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Servitization of project business
a case study at Heijmans Non-Residential Building

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Servitization of Project Business: A Case Study at Heijmans Non-Residential Building
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Abstract
This master thesis project studied the move towards services in project-based organizations. In order to describe the implications of servitization for project-based organizations, a framework is developed to categorize project business models on a product-service continuum consisting of nine business model elements and three categories of project business models. The framework is then tested in practice in a single embedded case study at a Dutch construction company. The collected empirical qualitative data was used to identify new variables and to remove irrelevant variables of the conceptual framework, resulting in a modified framework.
Preface

This master thesis is the result of my graduation internship at Heijmans. The project is the conclusion of the master program Innovation Management at the Eindhoven University of Technology (TU/e). The project was supervised by the department of Industrial Engineering & Innovation Sciences (IE&IS).

During the internship I had the opportunity to apply my knowledge of Innovation Management with my knowledge of construction, which I developed during my bachelor in Architecture, Building and Planning. My predilection for the construction industry has always been there since I started my studies in 2005. With excitement I look back on my master thesis project, especially my time at Heijmans. It has been a period of great personal development, both academically and professionally.

The completion of this master thesis would not have been possible without the help of many others. I would like to use this opportunity to express my gratitude to them. First of all, I am thankful to my university supervisors Joost Wouters and Jimme Keizer for their support and critique throughout the project and the preliminary literature study. Especially your knowledge on methodologies for qualitative research was really helpful.

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Bas Mertens
‘s-Hertogenbosch, June 2012
Executive Summary

Introduction
In developed countries, manufacturing companies are moving up the value chain (Wise & Baumgartner, 1999). They are no longer selling pure products, but offer integrated solutions in a combination of products and services (Neely, 2008). The process of creating value by adding services to products is called “servitization” as described for the first time by Vandermerwe and Rada (1988). Servitization literature has always been aimed at the manufacturing industry (Baines et al., 2009; Oliva & Kallenberg, 2008; Wise & Baumgartner, 1999), while project-based organizations are also increasingly focused on services in their offerings (Artto et al., 2008). Project suppliers are facing a new type of customers who are no longer interested in the acquisition of an investment project, but they want to purchase the performance of the project delivery during the use-phase (Kujala et al., 2010). These new customer types cause a variation in customer needs over customer segments, which brings new challenges for a project supplier’s business model (Kujala et al., 2010). Project business is characterized by a discontinuity of demand, uniqueness of individual projects, and complexity of offerings and business networks (Cova et al., 2002). Therefore, the role of projects, products and services in a firm’s business model differs from the manufacturing industry. Alignment of service and project processes with overall business processes is a specific issue for PBO’s that remains unaddressed by the general servitization literature (Artto et al., 2008). Hence, there is a gap in the servitization literature and this research will try to close or limit this gap. The scientific goal is to develop a framework that describes the servitization of project-based firms.

To achieve the scientific goal, a single embedded case study was performed during a research internship at Heijmans Non-Residential Building. This division of the construction company is active in many different types of projects with different product and service offerings. Since this research aims to be both practically and theoretically relevant, a business goal is defined in addition to the scientific goal. First, the need was identified to provide insight in the current level of servitization in the range of project types that Heijmans can offer. Second, because customers are increasingly demanding long term lifecycle-oriented projects, the company recognized the need to adapt the organization to become a service provider while at the same time maintaining the capabilities to deliver traditional projects. This change in project types requires a change in the company’s business models. Therefore the business goal of this master thesis is to analyze the current product and service offerings in non-residential building projects of Heijmans and to develop a tool that can be used to manage the servitization of project business.

Both the scientific and business goals are addressed by the following research questions:

RQ1: What are the different stages on the product-service continuum for a project-based organization when moving from offering products to offering product-service systems?

RQ2: What is the current position of the construction projects of Heijmans on the product-service continuum?

RQ3: What are the implications of servitization for project business models of Heijmans?

Research methodology
To answer the three research questions, the research methodology is divided in three parts. First, a literature review is performed to develop a conceptual framework that answers the first research question. The literature on business models, on project-based organizations and on servitization is synthesized in one conceptual framework to describe the servitization of project-based firms. The conceptual framework is then tested in practice in the form of a single embedded case study. This is considered to be the appropriate method to receive in-depth understanding of characteristics of the current business models at Heijmans. Case studies of the embedded type are characterized by multiple levels of analysis in order to find consistent patterns of
evidence across units, but within a case (Yin, 2009). The main unit of analysis is the non-residential building division of Heijmans. Within this single case, the embedded subunits of analysis are the construction projects. Eight cases are selected and the collected data consists of focused interviews, project documents and observations. The qualitative data generated by this case study is analyzed in a within-case analysis to answer the second research question and a cross-case analysis that answers the third research question. The within-case analysis results in a detailed description of the business model characteristics per case and a positioning of the cases on the conceptual framework. The cross-case analysis is used to identify patterns of similarities or differences in business models across categories of projects. The case findings will be used to adapt the conceptual framework to the practice at Heijmans Non-Residential Building. Comparing the current position of the projects with the complete range from the literature review will reveal opportunities for Heijmans to extend their current project business models. The analysis will result in a modified framework consisting of a set of variables per business model element with the characteristics per project type.

Results
The literature review resulted in the conceptual framework based on the product-service continuum of Oliva and Kallenberg (2003), ranging from pure product to pure service offerings. The continuum is extended with the nine business model elements of Osterwalder (2004), which are: customer segments, value proposition, channels, revenue model, customer relationships, key resources, key activities, key partnerships and cost structure. From the project management literature, it was found that project-based organizations can have three categories of project business models: transactional project deliveries, project-led solutions and lifecycle solutions. Business models from the servitization literature are compared and linked with the different project types. From these sources of servitization literature, the known characteristics of the different business models are added to the framework.

In the within-case analysis, eight construction projects and/or service contracts of Heijmans are analyzed on their business model characteristics and positioned on the conceptual framework. It was found that four cases had the transactional project delivery business model, three cases had the project-led solution business model and one case had the lifecycle solution business model. Within the first and second category of project business models, the offerings were product-oriented, while in the third category the offering was aimed at the customer’s process.

The cross-case analysis studied the cases for differences and similarities among the cases and between the cases and the conceptual framework from the literature review. Per business model element, three types of variables are identified: variables that confirm the conceptual framework, variables that are newly added to the framework and variables that are not confirmed by the case analysis. This last group of variables either is irrelevant in describing servitization of project business or is relevant but not part of Heijmans current business models and should be implemented to increase the level of servitization. The cross-case analysis is concluded with the design of a final framework that consists of the three categories of project business models, the nine business model elements and the variables per element that are confirmed or added to the framework.

Conclusions
In this thesis, a framework is developed that describes the servitization of project business. The model is based on the business model concept of Osterwalder (2004) and the three categories of project business models as proposed by Kujala et al. (2011). Servitization will change the distribution of projects over the different categories. The amount of transactional project deliveries will decrease, while the number of project-led solutions and lifecycle solutions will increase. In this context the framework is a useful tool, because mapping all Heijmans’ non-residential projects and maintenance contracts on the framework will provide insight in the current status of servitization of the company. By setting a target distribution of projects over the different categories for the coming years, the servitization of project business can be monitored and managed. Moreover, the business model elements of the framework enable the user to compare the characteristics of
projects in a structured way. This type of analysis provides better insight in opportunities of improving the PBO’s business performance. Future research at PBO’s in other industries is needed to test if the framework holds for project business in general. In addition, quantitative studies are needed with a larger sample to quantify the effects of servitization on financial results, customer satisfaction or sustainability.

**Recommendations**

Based on the analysis of the servitization of non-residential building projects of Heijmans, six recommendations for the management of Heijmans are proposed. These six are summarized in figure 0.1. To start with, servitization is not possible without customers who demand advanced service offerings. Therefore, Heijmans should proactively convince customers to outsource their hard and soft facility management to the contractor. Moreover, customers have to be convinced to specify their demand in more abstract terms, which will provide Heijmans more space to develop a solution that meets the customer need. The second short-term action is to implement customer-centric performance metrics. It is found that servitized project types include customers’ process-oriented offerings. This requires a change in performance metrics from short term revenues and margins on project deliveries towards metrics that are focused on the business of the customer. The third recommendation for the management of Heijmans is to benefit from the long term relationship with its customers by collecting data during the use phase. Feedback from use can provide the company with valuable knowledge about costs of maintenance and operations, but also knowledge of the performance of the building for the customers’ business. This knowledge is useful to make evidence-based design choices in future projects, which improves the customer’s business and reduces lifecycle costs. Another mid-term action is to initiate business consulting activities. Consultancy and advice on housing choices enables Heijmans to get involved earlier in the decision-making. Moreover, consultative selling is a potential channel for obtaining new work. The first action for the longer term is to develop financing capabilities. It is found that the need for financial resources increases when the company is servitizing towards lifecycle solutions. In the current situation Heijmans is dependent on bank loans that are characterized by high risk premiums which makes the financing activity costly. Because the availability of financial resources is of strategic importance, Heijmans should develop own financing capabilities in a separate division called Heijmans Capital. This is seen in other capital goods industries in which manufacturers offer equipment leasing. The final recommendation for Heijmans’ management is to use the recently established business development department to develop new business models in the category lifecycle solutions. The idea of ownerless consumption provides many directions for the company. Retaining the ownership of equipment enables Heijmans to become a true service provider.
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1 Introduction

1.1 Theoretical Background

In developed countries, manufacturing companies are moving up the value chain (Wise & Baumgartner, 1999). They are no longer selling pure products, but offer integrated solutions in a combination of products and services (Neely, 2008). The process of creating value by adding services to products is called “servitization” as described for the first time by Vandermerwe and Rada (1988). There are many reasons why firms should develop servitized offerings instead of just products. Services often have higher margins than products. The services market is often counter-cyclical with investments and equipment purchases, therefore services are a more stable source of revenue. Services can generate substantial revenue from an installed base of long lifecycle products. Customers are demanding more services, this increasing demand for service outsourcing is caused by the need to focus on core competencies to become more flexible, and to specialize. In addition, servitized offerings are a sustainable source of competitive advantage, since they are more difficult to imitate than goods, are less visible and more dependent on close relationships with customers (Oliva & Kallenberg, 2003).

Servitization is a generic term for concepts describing the integration of products and services, covering: integrated solutions (Davies, 2004; Windahl, 2007; Windahl & Lakemond, 2010), installed base service strategies (Gebauer, 2008; Oliva & Kallenberg, 2003), product-service systems (Tukker & Tischner, 2004; Neely, 2008), full-service (Stremersch et al., 2002) and functional products (Markeset & Kumar, 2005). Baines et al. (2009) defined servitization as: “The innovation of an organizations capabilities and processes to better create mutual value through a shift from selling products to selling product-service systems”. Oliva and Kallenberg (2003) developed a framework to describe servitization as a process. They found that servitizing companies are making a transition along a product-service continuum ranging from product offerings with services as add-on, to service offerings with products as add-on.

Servitization literature has always been aimed at the manufacturing industry (Baines et al., 2009; Oliva & Kallenberg, 2008; Wise & Baumgartner, 1999), while project-based organizations (PBO’s) are also increasingly focused on services in their offerings (Artto et al., 2008). These project suppliers are facing a new type of customers who are no longer interested in the acquisition of an investment project, but they want to purchase the performance of the project delivery during the use-phase (Kujala et al., 2010). These new customer types cause a variation in customer needs over customer segments, which brings new challenges for a project supplier’s business model (Kujala et al., 2010). Project business is characterized by a discontinuity of demand, uniqueness of individual projects, and complexity of offerings and business networks (Cova et al., 2002). Therefore, the role of projects, products and services in a firm’s business model differs from the manufacturing industry. Alignment of service and project processes with overall business processes is a specific issue for PBO’s that remains unaddressed by the general servitization literature (Artto et al., 2008). Hence, there is a gap in the servitization literature and this research will try to close or limit this gap.

1.2 Business Context

This master thesis study is performed during a research internship at Heijmans N.V. (in the continuing of this paper referred to as Heijmans). This construction company, with a total revenue of 2,4 billion euro in 2011 and 8.100 employees, is the third largest construction company in the Netherlands. Heijmans N.V. is listed at Euronext and the head office is located in Rosmalen (Heijmans Annual Report, 2011). The combination of the activities property development, residential and non-residential building and infrastructure enables Heijmans to employ an integrated approach. Heijmans is able to realize projects from the conceptual phase through design and realization up to management and maintenance. The company is primarily focused on its home market, the Netherlands, but is also active in Belgium and Germany.
The strategy of Heijmans is aimed at excellence on three dimensions: quality, sustainability and profitability. With the emphasis on margin over volume, the company is trying to become more profitable. One way to increase margins is by extending the value chain with services; this can be described as a servitization strategy. With the intention to become more customer-centric, to create more value for the customer and to increase the lifecycle profitability of projects, the company is making a transition from the traditional building projects towards more advanced lifecycle performance-oriented projects like Public Private Partnerships (PPP) in the form of design, build, finance, maintain and operate (DBFMO). Extending the value chain with design, maintenance and operational services is defined as a strategic objective in the report of the executive board (2011). Despite the servitization strategy, most of the projects are of a more traditional form. Only recently, during this research internship, Heijmans Non-Residential Building has won its first tender for a DBFMO project.

Although opportunities are recognized and first steps are being made, it seems that the company is lacking a true servitization strategy that coordinates the transition towards lifecycle performance-oriented projects. Within Heijmans, this research is limited to the Non-Residential Building division. Non-Residential Building consists of ‘Heijmans Utiliteitsbouw’ and ‘Burgers Ergon B.V.’ Technical Services (in the continuing of this paper referred to as Burgers Ergon). Burgers Ergon has been a subsidiary company of Heijmans since 2007 and is active in the design, realization and maintenance of electrical and mechanical installations. During the course of this study, Burgers Ergon is fully integrated in the Non-residential Building division. The combination of Technical Services and Non-Residential building enables Heijmans to offer an integrated approach of construction and installations, which lead to synergy benefits and ultimately to buildings that better meet customer needs over a longer period of time. The market segments that are targeted by Non-Residential Building are healthcare, government, commercial property, high-tech cleanrooms and datacenters. The integral approach, firstly by integrating design, realization and lifecycle performance-oriented services in one contract and secondly, by the integration of construction and technical installations makes projects more complex. The department Services provides the Design and Development department and the Service and Maintenance departments with advice in these complex integrated projects. Figure C.1 in Appendix C shows the organization chart.

