.

5.5. Extension

In this phase, the cash flow scenarios are partly used to examine the value of managerial flexibility in the timeframe of the project. Because management decision can occur often, cash flow variables are determined per half year rather than with growth rates. This way, not only the flexibility of management is examined, but the analysis is also an extension of the scenario analysis in which each financial period is viewed separately.

5.1.1. Decision tree analysis

In this part of the analysis, cash flow statements are converted to decision tree models to determine whether managerial flexibility increases value in this project and to what extent.

Scenario 7

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Because management has an embedded option to abandon, the expected value of the project has increased with around 20 percent. This example indicates the relevance of accounting for managerial flexibility when valuating investment decisions. The values in this example are calculated using the same method as in the previous phase with the risk free discount rate.
Some rational preliminary statements can be made about an embedded abandonment option.

1. If there is a positive gross margin, an abandonment option is only valuable if reinvesting is necessary.
2. An abandonment option is always valuable if price levels drop below production costs.
3. Whether an abandonment option is valuable based on sales volumes is determined by multiple accounting variables.

Scenario 8

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Having the option to abandon after the entire investment has occurred is invaluable if sales price exceeds production costs. Marginal profits will still earn back some of the investment that has been paid, pushing up the NPV and making abandonment irrational.

Scenario 9

On the next page, the abandonment option is elaborated by indicating the decision tree with three different possibilities.

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Binomial tree scenario

As explained in the previous chapter, a binomial tree provides a lay-out of the evolution of possible values of the underlying asset (project) throughout the option life. To recapture;
the upward and downward movement factors are calculated by the following formulas:

$$u = e^{(\sigma\sqrt{\delta t})} \qquad d = \frac{1}{u}$$

The risk-neutral probability (p) is calculated as follows:

$$p = \frac{e^{r\delta t} - d}{u - d}$$

To calculate backwards, the following formula is used:

$$Expected\ asset\ value\ at\ point = \\ [p(Option\ value\ at\ next\ upward\ point) + (1-p)(Option\ value\ at\ next\ downward\ point)] * e^{(-r\delta t)}$$

By using the scenario above, the following table can be generated:

	u	d	p	rf	pv	Option value				
t	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
	*	*	*	*	*	*	*	*	*	*
		*	*	*	*		*	*	*	*
			*	*	*			*	*	*
				*	*				*	*
					*					*

While the table indicates additional value of the option to abandon, this value is significantly higher in the decision tree tables. Moreover, because of the (fairly) unknown formulas, the idea behind the binomial tree might be more difficult to carry out to project management. From this viewpoint, decision trees show a more clear oversight of the project and the value of managerial options during this project. It is therefore recommendable to choose this method instead of the binomial tree.

The conclusions that can be made from this phase are reported in the decision phase in the following section.

5.6. Decision

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During this chapter, the project has undergone a series of financial valuation methods to produce indicators of both the likelihood and magnitude of financial success on both the short- and the long-term. The conclusions in this last section are mainly based on this financial valuation. However, when engaged in this financial examination, one can easily lose sight of the big picture, especially when the focus is drawn by corporate criteria that 'determine' the project value. The next chapter is therefore meant to both summarize the entire study and to construct conclusions and recommendations not only driven by financial figures.

Chapter 6: Conclusions & Recommendations

Should Power-Packer initiate or abandon the project?

Throughout this thesis the focus has been put on using all empirical and theoretical input to work towards an answer to the above question as elaborate and factual as possible. This last chapter is meant to give a structured summary of the findings, conclusions and general observations during this research period. Time and effort has been put into the process of generating practically valuable recommendations for Power-Packer. The pursuit of retrieving financial and strategic benefit in this (and other) market segment(s) can be guided by the findings in this study. The conclusions made from these findings are reported in this chapter. Preliminary, the last phase of the valuation framework is exercised in the previous section. In the following section, a recap is made towards the sub questions stated in the study outline in the first chapter. Subsequently, the conclusions made based on these questions are used to make recommendations in the section that follows based on the main research question. Finally, a reflection of the research study as a whole is carried out.