1.3 Problem Statement

1.3.1 Problem statement

Preliminary to this research, open interviews were conducted with several managers and directors of Heijmans Non-Residential Building. It was found that the company is active in many different types of projects with different product and service offerings. First, the need was identified for this study to provide insight in the current level of servitization in the range of project types that Heijmans can offer. Second, because customers are increasingly demanding long term lifecycle-oriented projects, the company recognized the need to adapt the organization to become a service provider. This change in project types towards services requires a change in the company’s business models that in the end will increase the profit margins.

The following problem statement is formulated:

Changin\g customer demand requires Heijmans to implement more servitized offerings and to participate in new project types. The company needs to know what changes are needed in its business models to increase business performance in terms of profit margins.

1.3.2 Assignment

The assignment in this master thesis is to design a framework that can be used to classify the different levels of servitization in project-based firms and to clarify the effects of servitization on project business models. The framework has to be tested in practice. By applying the framework to the current practice of Heijmans, recommendations for improving their current business models have to be made.
1.3.3 Research questions

The following research questions are formulated:

RQ1: What are the different stages on the product-service continuum for a project-based organization when moving from offering products to offering product-service systems?

RQ2: What is the current position of the construction projects of Heijmans on the product-service continuum?

RQ3: What are the implications of servitization for project business models of Heijmans?

1.4 Research design

1.4.1 Research methodology RQ1

To answer the first research question, a literature review is performed. Literature on business models, on project-based organizations and on servitization is synthesized in one conceptual framework to describe the servitization of project-based firms. The systematic review architecture by Denyer (2008) is used as presented in figure D.1 in appendix D. The methodology can be described in the following steps: a preliminary search, a comprehensive search, selection, extraction, synthesis and at the end reporting the findings.

1.4.2 Research methodology RQ2

To provide an answer to the second research question, a within-case analysis is performed. Empirical data is collected using a single embedded case study method (Yin, 2009). This is considered to be the appropriate method to receive in-depth understanding of characteristics of the current business models at Heijmans. Case studies of the embedded type are characterized by multiple levels of analysis in order to find consistent patterns of evidence across units, but within a case. The main unit of analysis is the non-residential building division of Heijmans. Within this single case, the embedded subunits of analysis are the construction projects. This within-case analysis is focused on the embedded units of analysis as stand-alone entities resulting in a distribution of cases on the conceptual framework.

1.4.3 Research methodology RQ3

The third research question is answered by a cross-case analysis that is used to identify patterns of similarities or differences across categories of projects. By comparing projects with different levels of servitization on their business model elements, the effects of servitization on project business models will be identified. These newly identified implications of servitization will be added to the conceptual framework. Comparing the current position of the cases with the complete range from the literature review will reveal opportunities for Heijmans to improve their business models.

1.5 Deliverables

Because the aim of this study is to be both practically and theoretically relevant, it has two goals. The scientific goal is to develop a framework to classify servitization levels in project-based firms. The business goal of this master thesis is to analyze the current product and service offerings in non-residential building projects of Heijmans and to develop a tool that can be used to manage the servitization of Heijmans’ project business. The first deliverable is a product-service continuum that is adapted to the context of project business. It provides a framework for analyzing project business models as stages in the transition. The second deliverable is an overview of the current level of servitization by positioning cases on the conceptual framework. Finally, the third deliverable is a list of business model variables that are related to servitization. Based on this knowledge, recommendations for Heijmans’ management are made on how to improve their current practice.
1.6 Thesis Outline

This first chapter is used to introduce the field, the business context and the aim of this study. The next chapter is a shortened version of the literature review (Mertens, 2012), in which the literature on project business, the literature on servitization and the literature on business models are reviewed in order to construct the framework. The third chapter contains the first part of the case analysis, namely the within-case analysis. The framework is applied at a project-based firm in the construction industry to analyze the firm’s business models and its current position on the continuum. The within-case analysis will study the business model elements per case. The within-case analysis is used to find an answer to the second research question and will result in a positioning of the cases on the conceptual framework. The second part of the case analysis is the cross-case analysis and is presented in chapter four. The cross-case analysis is used to study the implications of servitization for each business model element, which is the answer to the third research question. Finally, in chapter five the conclusion will be drawn of this master thesis. The results of the case analysis are used to complete the framework with findings from practice and to make recommendations to the company. Moreover, the conclusion will propose directions for future research and discuss the limitations of the study.
2 Literature Review

2.1 Introduction
In order to study the servitization of project-based firms, a literature review is performed to address the need for a modified product-service continuum, one that covers the servitization literature and that is useful in the context of project business. Therefore, the following research question will be answered in this chapter:

*RQ1: What are the different stages on the product-service continuum for a project-based organization when moving from offering products to offering product-service systems?*

2.2 Methodology

2.2.1 Search strategy
For this literature review, the systematic review architecture by Denyer (2006) is used, as presented in appendix D. The search started with a preliminary literature search to map the field, set the scope of the study and to find keywords. These keywords were then used to form search strings. The search engines recommended by the Tu/e library for finding articles in the field of industrial engineering are used. These are: ABI/Inform, Web of Science, Science Direct, Emerald and Jstor. The relevant articles that passed the first screening were then assessed by explicit selection criteria. The results of the literature search are assessed on basis of content and quality related selection criteria. The content related criteria addressed the date of publication and the scope of the papers. Only papers published after 2001 were selected to prevent referring to outdated sources. However, exceptions are there if historical articles are necessary to cite the original source of a theory that is still in use. To assess the quality of the journals, the journal quality list 2011 by professor Harzing is used as recommended by the Tu/e library website. Journals that score a two or higher according to the ABS 2010 (Association of Business Schools Academic Journal Quality Guide) are seen as well regarded and therefore allowed to use in this literature review. Appendix E presents an overview of the journals that are used with the ABS 2010 score and the ISI impact factors. Articles in journals that do not meet the quality requirements are checked for citations. If the article is cited by a number of high quality articles in the field, then the specific article is included. The same applies to conference papers and books, which are not published in scientific journals. The useful data is extracted out of the selected papers and pasted in a work file. The extracted information from the papers formed the building blocks of the literature review. In the end, all the key findings and concepts of the studies are synthesized in a framework to provide an answer to the research question.

2.2.2 Deliverable
This literature review will deliver a conceptual framework that can be used to describe the servitization of project business. The framework should contain the different categories of projects on the product-service continuum, the so called ‘stages’. Moreover, the framework should contain a set of business model elements that can be used to analyze projects. The outline of the framework is shown in figure 2.1. On the horizontal axis, different types of servitized projects are shown. On the vertical axis, the business model elements are displayed. The framework has to link the servitization literature with the project management literature and will have to present what is known about the business model characteristics of the identified project types. In the end, potential gaps in the framework will emphasize the need for further case study research.
2.3 Business Model Concept

To describe the servitization of project business, the business model concept of Osterwalder is used in this study. Although often used in literature, the definition of the term ‘business model’ is varying and there is no common understanding of the concept. Table F.1 in appendix F provides an overview of the most applied business model theories, with a definition and the business model elements. The business model concept is used because it expresses the business logic of a firm (Osterwalder, 2004) and provides a useful framework to analyze a particular company (Amit & Zott, 2001; Chesbrough & Rosenbloom, 2002). The need for consistency between a company’s strategy and its business model makes that implementation of a service strategy requires changes throughout the business model (Galbraith, 2002). The changing business logic caused by servitization should therefore be analyzed with a business model framework. Moreover, change in one element of the business model often requires corresponding realignments with other elements (Osterwalder, 2004). Which realignments are needed for servitization can thus be analyzed on the level of business model elements. For this study, the method of Osterwalder is applied for two reasons. The first reason is that the business model content identified by Osterwalder (2004) covers all elements that are part of the other methods. The different approaches have in common that they describe the value creation and the value capturing of a business model (Shafer et al., 2005; Chesbrough, 2007). Looking at table F.1, the business model elements of each approach can be traced back to the four pillars that are the basis for Osterwalder’s method: product, customer interface, infrastructure management and financial aspects. Exceptions are competitive strategy, of Chesbrough and Rosenbloom (2002) and Chesbrough (2007), and strategic choices of Shafer et al. (2005). These two elements are not included in this study, because there is a distinction between strategy and business models. Business models deal with the activities of an organization and how to deliver value to and capture value from a customer. In contrast, strategy is about how to use the business model and how to position a company by considering competition (Margretta, 2002). The second reason why the method of Osterwalder is chosen, is that his method is well documented, which improves the applicability of the method. Besides his doctoral thesis, he also wrote a book on this topic called ‘Business Model Generation’ (2009). Although some elements are named differently, the method described in the book is the same as in his doctoral thesis. In this study, the terminology of the book will be applied.
The conceptual framework is structured around the nine business model elements of Osterwalder (2004), in order to enable a detailed categorization of business models on the product-service continuum. These nine elements, which are briefly introduced in Table 2.1, are used to analyze the different project business models.

<table>
<thead>
<tr>
<th>Business Model Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer segment</td>
<td>&quot;The segment of customers a company wants to offer value to.&quot;</td>
</tr>
<tr>
<td>Value proposition</td>
<td>&quot;An overall view of a project’s bundle of products and services that are of value to the customer and that satisfy customer needs.&quot;</td>
</tr>
<tr>
<td>Channels</td>
<td>&quot;The way a company communicates with its customer segments and how a company reaches its customers to offer the value proposition.&quot;</td>
</tr>
<tr>
<td>Customer relationships</td>
<td>&quot;The link that is being established between the company and the customer.&quot;</td>
</tr>
<tr>
<td>Revenue model</td>
<td>&quot;The way a company makes money out of a variety of revenue flows from each customer segment.&quot;</td>
</tr>
<tr>
<td>Key resources</td>
<td>&quot;The most important assets that are needed by a company to make a business model work.&quot;</td>
</tr>
<tr>
<td>Key activities</td>
<td>&quot;The processes that have to be performed by the provider to make the business model work.&quot;</td>
</tr>
<tr>
<td>Key partnerships</td>
<td>&quot;The network of suppliers and partners who enable the provider to offer the value proposition.&quot;</td>
</tr>
<tr>
<td>Cost structure</td>
<td>&quot;The representation in money of all the means employed in the business model.&quot;</td>
</tr>
</tbody>
</table>

Table 2.1 Business model elements (Osterwalder, 2004)

2.4 PBO’s and CoPS

Project-based organizations (PBO’s) are companies that have their strategies and capabilities structured around projects that often occur across conventional industrial or firm boundaries (Hobday, 2000). The Project Management Institute defines a project as: “a temporary endeavor undertaken to create a unique product, service or result” (PMI, 2004). The PBO is considered as the ideal form to manage increased product complexity and is found in a wide range of industries. Examples of these industries are: consulting and professional services, cultural and sports industries and complex products and systems (CoPS) (Wikström et al., 2010). This study will focus on PBO’s in the CoPS industry, because these companies offer tangible goods as well as intangible services, which is a requirement for studying servitization. CoPS are high-tech capital goods that are sold in a business-to-business market and are used by their customers to produce goods and services. In contrast with the high volume consumption goods, CoPS are high cost and made of interconnected customized components (Windahl, 2004). CoPS are mostly produced in projects or small batches. Within CoPS industries, many different types of PBO’s exist, ranging from large prime contractors, specialized in project management and systems integration, to small sub-contractors, supplying components, software or services (Hobday, 2000). It should be noted that in the project management literature a different term is used for a tangible good, this is often called a project delivery (Kujala et al., 2010). If a customer acquires a project delivery, it is meant the customer acquires a tangible good produced and delivered in a project. PBO’s are extending their offerings beyond traditional project deliveries by the integration of maintenance, consultancy, design services, spare parts, management contracts, partial ownerships and operations of complex systems (Artto et al., 2008). These extensions of the traditional project delivery are found to occur in three lifecycle phases of a project: before, during, and after a project (Artto et al., 2008).

2.5 Business Models in PBO’s

Normally, business models are discussed on the firm level (Tikkanen et al., 2005). Nevertheless, the variety in customer types requires PBO’s to offer different types of projects with different business models (Kujala et al., 2010). Some customers are interested in the acquisition of the project delivery, while other customers prefer to purchase only the performance of the project’s product. In addition, it is found that firms can have different business models for different customers and markets (Chesbrough and Rosenbloom, 2002). Based on these perspectives on business models, Kujala et al. (2010) suggest that in the context of a project-based firm, business models should be analyzed at the solution level. According to Kujala et al. (2010), a solution consists of a project delivery component, the EPC (engineering, procuring and construction) part and an after-delivery service component, the O&M (operations and maintenance) part. In line with the findings of Artto et al. (2008),
in this study a third solution component is added, the pre-project services. These can be: consulting, feasibility studies, conceptual design, engineering design or systems integration (Artto et al., 2008). Figure 2.2 shows the three categories of solution business models, which are classified according to the role of services in the offerings. The first type of project business model consists of a transactional sale of the project delivery with minimal services that are provided on request of the customer. In the second type, the project-led solution, full-scale outsourcing of operations and/or maintenance is offered separately from the transactional sale of the core project delivery. The third type, the lifecycle solution, consists of an integrated value proposition of services and project products. It is a pure service offering in which the project delivery is offered as a service to the customer (Kujala et al., 2011).

![Three types of solution business models](image)

**Figure 2.2 Three types of solution business models (Based on Kujala et al. (2011) and Artto et al. (2008)).**

### 2.6 Design of the Framework

Now the business model concept is explained and three types of project business models are defined, the servitization literature will be used to provide the content of the conceptual framework. Therefore, the three types of project business models will be compared and linked with the service strategies from the servitization literature. To cover the servitization literature, three sources will be used: the literature on installed base service strategies, the literature on integrated solutions and the literature on product-service systems (PSS). This is in line with other literature reviews of Baines et al. (2009), Neely (2008) and Windahl (2007). These three sources of servitization literature have in common that they describe a set of service strategies on a product-service continuum. In figure 2.3, the strategies found in the literature are positioned under the project business model type that they have similarities with. In contrast to the three types of project business models, the servitization literature consists of six service strategies. However, the strategies that are positioned above each other in figure 2.3 have the same importance of services in their offering and are therefore positioned at the same stage on the continuum and in the same type of project business model.

Starting point in the design of the framework are the four quadrants of the installed base service space by Oliva and Kallenberg (2003), which are the first four boxes from the left in figure 2.3. They combine two elements of a firm's business model: the revenue model and the value proposition. In figure 2.3, move on the horizontal axis represents a change in revenue generation logic of the provider: from transactional product sales with transactional service income, to transactional product sales with relational service income, to relational service income of an integrated product-service offering. Move on the vertical axis represents the change in value proposition to the customer. The focus of the value proposition to the end-user shifts from product efficacy (whether products work as they should) to product efficiency and effectiveness within the end-user’s process. However, the installed base service space by Oliva and Kallenberg (2003) does not include integrated offerings.
of products and services as is the case with PSS and integrated solutions. To cover the complete range of servitized business models, the installed base service space is extended on the right side to include relational exchange of integrated product-service solutions. In the following subsections will be elaborated on the different business models in figure 2.3 and will be explained how the framework is created out of the different ‘ingredients’ from the servitization literature. The characteristics of the business models of figure 2.3 that are found in the servitization literature are presented per business model element in table 2.2. For a detailed explanation of the framework per business model element, the complete literature review of Mertens (2012) should be consulted.

![Figure 2.3 Linking servitization strategies to project business models](image)

**2.6.1 Business model 1: Transactional Project Delivery**

In the first stage on the product-service continuum, the transactional project delivery, two service strategies from the literature are combined: the installed base service strategy (Gebauer, 2008; Helander & Möller, 2007; Oliva & Kallenberg, 2003) and the professional services strategy (Gebauer, 2008; Oliva & Kallenberg, 2003). This subsection will briefly discuss the business model characteristics that are extracted from these two service strategies. It is found that the customer segment of this business model is characterized by a sourcing strategy that is to remain independent of the supplier and to have high in-house capabilities and sufficient financial resources (Helander & Möller, 2007). Because of these high capabilities, these customers have a low perceived technological complexity. Another characteristic of their sourcing strategy is they want to obtain the ownership of the equipment. These characteristics make that the customer segment is characterized by a low maturity with regard to servitized offerings. In this project business model, the value proposition consists of a core
project delivery with minimal services on request. According to Gebauer (2008) an after-sales service provider offers assistance and spare-parts to enable a proper functionality of the system. Services in this business model are offered to support the sales of equipment and material (Helander & Möller, 2007). Examples are: help-desks, repair services, emergency support, transportation, and product-oriented training. The transactional service strategy that is aimed at the customer’s processes, indicated with product + professional services, consists of services that improve the effectiveness and efficiency of the product in the customer’s processes (Gebauer, 2008; Oliva & Kallenberg, 2003). Examples are business consulting, engineering design and advice, process design and construction design services. Oliva and Kallenberg (2003) suggest that providers of professional services need a new distribution channel for these services. However, that paper provides no further description of these new channels. For the element customer relationships in this type of project business model, it is found that relationships are transactional based and that for offering professional services, new networks and different contacts in the end-users organization are needed (Oliva & Kallenberg, 2003). Again, not a very detailed description. The revenue model is transactional for both the project delivery as well as the services on request. These are priced based on cost-plus percentage fee on man-hours, equipment and material (Helander & Möller, 2007). The key resources that are central in this type of project business model are the technology, machinery and employees that enable the production (Barquet et al., 2010). In addition, offering transactional services requires the company to have an independent service organization (Oliva & Kallenberg, 2003). For offering professional services like consultancy and advice, resources are the knowledge of the customer’s business and a professional service infrastructure (Helander & Möller, 2007; Oliva & Kallenberg, 2003). These resources enable the company to perform the following activities that are specific for this type of project business model: production, product and process development and business consulting (Barquet et al., 2010; Davies, 2004). Since service activities in this project business model are not the core of the offering, these are regarded as non-core business and outsourced to service suppliers, which is identified as a characteristic of the key partnerships (Helander & Möller, 2007). The organizations in these partnerships operate as independent organizations and at arm’s length, without interfirm routines and minimal information exchange (Rapaccini et al., 2010). The cost structure for this type of project business model is defined by Barquet et al. (2010) as mainly production costs with additional material and human resource costs for the service activities.

### 2.6.2 Business model 2: Project-led Solution

In the second stage on the product-service continuum, the project-led solution, two corresponding service strategies that are identified in the literature are maintenance services (Gebauer, 2008; Oliva & Kallenberg, 2003) and operational services (Gebauer, 2008; Helander & Möller, 2007; Oliva & Kallenberg, 2003). The customer segment is characterized by customer who still want the ownership of the product (Barquet et al., 2010), but are willing to share expertise with the provider and to outsource certain activities to the provider (Helander & Möller, 2007). The effect of outsourcing is a reduction of in-house capabilities and is increased by perceived complexity (Helander & Möller, 2007). The combination of the need for ownership with outsourcing of activities is defined as a medium customer maturity level with regard to services (Kindström, 2010). The value proposition can be product-oriented maintenance services or customers’ process-oriented operational services. In the maintenance offering, the provider takes over the risk of machine breakdown and offers prevention of failures and guaranteed equipment availability (Gebauer, 2008). In the operational offering, providers assume the operating risk and take full responsibility for the customer’s operational processes. The value proposition consists of the reduction and more efficient management of operational risks and expenses (Gebauer, 2008) and of optimizing the customer’s processes (Helander & Möller, 2007). The sales channel for these type of offerings is generally at a higher management level than for the transactional project delivery (Helander & Möller, 2007). The customer relationships are characterized by a long duration (Kujala et al., 2011) and higher customer intimacy because the provider and the customer have a shared interest in preventing failures and the provider operates in the customer’s processes which requires trust and cooperation (Helander & Möller, 2007). Revenues in this type of project business model are generated through transactional product sales, which is still the core of the offering, and through additional services that are sold in relational exchange.
These relational services have a fixed price covering all service actions over an agreed period and are priced on basis of equipment availability and performance (Gebauer, 2008; Oliva & Kallenberg, 2003). The provider takes over operational risk which is worth a premium (Oliva & Kallenberg, 2003). The key resources needed for this business model are the reliability and quality of the product to increase equipment availability (Gebauer, 2008) and knowledge of the customers’ business processes (Helander & Möller, 2007). In addition, the organization needs new skills in information gathering to determine risk better (Oliva & Kallenberg, 2003). New activities that are specific for project-led solutions are the assessment of failure risk, which determines profitability, the maintenance of own equipment and the development of services (Kindström, 2010; Oliva & Kallenberg, 2003). The increased importance of services in the offering makes that key partnerships with suppliers are intensified (Rapaccini et al., 2010). Information exchange is intensified to communicate demand forecasts, technical feedback and complaints. Moreover, operational linkages are stronger with automated information flows with service suppliers and service level agreements are contractually defined in legal bonds. The cost structure of the project-led solution is characterized by a more efficient usage of the product and a higher utilization of the service capacity which both reduce costs (Oliva & Kallenberg, 2003).

2.6.3 Business model 3: Lifecycle Solution
The third business model on the product-service continuum corresponds to the service strategies use-oriented product-service system (Tukker & Tischner, 2004; Windahl & Lakemond, 2010) and result-oriented product-service system (Helander & Möller, 2007; Tukker & Tischner, 2004; Windahl & Lakemond, 2010). In this type of project business model, the customer segment is characterized by clients who don’t need the ownership of the product and prefer to have no assets on their balance sheet (Barquet et al., 2010; Tukker & Tischner, 2004). Helander & Möller (2007) argue that the sourcing strategy of these customers is to rely on the supplier’s expertise, because they have low in-house capabilities and low financial resources. Their demand for full service offerings is increased by a high perceived complexity of the product (Helander & Möller, 2007). The customer maturity level with regard to services is the highest in this customer segment (Kindström, 2010). In the product-oriented value proposition of this business model, the provider offers the output or functional result of an integrated product and service offering (Tukker & Tischner, 2004). Moreover, the reduced need for capital is also seen as part of the value proposition (Tukker & Tischner, 2004). The identified characteristics related to channels of the lifecycle solutions are somewhat contradictory. The first literature source noted a reduction in sales effort, because lease contracts are easier to sell then complex and expensive products (Barquet et al., 2010). In the second source it is argued that PSS providers should increase their sales effort to pull PSS adoption and to clarify customers about usage of PSS (Tukker & Tischner, 2004). In the lifecycle solution business model, customer relationships are characterized by a long duration (Kujala et al., 2011) and strong interactions (Barquet et al., 2010) because the customer and the provider have shared revenues and co-develop a solution (Helander & Möller, 2007). The revenues from the lifecycle solution are generated through payments on availability or per time unit usage (Barquet et al., 2010). These revenue models are also called pay-for-performance or pay-per-usage (Tukker & Tischner, 2004). Helander & Möller (2007) found that providers of lifecycle solutions share gains with their customers. In addition, shared usage leads to more revenues out of the same product (Barquet et al., 2010). The key resources needed for providers of lifecycle solutions are their tangible products and equipment through which they offer their services (Tukker & Tischner, 2004) and their knowledge of the customers’ business processes (Helander & Möller, 2007). Moreover, a specific characteristic of the lifecycle solution is the increased need for financial resources to retain ownership of the equipment (Tukker & Tischner, 2004). New activities specific for the lifecycle solution are the financial services (Davies, 2004), service development (Kindström, 2010), the design for function based on abstract customer needs and lifecycle costs (Van Halen et al., 2005). The strategic integration between partners is identified as typical for lifecycle solutions (Rapaccini et al., 2010). The provider either insources service provision or engages in equity-based partnerships (Rapaccini et al., 2010). The cost structure in lifecycle solutions is characterized by an increased cost of capital and an increased cost of uncertainty and risk, and a reduction in lifecycle costs (Tukker & Tischner, 2004).
2.7 Conclusion

New types of customers cause a variation in customer needs over different segments. This forces the project-based organization to operate multiple business models and to hold multiple positions on the product service-continuum. A project’s business model can be analyzed with the nine business model elements of Osterwalder (2004) which are: customer segments, value proposition, channels, revenue model, customer relationships, key resources, key activities, key partnerships and cost structure. This study followed Kujala et al. (2010) in its range of project business models. A project-based organization has three categories of project business models: transactional project deliveries, project-led solutions and lifecycle solutions. In the transactional project delivery, the provider sells the core product in a transaction. Services before and after the project are possible on request of the customer and are paid for per service activity. In the project-led solution, a sale of the project delivery is still the core of the offering. However, services are exchanged in a relational revenue model providing the client with a fixed fee for performance or availability. The lifecycle solution consists of an integrated offering of products and services in which the client pays a fee for the performance of the complete system without obtaining the ownership of the product. Within these three main categories, variations are possible ranging from product-oriented to customer’s process-oriented offerings. Service strategies from the servitization literature are linked with the different project business models in the conceptual framework. From these sources of servitization literature, the identified characteristics of the different business models are added to the framework as presented in table 2.2. However, it was found that servitization literature did not provide enough insight for every business model element of the framework. The elements value proposition, customer segments, key activities and revenue model are well described in the servitization literature. The other elements require more attention and need further studies to make the framework a useful tool. In addition, the framework needs to be tested in practice to find out whether the framework is a true representation of the real world.

### Servitization of Project Business: Framework 1.0

<table>
<thead>
<tr>
<th>Service as add-on</th>
<th>Product as add-on</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business model 1:</strong> Transactional Project Delivery</td>
<td><strong>Business model 2:</strong> Project-led Solution</td>
</tr>
<tr>
<td><strong>Customer Segment</strong></td>
<td>Clients who want ownership (Barquet et al., 2010); High capabilities, independence of the supplier, low perceived technological complexity (Helander &amp; Möller, 2007); Low customer maturity (Kindström, 2010).</td>
</tr>
<tr>
<td><strong>Value Proposition</strong></td>
<td>Assistance and spare-parts to ensure proper functionality of the system (Gebauer, 2008; Kujala et al., 2011); Improved utilization and effectiveness of the product in customer’s processes (Oliva &amp; Kallenberg, 2003).</td>
</tr>
</tbody>
</table>
| **Channels** | New distribution channel (Oliva & Kallenberg, 2003). | Sales channel at higher | Sales of lease contracts easier to
<table>
<thead>
<tr>
<th>Key Relationships</th>
<th>Transactional based (Oliva &amp; Kallenberg, 2003). New network and different contacts in end-user organization (Oliva &amp; Kallenberg, 2003).</th>
<th>Enables long term customer relations (Kujala et al., 2011). More intimate customer relationship: customer intimacy, trust and cooperation (Helander &amp; Möller, 2007).</th>
<th>Enables long term customer relations (Kujala et al., 2011). Longer term contracts and strong interactive relationship (Barquet et al., 2010); Shared revenues, co-development (Helander &amp; Möller, 2007).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue Model</td>
<td>Transactional sale of project delivery, transactional services on request (Kujala et al., 2011; Oliva &amp; Kallenberg, 2003); Cost-plus percentage fee (Helander &amp; Möller, 2007).</td>
<td>Transactional sales price plus relational service income (Tukker &amp; Tischner, 2004; Kujala et al., 2011; Oliva &amp; Kallenberg, 2003); Pricing on equipment availability (Oliva &amp; Kallenberg, 2003); Pay for performance (Gebauer, 2008); Accepting operational risk worth a premium (Oliva &amp; Kallenberg, 2003).</td>
<td>Payment on availability, shared or used by different users leading to lower capital need (Barquet et al., 2010); Gain sharing, performance based contracts (Helander &amp; Möller, 2007); Pay-per-usage, Pay for performance (Tukker &amp; Tischner, 2004).</td>
</tr>
<tr>
<td>Key Resources</td>
<td>Technology, machinery, employees (Barquet et al., 2010); Independent service organization (Oliva &amp; Kallenberg, 2003); Professional service infrastructure (Oliva &amp; Kallenberg, 2003); Knowledge of the customer’s business (Helander &amp; Möller, 2007).</td>
<td>Product reliability and quality (Gebauer, 2008); Knowledge of customers’ business processes (Helander &amp; Möller, 2007); Information gathering capabilities (Oliva &amp; Kallenberg, 2003).</td>
<td>Tangible products/equipment (Tukker &amp; Tischner, 2004); Knowledge of customers’ business processes (Helander &amp; Möller, 2007); Financial resources (Tukker &amp; Tischner, 2004).</td>
</tr>
<tr>
<td>Key Activities</td>
<td>Production, Product and process development (Barquet et al., 2010); Business consulting (Davies, 2004).</td>
<td>Assessing failure risks, maintaining own equipment, product development (Oliva &amp; Kallenberg, 2003); Systems integration (Davies, 2004). Service development (Kindström, 2009).</td>
<td>Systems integration (Davies, 2004); Lifecycle costing (Van Halen et al., 2005); Design for function (Van Halen et al., 2005); Service development (Kindström, 2009); Financial services (Davies, 2004).</td>
</tr>
<tr>
<td>Key Partnerships</td>
<td>Outsourcing of non-core business services (Helander &amp; Möller, 2007); Arm’s length service supplier relationships, low operational linkages, basic information exchange (Rapaccini et al., 2010).</td>
<td>Intense information exchange, cooperative norms, legal bonds, and strong operational linkages with service suppliers (Rapaccini et al., 2010).</td>
<td>Insource service provision, strategic integration between partners, equity-based partnerships (Rapaccini et al., 2010).</td>
</tr>
<tr>
<td>Cost Structure</td>
<td>Production costs, additional material and human resource costs (Barquet et al., 2010).</td>
<td>More efficient use of the product, higher utilization of service capacity which reduces costs (Oliva &amp; Kallenberg, 2003).</td>
<td>Uncertainty about system costs, Reduced for lifecycle costs (Meier, 2010); Increased cost of capital (Tukker &amp; Tischner, 2004).</td>
</tr>
</tbody>
</table>