6.1. Conclusion

The conclusions made through use of the sub questions are presented in this section to summarize the findings of the study. Not all findings can be linked directly to the project that is valuated, but they can surely affect the feasibility of making it a financial success.

1. *What are the internal characteristics of Power-Packer?*

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2. *What are the characteristics of the targeted market segment?*

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3. *How should the financial value of growth initiatives be quantified?*

As an introduction to this sub question, the meaning of value has been elucidated by stating that a project is valuable when it produces free cash flows and by explaining how these cash flows can be calculated. Methods like the NPV, Payback Period and IRR are identified as practically useful for projecting the value the project and its embedded cash flows. The input required for these methods to become financially justified are determined by three fundamental characteristics of the project of study: The **financial risk**, the market risk and the managerial flexibility.

The first is related to the volatility of the project's cash flows and the return investors require when taking the risk to invest. This volatility can be projected in the form of a discount rate through which future cash flows are depreciated. This rate is perceived differently across organizations and managers and can be (1) fixed for all investment decisions based on shareholder/manager criteria, (2) linked to the weighted average cost of capital across the organization or (3) calculated through looking at every project's risk characteristics individually.

The latter is the most theoretically justified approach because all projects have individual risk elements and the cash flows should be discounted accordingly. In this light, the capital asset

pricing model provides a useful tool for calculating the proper discount rate as it uses individual betas as a multiplier for the existing market risks, taking into account the individuality of projects and capital investments.
The **market risk** characteristics of the project are quantified by using a more elaborate approach. Given the fact that little is yet certain about the course of the project and it is expected that most projects will undergo valuation in this stage, a sensitivity analysis and a scenario analysis should provide you with the broadest view of the project, as a variety of different courses of events are contemplated. Although assigning a precise financial value to the project is not feasible in such an exploratory stage, this approach provides you with a lot of information about possible risks and high-impact financial variables.
Managerial flexibility is the term that is used in this report to underline the fact that the deterministic approach of fixed cash flows undermines the value of the strategic options and decision points embedded in the lifetime of the project. Being able to manipulate the course of events during a projects lifetime pushes up the value of the project as a whole, which is why this matter is addressed in this valuation process. A comprehensible way of elucidating the option characteristics of a project is through the use of decision trees. Decision trees provide you with a clear projection of the option interaction during a projects life, which is why the method is used in the valuation framework.
If all three factors have been analyzed, management has a thorough overview of the project at hand. All the value indicators found throughout the process can then be used to make decisions.

4. *What conclusions can be made from implementing the framework?*

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5. *Should Power-Packer initiate or abandon the project?*

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Below, a summarizing table is presented with a selection of factors that either support or impede the decision of investing in the project.

Invest	
Pros	**Cons**

Figure 19: Investment indicators

The factors described in this section and in the table above are used, among other findings, as input for the recommendatory section below.

6.2. Recommendations

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6.3. Reflection

This section is meant to close the study with a general view on the findings and conclusions and how they were established. The research in particular will be reviewed in the first section, whereas topics that have not been explicitly included in the report will be briefly discussed in the last section as concluding remarks and recommendations for further research.

6.3.1. Limitations

Although some choices in the outline of the study are case-drive, overall, the structure of this study and the methods to obtain data are not necessarily linked to Power-Packer as the unit of research, but can be used as guidelines for other studies as well. The study as conducted here has its limitations and points of improvement.

First of all, in the process of external data collection, not the entire value chain has been targeted. Original Equipment Manufacturers, wholesalers and a small amount of retailers have been the source of external communication in this study. While these sources are most relevant considering the position of Power-Packer in the value chain, end-users might enrich the data of this study because of their distinctive viewpoint. A possible method to retrieve the value parameters from an end-user standpoint could be through a (online) survey.

Furthermore, because of the nature of the product, a more extensive technical analysis might provide Power-Packer with valuable additional information. Technical bottlenecks might even lead to a negative attitude towards further investigation and future investments.