Table 2.2 Conceptual Framework
3 Within-Case Analysis

3.1 Introduction
The framework as developed in the chapter 2 will be used to analyze the servitization of Heijmans Non-Residential Building. The result of the within-case analysis will be a categorization of project business models on the product-service continuum that will be used in the cross-case analysis of chapter 4 to find patterns of within-group similarities and differences. This chapter will provide an answer to the second research question:

RQ2: What is the current position of the construction projects of Heijmans on the product-service continuum?

3.2 Methodology

3.2.1 Unit of analysis
Empirical data is collected using a single embedded case study method (Yin, 2009). Figure 3.1 is a graphical representation of the single embedded case study design. This is considered to be the appropriate method to receive in-depth understanding of characteristics of the current business models at Heijmans. Case studies of the embedded type are characterized by multiple levels of analysis in order to find consistent patterns of evidence across units, but within a case. It should be noted that the findings of this study apply only for the single case, and cannot be generalized to the complete Dutch construction industry. The main unit of analysis is the Non-Residential Building division of Heijmans. Within this single case, the embedded subunits of analysis are the construction projects. Context variability of the analysis is minimized because multiple subunits are selected within a single company. This within-case analysis will focus on the embedded units of analysis as stand-alone entities. Later in the cross-case analysis, the embedded units will be compared to find patterns across the cases.

![Diagram of single embedded case study design](image)

Figure 3.1 Single embedded case study design (based on Yin, 2009)

3.2.2 Case selection
Within the main unit of analysis, a selection is made on which projects to select for the case study. This selection of cases is represented in table 3.1. Construction projects can be classified on the type of contract. The different types of projects vary in the level of vertical integration between the design, build and maintenance phase of the construction value chain. The first selection criterion was to aim for a set of cases with a maximum variety in project types. For each of the categories of project business models, the intention
was to study three cases. However, the availability of cases differed per category. Of the traditional project types more than one hundred cases were available, while there were about five project-led solutions and just one lifecycle solution available to study within the organization. The second selection criterion is time. Since the subject of analysis is the current range of project business models, only recent projects that are realized in the last two years or not yet realized projects were considered to be relevant. Because the main unit of analysis is the division non-residential building of Heijmans, the selected projects had to contain a construction element, a mechanical installation element, an electrical installation element or a combination of the three. Another characteristic was whether a project’s work is scored or not in the call for tenders. In this context, a scored project is a project that is won in a call for tenders and the work is obtained by Heijmans or a consortium where Heijmans is part of. Because a tender of complex construction projects can take more than one year, projects that are tendering have also been considered to cover the business models of the most recent projects. Table 3.1 shows the selected cases in the different categories.

<table>
<thead>
<tr>
<th>Case I Meander Medical Centre</th>
<th>Case II MSD Organon</th>
<th>Case III Frederik Barracks</th>
<th>Case IV M. Museum Soesterberg</th>
<th>Case V Jeroen Bosch Hospital</th>
<th>Case VI COA</th>
<th>Case VII Municipal Office Rotterdam</th>
<th>Case VIII Eindhoven Airport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical Integration</td>
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<td>Design</td>
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<td>X</td>
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<td>X</td>
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<td>Build</td>
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<td>X</td>
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<td>Finance</td>
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<tr>
<td>Maintain</td>
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</tbody>
</table>

Table 3.1 Case selection

3.2.3 Data collection
To investigate the current business models at the project level, qualitative data is used. Construct validity and reliability of the case study evidence was assured by following the three principles of data collection (Yin, 2009): 1) Use multiple sources of evidence, 2) Create a case study database and 3) Maintain a chain of evidence. Multiple sources of evidence were used to develop converging lines of inquiry (Yin, 2009). This process is called triangulation and corroboration, which makes case study findings more convincing and accurate. The data is collected with three sources of evidence that are commonly used in case study research as proposed by Yin (2009): documentation & archival records, interviews and observations.

**Interviews**
Per project, two members of the project’s team were interviewed and preferably working at different places in the organization. Three types of employees were interviewed: (1) tender managers and project engineers who operate in the pre-project phase, (2) project managers and directors who lead the realization phase and (3) contract managers and service managers who work in the post-project phase. The interviews were of the type focused interview, in which informants are interviewed for about an hour. During these interviews, the conversations followed a structured line of open-ended questions. The business model elements that were the
outcome of the literature review were used to structure the interviews. With the interviewee’s permission, the interviews were audiotaped. The interview guideline is presented in appendix G.

**Documents & archival records**
Project documents like demand specifications, offering presentations and maintenance contracts were consulted in addition to the interviews. Because the interviewee’s responses can be subject of problems like bias, poor recall and inaccurate articulation (Yin, 2009), data from the interviews were checked for accuracy with data from project documents. The sources for this type of evidence were the firm’s archives that contain large quantities of project information and the Heijmans Intranet environment that contains a Wiki-site. The exact sources used per case are specified in more detail in the within-case analysis.

**Observations**
Because this research is performed during an internship at a Heijmans location, informal conversations provided insight in the processes of Heijmans and the construction industry. Observations also provided information about the people working at different positions in the firm and the projects in which the firm participated. This enabled the selection of case projects and interviewees for the case study.

**Case study database**
The case study data is documented in a formal presentable database. This enables other investigators to review the evidence directly without being limited to the case study descriptions and will increase the case study’s reliability. The database will include the case study notes, documents, tabular materials and narratives. The third principle to increase the reliability of the case study is to maintain a chain of evidence. Readers of the report will have to be able to trace back the basis for conclusions. This will be achieved by clear cross-referencing between steps in the case study process.

3.2.4 Data analysis
The within-case analysis is aimed at identifying a range of business models from product- to more service-oriented and to position these in the conceptual framework of chapter 2. This subsection will discuss the path from the initial data collection to the conclusions. The data collection resulted in a large volume of data (>100 pages), consisting of interview transcriptions and project documents. The first step was to make citations from the interview transcriptions and collect them according to the business model element they belong to. This resulted in a set of relevant data (± 40 pages), however still too large for inclusion in the report. Instead, detailed case descriptions of approximately one page per case are attached to the report (appendix H). These case descriptions can be seen as summaries of the interview transcriptions and provide the reader with a context of the cases. The second step was to create a table (3 pages) to present the findings from the citations in one or two words, called coding. Since the interviews were in Dutch, the words chosen in the results are copied and translated from the interviewees. This data extraction table is included in appendix I. In the results, the cases are briefly introduced followed by an elaboration of the project’s business model. The conclusion of the within-case analysis is a position in the framework that fits the best with the case. This positioning is based on the project’s business model and according to the criteria of the conceptual framework from chapter 2.

![Figure 3.2 Data analysis: within-case analysis](image-url)
3.3 Results
This section presents a description of the business models of the cases. To study the current position of the projects of Heijmans Non-residential building on the product-service continuum, eight cases are described and compared with the servitized business models of the literature review. Firstly, the different cases will be shortly introduced. A more detailed description of the cases can be found in appendix H. Secondly, the nine business model elements will be described per case in addition to the data extraction table in appendix I. Finally, the conclusion of this within-case analysis is a scoring of the cases on the conceptual framework presented in table 3.10. Based on this scoring, the cases can be positioned on the product-service continuum (figure 3.3) and the goodness of fit of the conceptual framework can be calculated.

3.3.1 Case I Meander Medical Centre
The project started in 2008 when two merged hospitals in Amersfoort initiated a public tender for the realization of a new to build hospital. The scope of the project is the realization of 113,000 m² GFA (gross floor area) of hospital, with a contract value of 175 million euro. The project can be described as traditional, because the design and realization are executed by two different parties. Nevertheless, the initiator tried to involve Heijmans in a building team to make use of the construction expertise in the design phase. The building contract was signed in May 2010 and commissioning is planned for September 2013.

<table>
<thead>
<tr>
<th>Data collection:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Award-/selection criteria</td>
</tr>
<tr>
<td>Interview 1 Project director</td>
</tr>
<tr>
<td>Interview 2 Cost calculator</td>
</tr>
</tbody>
</table>

Table 3.2 Sources of data case I

Project business model
This paragraph will shortly explain the business model elements of the project based on the extracted data displayed in table I.1 in appendix I. The client is part of the customer segment healthcare. The capabilities of the client with regard to maintenance are sufficient, because they used to have their own technical staff. Also for operating their accommodations, with for example cleaning, security and catering they have in-house employees. Demand is specified in a preliminary design after which the contractor is selected on MEAT (Most Economically Advantageous Tender). The value proposition in the project consists of the realization of the building including the construction elements as well as the electrical and mechanical installations, within time and for a fixed price. In the pre-project phase, Heijmans was involved in the final design to advice the design team about the realization. Design responsibility for the building is assigned to the architect. In contrast, for the technical installations, Burgers Ergon is design responsible. This involvement in the design phase extends the customer relationship to the pre-project phase. For the post project phase, the customer relationship is uncertain, because there is no decision made on the maintenance contract. Key resources necessary for this project are project management skills, the prefab concrete plant of Heijmans called Bestcon, the knowledge about realization costs, and the experience with the realization of other hospitals. The key activities identified in this project are cost calculation, advice during design phase, procurement and production. Because of capacity constraints and the reduction of risks, a direct competitor is asked to participate in a general partnership. The production activities are for 70 to 80% outsourced to subcontractors. The relation with the architect and the construction advisors is not included as a partnership; these are contracted by the client and have no contractual relationship with Heijmans. The project delivery has a fixed contract price. Revenues are obtained from efficient realization, a reduced lead time and optional additional work. The costs of the project are mostly determined by the size of the project and the design decisions of the architect.
3.3.2 Case II MSD Organon

The service building department of Heijmans is involved in a call-off maintenance contract with MSD Organon in Oss. For this pharmaceutical company, Heijmans maintains the construction elements of three industrial facilities.

| Data collection: |
| Service Contract |
| Interview 1 Project supervisor/work planner |

Table 3.3 Sources of data case II

Project business model

The client in this case is active in the pharmaceutical industry. The customer has own facility managers who manage the maintenance operations. Heijmans is contracted in a call-off contract for the maintenance of the construction elements. From the client’s side, there is uncertainty about the future of the production site at that location, therefore, the maintenance is only reactive in response to failures. It can be described as a quick repair service. The work is obtained through a framework agreement, which is no more than a pricelist for activities and material. Heijmans is selected as service provider on price and quality, for example response time to failure, engineering skills and capacity. The contract duration is 4 years. A ticket system is used in which the customer can enter failures, these are communicated to the service desk of Heijmans. Repair tasks or rebuildings that exceed the threshold of 25,000 euro are performed in a project form with a construction contract. Key activities in this business model are reactive maintenance, engineering, planning and cost control. The resources required for this business model are service capacity to ensure quick response times, a service desk to process the ticket stream and engineering skills to prepare small projects. The service capacity is to a large extent outsourced to subcontractors. Heijmans uses a network of service suppliers who are specialized in a certain task. Revenues in this case can be described as transactional. Pricing is based on cost plus percentage fee, which means Heijmans asks a surcharge on man-hours, equipment and material. For small projects, a construction contract is formulated to agree on a fixed price for the complete work. Finally, costs in this model are made for the fixed team of Heijmans employees and the service desk; variable costs are material, equipment, subcontractors and man-hours.

3.3.3 Case III Frederik Barracks

For the ministry of Defense, Heijmans is contracted for the design, realization and maintenance of the Frederik Barracks in The Hague. The total value of the contract is 28 million euro. Burgers Ergon is responsible for the mechanical and electrical installations and Bestcon for the prefab concrete elements. Realization started in 2011 and commissioning is planned for July 2012.

| Data collection: |
| Documents: Demand specification, award criteria, tender plan |
| Interview 1: Tender manager construction |
| Interview 2: Tender manager services |

Table 3.4 Sources of data case III

Project business model

The Ministry of Defense is represented by the Government Building Agency, the principal in this project. This client has a high maturity level with regard to advanced service offerings. They restricted their own role to the specification of the output they demand. The whole building process is outsourced to a single contractor including the design and maintenance. Capabilities with regard to maintenance will be low, since the client has planned not to have own technical staff. The value proposition in this case is the design, realization and 30
years maintenance of the barracks including both construction and technical installations. The project has to be
 delivered within time and for a fixed price. During the maintenance period, Heijmans delivers guaranteed
 availability of the building which makes maintenance a fixed cost for the client. The channel that is used by the
 client to obtain this value is a European restricted tender. The client formulated an output specification and
 selected five contractors out of 13 subscriptions to make a preliminary design, a maintenance plan and to
calculate the price. Awarding of the contract is based on MEAT criteria, 60% on price and 40% on quality. The
project results in a long term relationship (30 years) with the client. Before the awarding of the contract there
is a formalized relationship during which contact between the client and the contractor is legally restricted to
question rounds. Key resources needed for this project are a network of partners, production capacity and
equipment, knowledge about customer’s processes and service employees like a handyman. Because in this
type of DBM project, the contractor has to make a design based on an output specification, knowledge about
the customer’s processes is needed to find out what the client demands. With the design responsibility at the
contractor, Heijmans had to manage the design of a system with many subsystems and many different parties
contributing to the design. Heijmans used a method called system engineering to manage this process. Other
activities are lifecycle costing and design for maintenance. During the design phase Heijmans optimized the
lifecycle costs by making design choices that reduced the maintenance costs. During the maintenance phase,
Heijmans will apply FMECA to find an optimal balance between preventive and reactive maintenance activities.
A handyman will be placed at the customer’s site to perform most of the smaller maintenance tasks. To be able
to deliver the value proposition, Heijmans uses a range of partners. An architect and advisors were contracted
during the design phase and suppliers operated as co-makers, meaning that they not only deliver the
equipment, but also cooperate in the design. Revenues from the project are partly transactional and partly
relational. The core project delivery, the building will be sold in a transaction. The maintenance will bring in a
monthly fee. Costs for Heijmans are lifecycle costs of not only realization, but also cost of maintenance.
Therefore, the design for maintenance is an important activity. Another aspect with regard to costs are the
increased tender costs, because Heijmans had to make a preliminary design before contract awarding.

### 3.3.4 Case IV Military Museum Soesterberg

Two military musea will merge and move to a new location at the former military air base Soesterberg. For this
new to build military museum, the government initiated a tender for a Public Private Partnership that includes
the design, realization, finance, maintenance and operations of the museum over a period of 25 years, with a
total value of 107 million euro. At the time the interviews took place, the project was still in tender. The
contract will be awarded in March 2012 and commissioning is planned in September 2014.

<table>
<thead>
<tr>
<th>Data collection:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documents: Demand specification, tender plan</td>
</tr>
<tr>
<td>Interview 1: Manager design team</td>
</tr>
<tr>
<td>Interview 2: Tender manager Services</td>
</tr>
</tbody>
</table>

**Table 3.5 Sources of data case IV**

**Project business model**
The museum is represented by the Government Building Agency, who is the principal in this project. The
customer maturity with regard to advanced service offerings is high. The strategy of the client is to focus on
core competencies and outsource all other tasks. In addition, the client wants to pay only for the performance
instead of for the purchase of a building. The value proposition of the project consists of the design, realization,
finance, maintenance (hard facilities) and operations (soft facilities) of the museum over a period of 25 years.
Heijmans guarantees not only the availability of the building in a certain condition, but also guarantees a
certain service level during the exploitation. The client selected three contractors to participate in a
competitive dialogue. Based on an output specification, the contractors have to make a preliminary design. The
contract is awarded to the MEAT, with an assessment on qualitative criteria. The price is set at a fixed level, 107
million, and the contractor with the best plan wins the contract. The custom relationship can be described as
long-term, because of the 25 years O&M contract. In addition, the customer relationship is extended to the design phase, the contractor is involved from the start of the design phase. The intensity of the relationship is high, because Heijmans has to operate in the customer’s processes. Employees of the Heijmans consortium will be placed in house at the client. Key resources in this project are the capital to finance the project, knowledge of the customer’s processes, service employees, production capacity and equipment. The key activities in this project are service design, design for maintenance, procurement, production, lifecycle costing and systems engineering. To make the business model work, Heijmans needs a network of partners. During the design phase, Heijmans contracts an architect and advisors who are paid by the hour. This is different for the risk-bearing partners, like for the catering, these partners invest in the design phase to make a chance to win the contract. Some suppliers participate as co-maker in the design phase. For the required capital, the bank is another important partner. Revenues in this project will be different from the traditional construction projects. There are three revenue streams. Heijmans will be paid a monthly fee for availability of a working system as specified in the output specification. The income from the catering is the second revenue stream. The third revenue stream comes from the ticket sales, if the number of visitors exceeds the threshold of 200,000, Heijmans will receive a percentage of the sales price. During the 25 years of exploitation, Heijmans can obtain additional work in the form of rebuildings and modifications. Just as the revenue model, the cost structure is different from traditional projects. Examples are the increased cost of capital, the cost of facility management and the energy costs. The relation between realization costs and lifecycle costs is 50/50.

3.3.5 Case V Jeroen Bosch Hospital

In ‘s-Hertogenbosch, three locations of the Jeroen Bosch hospital moved into one new to build hospital. The client called for tenders in 2006, at that time, Burger Ergon was not yet part of Heijmans. The work was split up in a construction part, a mechanical installations part and an electrical installations part. Burgers Ergon was selected for the mechanical installations part. The contract for realization represented a value of 52 million euro, on top of that will the 10 years maintenance contract bring in a fixed revenue per year. The commissioning of the building took place in April 2011.

<table>
<thead>
<tr>
<th>Data collection:</th>
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<tbody>
<tr>
<td>Service contract</td>
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<tr>
<td>Interview 1 Contract manager</td>
</tr>
<tr>
<td>Interview 2 Tender manager</td>
</tr>
</tbody>
</table>

Table 3.6 Sources of data case V

Project business model

The Jeroen Bosch Hospital is part of the customer segment Healthcare. The client can be described as medium mature. Maintenance is completely outsourced, but they wanted to retain the control over the design and the construction process and involved Heijmans in the final design phase after the statement of work (SOW) was finished. The value proposition of the project was the realization of the mechanical installations and 10 years performance based maintenance. Heijmans non-residential building guarantees the availability of the system, which means maintenance becomes a fixed cost for the client. The client made use of a European restricted tender to find a contractor for the work. The contract was awarded to the contractor with the lowest price for realization and maintenance according to the statement of work. The relationship with the customer started after the final design phase with the realization phase and will continue for 10 years in a maintenance contract. The key resources needed for the delivery of the project that are mentioned in the interviews are a service department (called S&O) with a contract manager and service employees at the customer site, knowhow on service contracts, a remote monitoring system to deliver monthly reports of performance and human resources. Besides the traditional activities like cost calculation, procurement and production, new activities are found in this project. Heijmans non-residential building applied a FMECA analysis (Failure Mode, Effects and Criticality Analysis) as experiment to implement risk driven maintenance. The key partnerships for the maintenance period are the service suppliers. Heijmans makes use of 20 to 30 subcontracted suppliers. These
suppliers not only deliver the equipment, but also maintain it. Also, because of capacity constraints Heijmans started a general partnership with a direct competitor to divide the work. Revenues from the project are generated in the transactional sales of the project delivery and the relational maintenance revenues. The relational revenue generation consists of monthly payments which are not related to performance. If Heijmans does not deliver the specified performance, the contract can be discontinued by the principal. There is a bonus/malus system on mean time to solve a failure. Other revenues are generated in additional work. Transactional revenues come from small rebuildings and modifications. Costs for the provider are the standard costs of realization, but also a small part of the building’s lifecycle costs because of the 10 years maintenance.

3.3.6 Case VI COA
The service building department of Heijmans provides maintenance services at the locations of COA (Central Agency for the Reception of Asylum Seekers) throughout the Netherlands. For this public organization, Heijmans maintains the construction elements in a call-off contract.

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<th>Data collection:</th>
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<tbody>
<tr>
<td>Service contract</td>
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<tr>
<td>Interview 1 Service manager</td>
</tr>
</tbody>
</table>

Table 3.7 Sources of data case VI

**Project business model**
The COA is a government organization with own technical staff. With regard to service offerings, the organization has a low maturity level, because they want to control their maintenance activities with own facility managers. The preventive multiannual maintenance planning is made by the client’s facility managers. The value proposition in this case can be described as a quick repair service for failures in construction elements of one third of the COA accommodations in the Netherlands. Besides this type of reactive maintenance, Heijmans also performs tasks based on the MAMP of the client. The third element of the value proposition are the small (rebuilding) projects. Projects under a certain threshold are part of the call-off contract. The value proposition is formulated in sla’s in the contract. The channel used by the customer to select a contractor was a tender based on MEAT criteria. The client specified a list of activities and list of sla’s. Subscribing contractors had to price these activities and had to write a plan on how the service organization will achieve the sla’s. An example of pricing an activity is a square meter of paintwork. Performance indicators that were part of the sla’s were for example response time to failure. After Heijmans obtained the contract, a relationship with the customer is established. The duration of the relation was set at a maximum of 4 years or when the budget was reached. The second option was the case after two years and early 2012 a new tender was initiated. Heijmans has its own service desk to communicate with the customer. Because of the size of the contract, the relationship with the customer takes place at three levels: operational, tactical and strategic level. The different levels require different type of service employees like contract managers and service managers.

Other key resources in this case are a network of partners for specialized activities, Heijmans own service capacity and the service desk. The key activities identified in this case are the acquisition of work, the processing of maintenance tasks, reactive and preventive maintenance, and small (rebuilding) projects. The acquisition of work requires Heijmans has to subscribe for tenders to obtain work. The knowledge about the customer that is gathered during the maintenance contract is used for tenders of large projects or new maintenance contracts at the same customer. For specialized maintenance activities, key partnerships are established with national service suppliers. Examples are roofing, glazing and swaging. There are two types of partners, for some activities national service suppliers are used and for other activities local suppliers are contracted. Revenues are generated through a cost plus percentage fee construction. Heijmans receives a surcharge on man-hours, equipment and material. For small (rebuilding) projects, the same prices are used in a construction contract. The costs identified in this case are the cost of man-hours, material, equipment and subcontractors.
3.3.7 Case VII Municipal Office Rotterdam
At the moment the interviews for this case were taken, the project was still in tender. However, at the moment of writing, Heijmans has won the contract worth of 95 million euro. The realization is planned to start early 2013 and commissioning is planned in October 2014. The contract involves the final design phase, the realization and 15 years maintenance of the new to build municipal office of Rotterdam. Part of the project is the development and exploitation of 92 apartments.

<table>
<thead>
<tr>
<th>Data collection:</th>
</tr>
</thead>
<tbody>
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<td>Demand specification</td>
</tr>
<tr>
<td>Interview 1 Tender manager</td>
</tr>
<tr>
<td>Interview 2 Tender manager</td>
</tr>
</tbody>
</table>

Table 3.8 Sources of data case VII

Project business model
The client in this case is a local government, the municipality Rotterdam. Demanded by the client is the realization of a new to build municipal office together with the final design and 15 years maintenance. Heijmans is involved in the project after the preliminary design phase, this indicates that the principal is assigning more responsibilities to the contractor. However, because the client keeps control over the early design phase, the customer maturity with regard to advanced service offerings is described as medium. The value proposition in this case is besides the realization of the building within time and for a fixed price, also the availability of the building and a guaranteed performance. The channel through which the client selected the contractor is a European restricted tender, with both qualitative and quantitative selection criteria. Based on a preliminary design, potential contractors had to give a price for realization and for maintenance. In addition, the contractors had to present a plan that shows how the work will be realized and maintained. The customer relationship starts with the final design phase, continues in the realization phase and in the 15 years maintenance contract. Therefore, the case covers all three project lifecycle phases. Key resources identified in this case are at the first place the combination of different disciplines such as real estate and housing, civil engineering and the services department. Second, the knowledge from use-phase, because Heijmans has experience with realization and maintenance, is a valuable resource in the design phase and an advantage that Heijmans has over advisors. Activities identified in this case are the traditional contractor’s activities: cost calculations, project management, risk estimation and realization. However, a new activity is the design for maintenance. Although already many decisions have been made in the preliminary design, Heijmans is able to reduce lifecycle costs in the final design. The choice of material has influence on the maintenance costs for Heijmans. Therefore, design for maintenance becomes a key activity. Partners in the project are the architect and the advisors. They had a special role, in the preliminary design phase, these companies are contracted by the principal, while in the final design, Heijmans has the design responsibility and has to take over the contract with the same architect and advisors. Some suppliers act as co-makers, by taking part in the tender these partners improve the offering and thus increase the chances for Heijmans to win the contract. Revenues from the project are partly transactional, from the sales of the project delivery, and partly relational from the maintenance contract. Additional work during the realization and small rebuilding projects during the maintenance phase can increase the revenues. Costs of the project are the traditional production costs. However, the DBM contract enables Heijmans to reduce costs by optimizing lifecycle costs in the design phase and by shortening realization time. Other costs can occur in case of delays, in the form of penalties.