From a geographical perspective, further (empirical) research will probably be most rewarding when conducted in North America. As a significantly high portion of the total market is situated here, shorter communicatory lines might increase the efficiency of data collection. Moreover, an American executive might be able to transfer the value proposition in a more convincing and trustworthy way from a psychological view.

Given this assumption, the research study conducted is limited in the sense of not having initiated North America based data collection. Though achieving starting communication is attempted through e-mail, response was non-existent.

Finally, in some instances, mature data was used to map out the market because more recent data was unavailable or undetectable from this position. It would be advisable, in case more data is a must, that the option of paying for more enriched data is contemplated.

6.3.2. Concluding remarks and recommendations for further research

In the recommendations a feasible and plausible course of the project has been outlined. However, there are matters that could redesign the market entry strategy or the decision making process on a fundamental level. Some of these topics are briefly explained in this section to indicate that the projection above is not necessary the only possible way of entering this market or to base decisions on.

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Appendices

Appendix I: The McKinsey 7s Model

This model provides useful guidance in describing the corporation's way of operating. It is built around several ideas and concepts (Waterman, R. H., Peters, T. J., & Phillips, J. R., 1980):

1. It pays attention to a multiplicity of factors that influence an organization's ability to change and its proper mode of change.
2. It is intended to convey the notion of the interconnectedness of the variables.
3. The failure of planned strategies is caused by an inattention to important factors. Every factor in itself can cripple a well structured plan.
4. The framework has no hierarchy. It is not determined which factors will be the driving force in a particular organization.

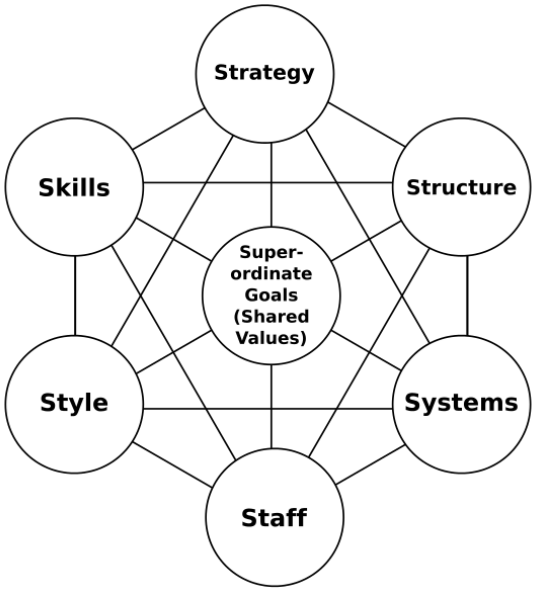

Figure 20: The McKinsey 7s Framework

Hard Elements

- Structure: Divides tasks and then provides coordination.
- Strategy: Actions that a company plans in response to or anticipation of changes in its external environment.
- Systems: All the procedures, formal and informal, that make the organization go, day by day and year by year.

Soft Elements

- Style: Management's style of leading the organization.
- Staff: Employees and their morale, attitude and behavior.
- Skills: The organizations core competences
- Shared values: Guiding concepts, a set of values and aspirations that goes beyond the conventional formal statement of corporate objectives.

Appendix III: Power-Packer Europa product portfolio.

Market segment	Products for
Automotive	Convertible rooftop actuation, emission control systems
Truck	Cab tilt actuation, cab latch actuation, leveling, trailer landing, emission control systems.
Medical	Stable bed height adjustment, patient lifts
Recreation Vehicles	Actuating steps, adjustable rooftops, leveling systems, slide-out systems, cargo trays.
Marine	Actuation of ship doors, actuation of convertible roofs, actuation of butterfly valves, steering systems and tilt/trim systems.
Off-Highway	Stabilization legs, trailer tilt systems.
Other	Valve actuation

Figure 21: PPE market segments and product applications

Business unit	Market focus
Power-Packer	All markets
Power-Gear	Recreational Vehicles
Gits	Truck (emission control)
Yvel	Truck (latches)

Figure 22: PPE business units and market segment focus

Appendix VI: Levered- versus unlevered-firm value

To explain the (initial) increase in value when a firm becomes levered, consider the following example:

Power-Packer Europe B.V. has two alternative capital structures.