3.3.8 Case VIII Eindhoven Airport
The last case is a project that is obtained in November 2011. The contract covers the realization of an extension of the terminal and the realization of a hotel with 120 rooms. Heijmans is responsible for the construction elements with a value of 12 million euro. The work is obtained in a direct agreement after a successful previous project with the same customer in 2005.
Data collection: 
Interview 1 Director Production

Table 3.9 Sources of data case VIII

Project business model
The client is part of the customer segment commercial building. Eindhoven Airport is a plc owned for 49% by the local governments of Eindhoven and the province North Brabant and for 51% by Schiphol Airport, which is owned by the Dutch state and the municipalities of Amsterdam and Rotterdam. The client is a small organization and hired a construction management bureau to organize the construction project. Maintenance is managed by the client’s facility manager who contracts local service suppliers on ad-hoc basis. Therefore, the client’s attitude with regard to advanced service offerings is characterized by a low customer maturity. The client asked Heijmans to participate in a building team starting with from preliminary design. The value proposition can be described as the realization of construction elements; the cooperation with the architect and advisors in the final design phase; timely project delivery; for realization costs within budget. The channel used by the client to obtain the prescribed value is through a direct agreement with Heijmans. The demand is specified in a preliminary design and a budget. The informal relationship with the customer was important in the acquisition of the project. Heijmans had a relationship with the client since a previous successful project. The contractual relationship has a duration of just two years for the design and realization. After the realization, maintenance activities can occur on request. Key resources specific for this case are the customer relationship, through which the project is acquired and the experience with the previous project at the same client. Key activities identified in this case are the traditional contractor’s activities: cost calculations, planning, risk estimation, procurement and production. New is the participation in a building team, thus advising the design team. Key partnerships are the members of the building team: the architect, the advisors, the installation contractors and the construction management bureau. These members of the building team are contracted by the principal and have no direct relationship with Heijmans. Revenues are generated through transactional sales of the project delivery. Heijmans profits from an efficient realization, procurement and a reduced lead time. Costs are identified for the participation in the building team, like work planning and cost calculations. During the realization, Heijmans has the cost of interim interest, caused by the difference in time between expenses and income. Other potential costs are the penalty costs in case of delays, because the terminal and hotel should be opened before the charter season.
<table>
<thead>
<tr>
<th></th>
<th>Business model 1: Transactional Project Delivery</th>
<th>Business model 2: Project-led Solution</th>
<th>Business model 3: Lifecycle Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customer Segment</strong></td>
<td>Clients who want ownership [case: 1,2,3,5,6,7,8];</td>
<td>Clients who want the ownership of the product [case: 1,2,3,5,6,7,8];</td>
<td>Prefer to have no assets on balance sheet [case: 4];</td>
</tr>
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<td></td>
<td>Independence of the supplier [case: 1,2,6,8]</td>
<td>Shared expertise with provider [case: 5,7];</td>
<td>Client relies on the supplier’s expertise [case: 3,4];</td>
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<td></td>
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<td>Medium capabilities [case: 2,5,7];</td>
<td>Low capabilities [case: 3,4,6];</td>
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<td>High financial resources [case: 2,3,4,];</td>
<td>Low financial resources [case: 1,5,6];</td>
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<tr>
<td><strong>Value Proposition</strong></td>
<td>Assistance and spare-parts on request, to ensure proper functionality of the system [case: 1,2,6,8];</td>
<td>Prevention of failures and guaranteed equipment availability [case: 3,5,7];</td>
<td>Functional result of an integrated product and service offering, customers obtain use of, or access to a product [case: 4];</td>
</tr>
<tr>
<td></td>
<td>Improved utilization and effectiveness of the product in customer’s processes [case - ];</td>
<td>Reducing customer’s operating risks and expenses, fixed operating costs [case: 3,5,7];</td>
<td>Reduced need for capital [case: 4];</td>
</tr>
<tr>
<td></td>
<td>Optimizing customers’ processes [case: - ];</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Channels</strong></td>
<td>New distribution channel [case: - ];</td>
<td>Sales channel at higher management level [case: - ];</td>
<td>Sales of lease contracts easier to manage than sales of complex products [case: - ];</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pull PSS adoption by sales department and clarify customers about PSS usage [case: - ];</td>
</tr>
<tr>
<td><strong>Customer Relationships</strong></td>
<td>Transactional based [case: 1,2,6,8];</td>
<td>Enables long term customer relations [case: 3,4,5,7];</td>
<td>Enables long term customer relations [case: 3,4,5,7];</td>
</tr>
<tr>
<td></td>
<td>New network and different contacts in end-user organization [case: - ];</td>
<td>More intimate customer relationship: customer intimacy, trust and cooperation [case: 3,4,5,7 ];</td>
<td>Strong interactive relationship [case: 4];</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Shared revenues, co-development [case: 4];</td>
</tr>
<tr>
<td><strong>Revenue Model</strong></td>
<td>Transactional sale of project delivery, transactional services on request [case: 1,2,6,8];</td>
<td>Transactional sales price plus relational service income [case: 3,5,7];</td>
<td>Sharing or usage by different users leading to lower capital need [case: - ];</td>
</tr>
<tr>
<td></td>
<td>Pricing on equipment availability Pay for performance [case: 4,5,7];</td>
<td>Gain sharing, performance based contracts [case: 4];</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accepting operational risk worth a premium [case: 4];</td>
<td></td>
<td>Pay-per-usage [case: 4];</td>
</tr>
<tr>
<td><strong>Key Resources</strong></td>
<td>Technology, machinery, employees [case: 1,2,3,4,5,6,7,8];</td>
<td>Product reliability and quality [case: 3,4,5,7];</td>
<td>Tangible products/equipment [case: 1,2,3,4,5,6,7,8];</td>
</tr>
<tr>
<td></td>
<td>Independent service organization [case: 1,2,3,4,5,6,7,8];</td>
<td>Knowledge of customers’ business processes [case: 3,4,5,7];</td>
<td>Knowledge of customers’ business processes [case: 3,4,5,7];</td>
</tr>
</tbody>
</table>
With the data extracted from the cases it is now possible to test the framework in practice. In Table 3.10, the scoring of the cases on the conceptual framework is displayed. Based on the data extraction table (Appendix I) and the case descriptions of paragraph 3.3, the characteristics of the cases are compared with the business model characteristics as derived from the literature study. If the case contains a similarity with the characteristic of one of the three business model types, then the case number is written behind the characteristic and the case receives 1 point for that category. At the end of the scoring list, the total scores for each case are showed per business model category. If a case scores high on one of the three categories, then it is clear that according to the conceptual framework the case belongs to that category. However, it can be seen that many cases have their scores distributed over the three categories. In the total score per category, the highest score of each case is underlined. Based on the distribution of scores, the cases are positioned on the continuum as displayed in Figure 3.3. Cases 1, 2, 6 and 8 have a high score in the first category and low scores in the other categories and therefore place on the left side of the first stage on the continuum. Cases 3, 5 and 7 have their highest scores in category 2, but have relatively high scores in the other categories as well. Depending on which side these cases score higher, category 1 or 3, the cases are positioned left or right outside the middle. Case 4 has its highest score in business model type 3, however, also a relatively high score in type 2 and a lower score for type 1. Therefore, this case is positioned on the left side in category 3.

The fact that many of the cases have scores in multiple categories indicates that the data poorly fits the framework. To measure the goodness of fit of the framework, the scores of each case within their business model category is subtracted by the scores in the two other categories and then divided by the scores within

<table>
<thead>
<tr>
<th>Key Activities</th>
<th>Professional service (consultancy) infrastructure [case: - ];</th>
<th>Assessing failure risks [case: 3,4,5,7];</th>
<th>Financial resources [case: 4];</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Product and process development [case: - ];</td>
<td>Maintaining own equipment [case: 3,4,5,7];</td>
<td>Financial services [case: 4];</td>
</tr>
<tr>
<td></td>
<td>Business consulting [case: - ];</td>
<td>Service development [case: 4];</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Service development [case: 4];</td>
<td>Lifecycle costing [case: 3,4];</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Design for function [case: 3,4];</td>
</tr>
<tr>
<td>Key Partnerships</td>
<td>Outsourcing of non-core business services [case: 1,2,3,4,5,6,7,8];</td>
<td>Intense information exchange, cooperative norms, legal bonds, and strong operational linkages with service suppliers [case: 3,7];</td>
<td>Insource service provision [case: - ];</td>
</tr>
<tr>
<td></td>
<td>Arm’s length service supplier relationships, low operational linkages, basic information exchange [case: 1,2,5,6,7,8];</td>
<td>Strategic integration between partners [case: 1,4,5];</td>
<td></td>
</tr>
<tr>
<td>Cost Structure</td>
<td>Production costs [case: 1,3,4,5,7,8];</td>
<td>More efficient use of the product [case: 3,4];</td>
<td>Uncertainty about system costs, need for lifecycle costs [case: 3,4,5,7];</td>
</tr>
<tr>
<td></td>
<td>Additional material and human resource costs for service [case: 2,3,4,5,6];</td>
<td>Higher utilization of service capacity which reduces costs [case: 3,4,5,6];</td>
<td>Increased cost of capital [case: 4];</td>
</tr>
<tr>
<td>Total</td>
<td>1=12 2=11 3=6 4=6</td>
<td>1=1 2=3 3=14 4=12</td>
<td>1=3 2=1 3=9 4=20</td>
</tr>
<tr>
<td></td>
<td>5=7 6=11 7=6 8=12</td>
<td>5=14 7=15 8=1</td>
<td>5=6 6=2 7=4 8=1</td>
</tr>
</tbody>
</table>

Goodness of fit = \[ \frac{\text{Scores in line} - \text{Scores out of line}}{\text{Scores in line}} = \frac{109 - 69}{109} = 0.37 \]

Table 3.10 Positioning of the cases 1.0

3.4 Positioning of the Cases 1.0
their own category. This results in a number between 1 and -1, where 1 stands for the maximum amount of fit. The conceptual framework has a score of 0,37. This can have two reasons. The variables of the business model elements in the conceptual framework don’t cover the effects of servitization on the project business models, or the cases don’t have their business model elements aligned within a certain category. The first reason can be solved by modifying the framework with variables identified in the cross-case analysis in the next chapter. The second reason requires managerial actions to modify project business models in order to better align the business model elements.

**Product-Service Continuum:**

**Positioning 1.0**

![Product-Service Continuum Diagram](image)

**Figure 3.3 Cases on product-service continuum**

### 3.5 Conclusion

The within-case analysis studied eight cases of which six construction projects and two maintenance contracts. These cases are positioned on the conceptual framework as presented in figure 3.3. It can be concluded that there is not one single position of Heijmans on the continuum. Instead, the firm holds several positions at the same time. The projects are distributed over three categories of project business models as described in literature (Kujala et al., 2011). It was found that four cases have business models that are part of the transactional project delivery, three cases have project-led solution business models and one case is characterized by a lifecycle solution business model. However, the distribution of scores in multiple categories indicated that the conceptual framework poorly fits the data. Some variables from the servitization literature were not found in the case study data and the data contained elements that were not described in the servitization literature. To improve the goodness of fit, the variables in the framework needs modification. This will be one of the topics in the next chapter.
4 Cross-Case Analysis

4.1 Introduction
This chapter will analyze the differences between the three types of project business models per business model element based on a cross-case comparison of the eight cases. Moreover, the characteristics of the different project types are compared with the characteristics as described in the theoretical framework. Potential differences lead to corrections or additions to the conceptual framework. This chapter will be concluded with the design of the final framework that provides the answer to the third research question:

RQ3: What are the implications of servitization for project business models?

4.2 Methodology

4.2.1 Unit of analysis
Besides receiving in-depth understanding of characteristics of the current business models at Heijmans, the single embedded case study method is also useful for identifying patterns of similarities or differences across categories of projects. Embedded unit analysis is preferred to enable control over external effects that influence the characteristics of the business models. As mentioned earlier, case studies of the embedded type are characterized by multiple levels of analysis in order to find consistent patterns of evidence across units, but within a case (figure 3.1). The main unit of analysis is the non-residential building division of Heijmans. Within this single case, the embedded subunits of analysis are the construction projects. Context variability of the analysis is minimized because multiple subunits are selected within a single company.

4.2.2 Data analysis
The case findings will be used to adapt the conceptual framework to the practice at Heijmans non-residential building. Comparing the current position with the complete range from the literature review will provide opportunities for Heijmans to change certain elements of the business model. The cross-case analysis compares the different cases on the business model elements to find the implications of servitization for a firm’s business model. The analysis will result in a modified framework consisting of a set of variables per business model element with values per project type. Four different actions are possible with the identified variables. The first option is that the variable is described in literature and identified to be relevant in the case study. This type of variable was already part of the conceptual framework and maintained in the final framework. The second and third options are variables that are identified in literature, but not confirmed by case study evidence. This can mean that the variable is not relevant for describing servitization of project business (option 2) and will thus be removed from the framework. Or, the variable is valuable for describing servitization of project business but not part of Heijmans’ current practice (option 3). This third type of variable will result in managerial implications. The fourth option is a variable that is not identified in the servitization literature, but identified in the case study. This last group of variables is added to the final framework and will form the contribution to theory.

Table 4.1 Data analysis: cross-case analysis

<table>
<thead>
<tr>
<th>Position in the framework</th>
<th>Within group similarities</th>
<th>Comparison with literature</th>
<th>Modified framework</th>
</tr>
</thead>
</table>

Figure 4.1 Data analysis: cross-case analysis
4.3 Results
In this paragraph, the results of the cross-case analysis will be discussed. Per business model element, the patterns of change that are found to occur across the cases are compared with the conceptual framework of the literature review. Similarities and differences among the cases on certain variables are used to identify patterns. Each subsection will end with the contribution to the framework for the specific business model element. The variables are presented in the form of a table with different colors for the four different options as described in subsection 4.2.2. Variables that are identified in literature and confirmed by case study evidence are shown as regular text. Variables that are identified in the case study but not found in literature are underlined and given a yellow color. Variables that turned out to be irrelevant in relation to servitization of project business are struck through. Finally, the variables that were found in servitization literature, but not found in the case study and are potentially interesting to implement at the case study’s company are given a green color and marked with brackets.

4.3.1 Customer segment
In this first subsection, the focus will be on the implications of servitization for the first business model element customer segment. It should be noted that the term customer segment is not the same as the general market segments as defined by Heijmans. From the literature review, it is found that in the context of servitization, customers can be segmented based on customer maturity level, which was defined in this study as the willingness of a customer towards more advanced service offerings. The following variables are identified that determine a customer maturity level: sourcing strategy, perceived complexity, capabilities and financial resources. These variables will be used to compare the different project business models.

Sourcing strategy
In the cases with the transactional project delivery business model (cases: COA, MSD Organon, Meander MC, and Eindhoven Airport), the customers have the same sourcing strategy. These customers want the ownership of the facilities and want to have direct control over activities in the pre-project and post-project phase. In the design phase, the client directly contracts the architect and advisors. As much activities as possible are performed with own employees and for work that cannot be performed in-house, service is demanded on request. This makes the customer not completely independent from the supplier; therefore the sourcing strategy of this type of customers is described as shared expertise with the supplier (Helander & Möller, 2007). In the project-led solution cases it is found that customers outsource their maintenance activities to the supplier (cases: Jeroen Bosch Hospital, Frederik Barracks, Municipal Office Rotterdam). This sourcing strategy is described by Helander and Möller (2007) as a reliance on the supplier’s expertise strategy. However, the customers in these cases have different roles in the pre-project phase. In the cases Jeroen Bosch Hospital and Municipal Office Rotterdam, both clients have direct control over the architect and advisors. The client in the case Frederik Barracks, starts to outsource the complete project with an abstract demand specification before starting the design. This difference in the pre-project phase is represented in the different names for the project types: Design-Build-Maintain, Engineer-Build-Maintain and Build-Maintain. The sourcing strategy of the customers in the lifecycle solution business model is reliance on the supplier. The museum is completely focusing on their core competencies and outsources all activities related to the exploitation. This client is not interested in the ownership of the building, but in the performance of the building in its own processes. They prescribe the output of the building they need and leave the question “how” to achieve this output to the provider. Outsourcing of all the tasks around the project to the contractor requires trust. The customer becomes dependent of the provider, which was already part of the conceptual framework. In addition, it is found that the clients have different expectations with regard to control and influence in the design phase. In the case Meander MC, the client wanted to decide on details during the design phase while in the case Frederik Barracks, the client only formulates an abstract demand specification and let the contractors manage the design. This variable is added to the framework as control over design.
**Perceived complexity**

The idea behind this variable is that customers with low capabilities using highly complex technology were expected to be more willing to demand project-led or lifecycle solutions. Within the cases, there is a difference in complexity between technical installations and construction. For technical installations, which are more complex to maintain, customers demand more services than for low complex construction elements. However, another factor plays a role, technical installations are not only more complex, but also require more maintenance and a failure results immediately in less comfort. Therefore, perceived complexity is positively related with customer demand for advanced service offerings. Complexity can also work the other way around. Both technical and operational complexity in a hospital project is higher than complexity of a museum project. One of the respondents argued that the large number of stakeholders in hospital projects makes lifecycle solutions less appropriate, because the contractor would be incapable to manage the design phase.

**Customer’s capabilities**

With capabilities, the presence and skill level of the existing organization is meant. Capabilities are a logic result of the customer’s sourcing strategy. Clients in the transactional project delivery have their own technical staff and facility managers (MSD Organon, COA, Meander MC). In the project-led solution, the client has no own technical staff. In these cases, technical personnel from Heijmans are permanently placed at the customer’s site. For the operational activities, these customers have facility managers for their accommodations (Jeroen Bosch Hospital, Frederik Barracks, Municipal Office Rotterdam). In the lifecycle solution, the Military Museum Soesterberg, the customer needs only capabilities with regard to its core business, the museum management. Thus, servitization reduces the need for non-core business capabilities.

**Financial resources**

From the literature review it is expected that customers with low financial resources are more interested in advanced service offerings. However, this is not supported with the case study. In the case Meander MC, a transactional project delivery, the customer had to reduce budget for the project during the design phase and thus low financial resources. In the Military Museum Soesterberg, the customer also had to reduce costs, and chose for the lifecycle solution business model. The difference could be caused by their financial planning horizon. The traditional maintenance contracts, cases MSD Organon and COA, both had a short planning horizon. Traditional project delivery results in short term cost reductions, while project-led solutions result in long term cost reductions. Another point of interest is the access to financial resources. It was found that although hospitals have difficulties in financing their projects, these projects were not financed by the contractor. In contrast, the Government Building Agency has sufficient access to financial resources (the public treasury), while this customer demanded the contractor to finance the project. There is no relation found between access to financial resources and their choice for advanced service business models.

**Customer maturity**

It is notable that the most mature customers are found in the projects of the Government Building Agency. The customer of the cases military museum Soesterberg and the Frederik Barracks is the same, the Government Building Agency. However, the cases hold a different position on the continuum indicating that customer maturity level is not the only determinant for a project’s business model. Some projects are better suited for lifecycle solutions than other. From observations and additional research on contract types, it was found that the size of the project determines the possibilities for a lifecycle solution business model. Procedures for lifecycle solutions are complex and expensive and only pay-off in large scale projects.
Customer segments

<table>
<thead>
<tr>
<th>Business model 1: Transactional Project Delivery</th>
<th>Business model 2: Project-led Solution</th>
<th>Business model 3: Lifecycle Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sourcing strategy</strong></td>
<td>Shared expertise;</td>
<td>Reliance on supplier;</td>
</tr>
<tr>
<td><strong>Control over design</strong></td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Perceived technical complexity</strong></td>
<td>Low technical complexity</td>
<td>High technical complexity</td>
</tr>
<tr>
<td><strong>Organizational complexity</strong></td>
<td>High organizational complexity</td>
<td>Low organizational complexity</td>
</tr>
<tr>
<td><strong>Customer’s capabilities</strong></td>
<td>High capabilities; own technical staff;</td>
<td>Medium capabilities; no technical</td>
</tr>
<tr>
<td>own facility managers.</td>
<td></td>
<td>staff; own facility managers.</td>
</tr>
<tr>
<td><strong>Access to financial resources</strong></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Financial planning horizon</strong></td>
<td>Short term planning</td>
<td>Long term planning</td>
</tr>
<tr>
<td><strong>Customer maturity</strong></td>
<td>Low maturity</td>
<td>Medium maturity</td>
</tr>
</tbody>
</table>

Table 4.1 Customer segments

4.3.2 Value proposition

Also for the second business model element, the ‘value proposition’, the differences between the cases will be compared to find consequences of servitization for this element. To describe differences in value proposition, a classification in horizontal and vertical integration is used as is displayed in figure 4.2.

**Horizontal integration: Installations E/W, construction**

Horizontally, the physical goods from the value proposition range from electrical installations, mechanical installations to construction elements (see figure 4.2). Some projects are divided in separate parts for electrical installations, mechanical installations and construction elements (Eindhoven Airport, Jeroen Bosch Hospital, MSD Organon and the COA). Other projects have integrated these different elements in one contract (Meander MC, Municipal Office Rotterdam, Military Museum Soesterberg and the Frederik Barracks). In the transactional project delivery, the work is disintegrated in different elements with one exception: the Meander MC. In the project led solutions, both integrated (Jeroen Bosch Hospital, Municipal Office Rotterdam) as well as separated work (Jeroen Bosch Hospital) is found. In the lifecycle solution, the project is horizontally integrated. Therefore, it can be stated that horizontal integration is not related to servitization and is seen as a separate trend from
the recent years. For the conceptual framework, this means that in the core project delivery there is no pattern of servitization found and is therefore removed.

**Vertical integration: Design, Realization, Finance, Maintain, Operate**

Vertically, a distinction can be made between the different lifecycle phases that are covered by the value proposition. The value propositions in the Eindhoven Airport project and the Meander MC project focus on the core project delivery phase, plus advice during the final design. Pre-project and post-project activities are not part of the contract. In the cases Frederik Barracks and the Military Museum Soesterberg, the value proposition is aimed at all the phases of the project’s life cycle to optimize the value in the use-phase of the building. The Frederik Barracks project included design and maintenance services, while the Military Museum Soesterberg also included the operations of the building.

**Design**

In the pre-project phase, the value proposition is varying among the cases. In the first group of cases (Jeroen Bosch Hospital, COA, MSD Organon), Heijmans has no pre-project value proposition. In the second group of cases (Eindhoven Airport, Meander MC) Heijmans is involved in the design phase to provide advice. In the third group of cases (Frederik Barracks, Municipal Office Rotterdam, Military Museum Soesterberg), Heijmans offers the design in the pre-project phase. Design service is seen as a professional service, which is part of the transactional project delivery in the conceptual framework. However, the design service in the cases was found in the project-led solution and lifecycle solutions. Therefore, the professional services have to be removed from the conceptual framework and design should be added to the second and third project business models.

**Maintenance**

Maintenance services are called hard facility management. Clients have different options to maintain their property and sometimes they have their own technical staff. There are three types of maintenance: reactive maintenance, preventive maintenance and performance based maintenance.

- **Reactive maintenance**: in case of failure of one of the building’s elements a client calls a technical service provider to solve the problem. Clients form call-off contracts with service contractors to agree on a fixed percentage fee on top of labor and material costs for a period of time. Examples of these call-off contracts are the MSD Organon service contract and the COA service contract.

- **Preventive maintenance**: to keep a client’s property at a certain quality level, the service contractor can offer a multiannual maintenance plan (MAMP). The contractor performs an analysis of the current state of the building and makes a planning of all the activities necessary in the future to bring the building to another state or to keep the building at its current state. This type of planning provides the client a better insight in expected costs.

- **Performance based maintenance**: in both the reactive maintenance and the preventive maintenance contracts, the client is responsible for the quality of his building. This is different with performance based contracting. With performance based maintenance contracts, the client prescribes a quality level according to the NEN 2676 (condition measurement) and the contractor takes over the responsibility to keep the building at this level for a fixed price during a period of time. Examples from the case study are the Jeroen Bosch Hospital, the Frederik Barracks and the Military Museum Soesterberg.

**Operations**

The operations of a building are called soft facility management. This was the case at the Military Museum Soesterberg. Soft facility services are all services that are not directly related to the product, examples are cleaning, security, catering, energy and ICT. These are activities that used to be performed by the client, but can be outsourced if suppliers perform the same tasks more cost efficient. Providers who offer operational services take over customer processes. In the case of the Military Museum, the operational services directly affect the customer’s core processes. The catering services for example, are directly offered to the end-
customer. The service personnel of the provider is in contact with the end-user. In contrast with the conceptual framework, operational services are not found in cases with a project-led solution business model.

**Ownership**

In all of the cases, the ownership of the physical product is transferred to the customer. Even in the case of Military Museum Soesterberg, where the provider finances and operates the complete building, the client obtains the ownership. Only elements of a building can be retained by the provider, in the case of the Municipal Office Rotterdam, Heijmans offered to retain ownership of the ground source heat pump (GSHP) and lease it to the client. In one of the interviews it was explained that it is a strategic choice of Heijmans not to retain the ownership of the realized buildings. If clients don’t want their real estate assets on their balance sheet, for example offices or industrial plants, then Heijmans cooperates with investors who can lease the real estate to the client. In contrast with PSS and integrated solutions literature, ownerless consumption was not found in any of the cases. Moreover, since there is no leasing/rental offering found, the use-oriented PSS from the conceptual framework is marked as new to the company.

<table>
<thead>
<tr>
<th>Value Proposition</th>
<th>Business model 1: Transactional Project Delivery</th>
<th>Business model 2: Project-led Solution</th>
<th>Business model 3: Lifecycle Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-project phase</td>
<td>Advice</td>
<td>Design</td>
<td></td>
</tr>
<tr>
<td>Project delivery</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>phase</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-project phase</td>
<td>Quick repair service on request; (optimizing</td>
<td>Guaranteed performance; prevention</td>
<td>Availability of a functioning building; reduced need for capital; (customer obtains use of, or access to the product)</td>
</tr>
<tr>
<td></td>
<td>customer’s processes)</td>
<td>of failures; reducing customer’s</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>operating risks; (optimizing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>customer’s processes)</td>
<td></td>
</tr>
<tr>
<td>Ownership</td>
<td>Customer obtains ownership</td>
<td>Customer obtains ownership</td>
<td>(Provider retains ownership)</td>
</tr>
</tbody>
</table>

Table 4.2 Value proposition

### 4.3.3 Channels

This subsection will analyze the within-case analysis findings for the business model element channels. In the literature review it was found that channels can be sales-, communication- and distribution channels. In the construction industry and project business, work is obtained through methods of order acquisition. The provider has a direct channel with the customer, there are no intermediary distributors. Channels in the construction industry are controlled by the customer. The customer decides which method to use for procurement. Heijmans Non-residential building is not offering value propositions proactively. This paragraph will zoom in on the methods of order acquisition, the demand specifications and the assessment criteria.

<table>
<thead>
<tr>
<th>Order acquisition:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Public tender</td>
</tr>
<tr>
<td>- Restricted tender</td>
</tr>
<tr>
<td>- Negotiated tender</td>
</tr>
<tr>
<td>- Direct agreement</td>
</tr>
<tr>
<td>- Property development</td>
</tr>
</tbody>
</table>

Table 4.3 Methods of order acquisition

**Method of order acquisition**

Customers have different options to select a contractor for their project. For procurement methods, two types of clients exist: public clients, who are legally obliged to release tenders for works or services and non-public clients who are free to choose their procurement method. The smallest orders are repairs of failure. In service contracts, these orders are processed with an automated ticket system. For smaller projects clients invite one or two contractors to make a price. Customers that have a maintenance contract with a contractor, as was the case in 6 out of 8 cases, let the smaller projects be performed by the maintenance contractor through a direct agreement. However, if the projects become larger, then the client will choose to initiate a tender. Depending on the method of procurement, different channels are used. Public tenders, restricted tenders, competitive
dialogue tenders and negotiated tenders with announcement have to be announced on the Tenders Electronic Daily (TED) or the Dutch Tender Calendar. This channel is strictly bounded by European procurement rules. The channel for procurement through a negotiated tender, which is not allowed in most cases for public organizations (see appendix J), is basically an invitation by the client. The client invites a number of preferred providers to participate in a call for tenders.

When comparing the cases in the transactional business model with the cases in the project led solution business model and the lifecycle solution business model, there is no relationship found between the level of servitization and the method of order acquisition. Which method is used is determined by the size of the project and the type of customer.

**Demand specifications**

The studied projects and services show that the value proposition of Heijmans is not actively offered to the customers. It is the other way around. Customers take the initiative and ask for a set of products and services. This customer demand can be formulated in different ways. In the cases Jeroen Bosch Hospital, COA and MSD Organon, the customer specifies exactly what the contractor has to do, in what is called a statement of work (SOW). In other cases, the customer leaves room for the contractor to make decisions in the engineering or in the finishing of the building. The most advanced projects are specified with an output specification. This was the case at the Frederik Barracks and the Military Museum Soesterberg. The output specification is an abstract description of the output that is demanded from the project delivery. This pull back of the principal enables the contractor to deliver professional services in the design phase. Because the variable ‘Demand specification’ is important in the servitization of project business, the variable is added to the framework.