1. No debt
2. Debt of €3,000,000

- The company has yearly earnings before interest and taxes (EBIT) of €2,000,000.
- The corporate tax rate (t_c) is 40 percent and the interest rate (R_B) is 10 percent.
- All net earnings are paid as dividends to shareholders.

These assumptions will yield the following financial projection:

	Structure 1	Structure 2
EBIT	€2,000,000	€2,000,000
Interest expenses	€0	€300,000
EBT	€2,000,000	€1,700,000
Tax expenses	€800,000	€680,000
Net earnings	€1,200,000	€1,020,000
Total cash flow to bond- and shareholders	**€1,200,000**	**€1,320,000**

Figure 23: Capital structure differences

Because tax expenses do not increase value and interest expenses do, the tax shield will lead to an increase in the firms market value. However, as one can imagine, this tax advantage will only last when the amount of debt does not put too much financial pressure on the firm. In this case, bankruptcy costs and agency costs will exceed the value of the tax shield, leading to a decrease in firm value.

Appendix VII: Discount rates

To elucidate the importance of using discount rates in cash flow/project valuation, consider the following example.

Power-Packer Europe B.V. is considering investing in a new product-market project. The project is considered to be riskless, which is why the discount rate is equal to the interest rate of a riskless bond: 7 percent

The initial cost of the project is €200K and it will receive 1 cash flow of €210K in one year.
An undiscounted present value calculation would yield the following outcome.

$$-200 + 210 = 20$$

Assuming the above, the project should be undertaken. However, discounting the cash flow at the risk free interest rate would yield the following outcome.

$$-200 + \frac{210}{1.07} = -3.74$$

This calculation would dictate a rejection of the project because of a negative NPV.
A rational corporate financial manager would indeed reject the project because of the following assumptions.

If the project is initiated and the earnings will be paid as dividend, the value for the collection of shareholders will be 210K.
If the project is not initiated and the investment is paid as dividend instantly, the value for shareholders will be 200K. However, if this 200K is invested in a risk free bond, after one year the value would be 200×1.07=214K.
In other words, accepting the project would be irrational based on the NPV calculations.

Appendix VIII: Beta

By giving an example of stock-returns of a virtual Power-Packer, the formula of beta is explained.

$$\beta = \frac{Cov(R_i, R_m)}{\sigma^2(R_m)} = \frac{\left(\frac{\sum[(R_i - \bar{R}_i) \times (R_m - \bar{R}_m)]}{N}\right)}{\left(\frac{\sum(R - \bar{R})^2}{N}\right)}$$

Considering the following information about a stock at Power-Packer:

Economic state[31]	Return rate R_i	Deviation $R_i - \bar{R}_i$	Squared value $(R_i - \bar{R}_i)^2$
Bad	-0.15	-0.2875	0.00826
Normal	0.10	-0.0375	0.00141
High	0.20	0.0625	0.00391
Booming	0.40	0.2625	0.06891
Expected $\frac{\sum R_i}{n}$	$0.1375 = \bar{R}_i$		

Figure 24: Virtual stock information PP

The average squared value is the variance σ^2 of the stock, which in this case is:

$$\sigma^2 = \frac{0.00826 + 0.00141 + 0.00391 + 0.06891}{4} = 0.0262$$

Now consider the following information concerning the market return characteristics:

Economic state	Return rate R_m	Deviation $R_m - \bar{R}_m$	Squared value $(R_m - \bar{R}_m)^2$
Bad	-0.30	-0.45	0.2025
Normal	0.10	-0.05	0.0025
High	0.30	0.15	0.0225
Booming	0.50	0.35	0.1225
Expected	0.15		$\boldsymbol{\sigma^2 = 0.0875}$

Figure 25: Virtual market return characteristics

By multiplying the deviations of both PP and the market portfolio, and dividing this number by the total numbers (in this case 4), you can retrieve the covariance σ_{im}:

$$\frac{[(-0.2875 \times -0.45) + (\ldots \times \ldots)}{4} = 0.0581$$

Dividing the two numbers (i.e. the covariance and the variance of the market) yields the beta:

$$\beta_i = \frac{0.0581}{0.0875} = 0.664$$

In this case PP has a beta below one, indicating a low responsiveness to the market. While the covariance is positive (i.e. if economic state worsens so does the return on PP-stock), a market return decline of, for instance, 10 percent would not lead to a 10 percent drop in the return on the stock portfolio of PP. In short, the stock of PP has lower finance risk than the market in this virtual scenario.

[31] For practical purposes, all economic states have the same probability of occurrence

Appendix IX: Scenario analysis tables

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Appendix XII: Glossary

Arithmetical	Sum of all figures divided by the number of figures
Assets	Physical resources of the business
Bias	A systematic distortion of a statistical result due to a factor not allowed for in its derivation
Binomial	Consisting of two terms/variables
Bond	A certificate issued by a government or company promising to repay borrowed money
Capital	A valuable resource of a specific kind
Capital structure	How the organization is financed
Cash flow	Residual money after expenses
Climate	The prevailing trend of opinions within the organization
Contingent	Subject to chance
Conversion	When a consumer becomes a customer through buying products
Correlation	A mutual relationship or connection between two or more variables
Creditor	Someone who has loaned money to the organization and expects a return
Culture	Pattern of shared basic assumptions
Deficit	An excess of expenditures compared to income
Deterministic	Cash flow events are determined by external factors beyond the organizational reach
Differentiation	Achieving competitive advantage through doing things different than competitors
Diversification	Enlarge or vary the organizations product range or lines of business
Dividend	Cash paid to shareholders
E-commerce	Commerce through the internet
Economies-of-scale	Achieving a cost advantage through high volumes and therefore low per product costs
Empirical	Based on observations and experience rather than theory
Entrepreneurial	Taking financial risks in the hope of profit
Equity	The value of the shares issued by the organization
Exploratory	Involving extensive investigation
Feasibility	Whether certain actions are justified/possible based on criteria assumptions
Gross margin	The amount gained per sold product (price minus costs)
Head-hunter	Identify and approach suitable individuals to fill business positions
Hierarchy	A system in which an organization's members are ranked
Hybrid	Something manufactured by making use of two or more different elements
Induction	Using a variable to retrieve another variable's value
Innovation	The process of bringing new ideas to commercialization
Lead time	The time it takes before an idea becomes a sold product
Leverage	The ratio of an organizations loan capital to its equity
Linear	Extending along a straight line
Macro-economy	The general environment of an organization
Marimekko	Form of market mapping used for visualization
Mechanical structure	Structure with a high degree of task specialization
Micro-economy	The market specific environment of an organization
Modular	Some aspects can be changed without altering the entire product

Newton	Unit of force equaling 0.1 kilogram or 0.2 pounds
Normal distribution	A function that represents the distribution of random variables as a bell shaped graph
Off-the-shelve	Available as product in itself in retail
Organic structure	Structure in which people are expected to cooperate and to use own initiatives to solve problems
Perpetuity	Lasting forever
Portfolio	The range of products offered by an organization
Probabilistic	Involving chance variation
Profiling	Increasing the visibility of your organization in different fields
Robustness	Able to withstand harsh conditions
Rod	The thin straight bar in a system that actuates in a linear fashion
Security	The ownership of stocks or bonds
Strategy	The outset of the overall direction of the organization
Stroke	The specifics of a rod movement
Synergy	The interaction or cooperation of two or more organizations to produce a combined effect greater than the sum of their separate effects
Treasury bill	A short dated governmental security
Turnover	The amount of income of an organization in a given period
Urbanization	The process of the rural population moving to city areas
Valve	A device for controlling the passage of fluids through a pipe/tube
Vision	A mental image of what the future could look like