**Assessment criteria**

One finding of the case study is the fact that the assessment criteria of a tender determine the value proposition of the provider. The contractor offers always what the customer demands. The customer has a list and checks off if the offering meets his requirements. Two types of assessment criteria are found: quantitative criteria and qualitative criteria. Lowest price is a quantitative criterion and was used in two cases as the only award criterion. In the six other cases, a combination of qualitative and quantitative criteria was used called Most Economically Advantageous Tender (MEAT) criteria. Heijmans and Burgers Ergon prefer MEAT projects over lowest price projects because these projects can provide higher margins. Qualitative criteria that are found in the case study are: aesthetics, sustainability and functionality. For every project, different qualitative aspects are used. In tenders for maintenance contracts, service levels (sla’s) like response time to failure and mean time to repair are qualitative aspects. However, there is no pattern identified in the level of servitization and the assessment criteria.

<table>
<thead>
<tr>
<th>Channels</th>
<th>Business model 1: Transactional Project Delivery</th>
<th>Business model 2: Project-led Solution</th>
<th>Business model 3: Lifecycle Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method of order acquisition</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Demand specification</td>
<td>Detailed specification, SOW</td>
<td>Preliminary design</td>
<td>Abstract specification of output, OS</td>
</tr>
<tr>
<td>Assessment criteria</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 4.4 Channels

**4.3.4 Customer relationships**

In this subsection, the consequences of servitization for the business model element customer relationship will be analyzed. From the literature study it was found that ‘duration’ and ‘intensity’ are variables that can be used when describing customer relationships. In addition, it was found that in the lifecycle model, the customer and the provider have shared revenues and co-develop the solution. The following will describe the patterns that are identified among the cases.
Duration
The two transactional project deliveries, Eindhoven airport and Meander MC both have short customer relationships. If there is no maintenance contract sold after the realization, then the relationship will be ended. The two cost plus maintenance contracts, COA and MSD Organon are both intended to run for 4 years. The project-led solutions, Frederik Barracks (30 yrs.), Jeroen Bosch Hospital (10 yrs.) and the Municipal Office Rotterdam (15 yrs.) are characterized by much longer customer relationships after the realization. The lifecycle solution, Military Museum Soesterberg (25 yrs.), has also a long during customer relationship. Therefore, it can be concluded that more advanced service offerings lead to longer customer relationships.

Intensity
The relationship before the project, when the project is in tender, is a formalized procedure. The contractor can only communicate with the client through question rounds in order to spread information equally over the different subscribing contractors. After the contract is awarded to the contractor, the relationship intensifies because the contractor has to work together with the client. In performance based maintenance contracts, the relationship is managed through bonus/malus systems. If performance is below the specified conditions, the contractor receives penalties. In the most advanced service offerings, the contractor and the client have shared benefits. In the lifecycle solution, the relationship is the most intense because Heijmans invested in the project and will have the highest revenues if the customer’s processes are optimized. To describe the intensity of a customer relationship, the term ‘share of wallet’ is used (Seth et al, 2000). Closer relationships are characterized by a higher share of wallet of the customer. The share of wallet is the income of the provider as the percentage of the customer’s total expenses. Share of wallet is used by Atos Consulting (2010) as a customer-centric performance indicator.

<table>
<thead>
<tr>
<th>Customer relationships</th>
<th>Business model 1: Transactional Project Delivery</th>
<th>Business model 2: Project-led Solution</th>
<th>Business model 3: Lifecycle Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensity</td>
<td>Low intensity; transaction based.</td>
<td>Medium intensity</td>
<td>High intensity; shared revenues, co-development.</td>
</tr>
<tr>
<td>Share of wallet</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Duration</td>
<td>Short term (&lt;5yrs.)</td>
<td>Long term (5-15yrs.)</td>
<td>Long term (15+yrs.)</td>
</tr>
</tbody>
</table>

Table 4.5 Customer relationships

4.3.5 Revenue model
This subsection analyzes the business model element ‘revenue model’. It is defined as the way a company earns money from the value proposition (Osterwalder, 2004). Osterwalder and Pigneur (2009) made a distinction between transactional revenues and relational revenues. This distinction is also made in the servitization literature (Oliva & Kallenberg, 2003). The cases are compared to find patterns in revenue models that are related to servitization.

Transactional revenues
In the traditional projects, revenue is mainly made on the production of the building. This was found in the case Meander MC and in the case Eindhoven Airport. For the agreed fixed price, on basis of the SOW, the work should be realized. The focus is on reducing costs during realization to increase the profitability of the project. In many projects, the reduction of costs causes a tension between the contractor and the architect and/or the client. These traditional projects provide transactional revenues and are found in cases with a transactional project delivery business model.

The two traditional service contracts (MSD Organon and COA) both have a transactional revenue model. In these cost-plus contracts, also called cost reimbursement contracts, the provider and the client agree on a fixed percentage fee on top of the cost of material, labor or subcontracting. For every repair or modification of the system, the provider can charge the costs plus a fixed margin. With this business model, the provider profits of the problems of the customer. The more problems occur at the customer’s site, the more projects
will occur and the more profit for the provider. These two service contracts are also characterized by a transactional project delivery business model. Therefore, it can be concluded that in the transactional project delivery, the revenue model consists of transactional sales of the project delivery plus possible post-project transactional service revenues.

**Relational revenues**
In the cases with a project-led solution business model, the revenue model consists of both transactional and relational revenues. The core project delivery is sold in a transaction. The relational revenues are generated when the provider takes over the risk of failures and guarantees a certain performance level. In return, the client pays a monthly fee for a functioning system. This was the case at the performance based contract at the Jeroen Bosch Hospital, the Frederik Barracks and the Municipal Office Rotterdam, which confirms the findings in servitization literature. In the relational revenue model, the provider has the highest profits if the system causes no problems for the customer. However, the maintenance contract is not completely relational. Destruction or additional work, that falls outside the scope of the contract is paid for in transactions.

In the case Military Museum Soesterberg, revenues from the project are completely relational. The core project delivery is part of the accommodation service. The client pays a monthly fee for a functioning museum. Other revenues for Heijmans generated by the project are the revenues from the catering and revenues as a percentage of the ticket sales. Therefore, it can be concluded that in the lifecycle solution business model, the client and the provider share gains, just as proposed by Davies (2004) and Helander and Möller (2007). These shared revenues from ticket sales can also be described as a pay-per-usage revenue model. The more visitors, the more the museum is used and the more revenues for the contract.

The differences with regard to the revenue models are explained per project phase as presented in table 4.6. Revenues from pre-project services were not found in the case study and therefore removed from the framework.

<table>
<thead>
<tr>
<th>Revenue model</th>
<th>Business model 1: Transactional Project Delivery</th>
<th>Business model 2: Project-led Solution</th>
<th>Business model 3: Lifecycle Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-project phase</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Project delivery phase</td>
<td>Transactional sales revenues.</td>
<td>Transactional sales revenues.</td>
<td>Relational revenues; product as a service.</td>
</tr>
<tr>
<td>Post-project phase</td>
<td>Transactional service revenues; cost-plus pricing.</td>
<td>Relational service revenues; pay-for-performance and equipment availability.</td>
<td>Pay-for-performance; gain sharing; pay-per-usage.</td>
</tr>
</tbody>
</table>

Table 4.6 Revenue model

### 4.3.6 Key resources
In order to offer a value proposition, a company needs resources. According to Osterwalder and Pigneur (2009), resources can be tangible (production assets), human, financial or intellectual property. Key resources can be owned by the company, or obtained from key partners. From the servitization literature, it was found that service oriented business models require knowledge and skills as key resources while product-oriented business models make use of physical resources. Moreover, implementation of product-service systems increases the need for financial capital as a key resource. The following will describe the variables that are identified in the case study.

**Human resources**
Interviewees stated that the new type of service contracts demand a new type of employee, one that is able to translate abstract customer needs into a design of a technical system. The new performance based contracts require interaction with the client at strategic levels in the client’s organization. Therefore, employees should be higher educated to communicate with higher educated customers.
**Knowledge and skills**

In traditional construction projects, the role of Heijmans was to produce what was specified by the customer. Key resources were human resources, knowledge and skills and equipment to produce buildings efficiently, at high quality and at low cost. Clients make use of the contractor’s knowledge by involving the provider earlier in the process. In building teams like the Eindhoven Airport project and the Meander MC project, Heijmans was asked to provide input in the final design. For the key resources this means knowledge and skills about realization are the most important assets. For the integrated projects, knowledge about maintenance costs becomes important. To offer a fixed price for guaranteed performance over a period up to 30 years is a recent development. There is no experience with these long term contracts, which makes it difficult to predict what will happen. The service organization is one of the biggest commercial entities of Heijmans. Knowledge about the customer’s processes is the highest in this part of the company.

What was found in the case study is that the company struggles to extract knowledge from the service business to use it in the design phase of new projects. There is no structured approach. What is measured is the behavior of the technical equipment and the failures of systems. It was mentioned in the interviews as well as in the literature, that knowledge about customer’s processes becomes a necessary resource to implement more advanced service offerings. Therefore, in the post-project service phase, the effectiveness of the system for the customer’s processes should be measured. At the moment, the effect of a building aesthetics, logistics or internal climate on for example the productivity of the end-user or the satisfaction of the end-user are unknown. This is an important step that the company should make in order to offer customer’s process-oriented value propositions.

**Financial resources**

What was found in the case Military Museum Soesterberg is a need for financial resources. The contractor has to finance the complete project and receives the return on investment in the form of monthly payments for services and the availability of the system. This is in line with the literature on PSS and integrated solutions, mentioning the increased need for capital.

<table>
<thead>
<tr>
<th>Key resources</th>
<th>Business model 1: Transactional Project Delivery</th>
<th>Business model 2: Project-led Solution</th>
<th>Business model 3: Lifecycle Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>-</td>
<td>Own requirements for reliability and quality</td>
<td>Own requirements for reliability and quality</td>
</tr>
<tr>
<td>Human resources</td>
<td>Meet customer requirements.</td>
<td>Higher educated employees; Higher educated employees;</td>
<td></td>
</tr>
<tr>
<td>Knowledge and skills</td>
<td>Project management;</td>
<td>Project management; [feedback from use; knowledge of customer’s business]</td>
<td>Project management; [feedback from use; knowledge of customer’s business]</td>
</tr>
<tr>
<td>Financial capital need</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
</tbody>
</table>

Table 4.8 Key resources

4.3.7 Key activities

The processes that make a business model work are called key activities (Osterwalder, 2009). In the literature review, the activities that are found to be related to servitization are: maintaining own equipment, systems integration, operational services, business consulting, financing, lifecycle costing and design for function. In this subsection, the cases will be analyzed for patterns in activities that are related to servitization. It was found that for the studied cases, certain key activities are the same for every project type. Other activities belong to a specific type of project. First the basic activities will be described followed by the newly developed activities.

**Traditional activities**

Procurement, calculation, systems integration and production are the traditional activities that are found in all of the cases. These activities belong to the traditional construction business model. The procurement department buys all the parts needed according to the SOW. Besides parts, they also procure services of
subcontractors. The calculation department makes cost estimations based on the design that is available. This can be a preliminary design, a final design or a SOW. The further in the design process, the more accurate the calculation. Besides cost calculation, they also look for cost optimizations to reduce the cost of the building to be able to make a better proposition than the competitors. The production activity can be seen as the core process of Heijmans. This is the assembly of the parts into a complete system on the construction site. Since these activities are found in each of the three types of business models, the traditional activities are seen as irrelevant in relation to servitization. Therefore, the following activities are removed from the framework: cost calculation, systems integration, production and procurement.

**Systems Engineering**
The most mature customers specify their needs in an output specification (OS) leaving room for solutions to be developed by the provider (Frederik Barracks, Military Museum Soesterberg). The OS is formulated in abstract terms, as functional requirements. The contractor needs to design for function, as was identified in the literature review. Complex projects, consisting of many interrelating subsystems require that many partners work together on the same design. The OS is no longer written on paper, instead, it is formulated as a database in a computer program called Relatics. To check if the design meets the requirements, one should systematically check all the parameters. One mistake could mean that the tender is invalid. What is called systems engineering is a method of verification and validation, in order to clarify the requirements and who is responsible for which requirement. For every parameter, one member of the design team, internal or external, is design responsible. This team member provides the evidence that a requirement is met. Then, for every parameter one member of the internal design team has the final responsibility. This team member checks if the evidence is sufficient.

**Design for maintenance**
A recent development is the demand for long-term maintenance contracts that are offered to the customer in integrated construction projects (Jeroen Bosch Hospital, Municipal Office Rotterdam, Frederik Barracks and Military Museum Soesterberg). In the pre-project phase, design choices have to be made that reduce the cost of maintenance in the post-project phase. The degree of freedom in these design choices depends on the moment that the contractor gets involved. The influence the contractor has on the maintenance costs is the highest if the contractor is involved early in the preliminary design phase. Employees from the services department provide their expertise during the design phase as specialists of maintenance costs.

**Risk driven maintenance (FMECA)**
A new activity related to the performance based service contracts is the Failure Mode, Effects and Criticality Analysis (FMECA). This risk analysis method is applied in a pilot at the Jeroen Bosch Hospital, the first project that included a performance based maintenance contract. Although the contract type was new, the maintenance activities were performed as before with preventive maintenance contracts. For example, with the three large boilers of the Jeroen Bosch Hospital, they asked the supplier to perform preventive maintenance. This means an inspection once a year and to clean the air filters once a year. However, for some elements, it might be more efficient to wait until a failure occurs and then have the element repaired or replaced. What they do with a FMECA is risk driven maintenance. They analyze which elements are linked to each other and what the consequences are if one element fails. The result of this analysis provides insight in critical objects related to the performance. On basis of this analysis, a maintenance strategy will be determined. The principle is to apply preventive maintenance to critical elements and reactive maintenance to non-critical elements. At the pilot in the Jeroen Bosch Hospital, at part A of the building the risk driven maintenance is applied and for part B traditional preventive maintenance is applied to compare the maintenance costs. Projects that are being realized in the coming years also include FMECA, these are: Jeroen Bosch Hospital, Municipal Office Rotterdam, Frederik Barracks and Military Museum Soesterberg.


**Service development**

In one of the cases, Heijmans offered operational services. This was the case at the Military Museum Soesterberg. Based on the functional requirements in the output specification, the contractor had to develop a hospitality service offering. A plan had to be proposed how the museum would attract the most customers and how the consumptions of the customers would increase. Since this is a new activity for Heijmans and there is no knowledge present in the organization on hospitality services, an external company was hired for the service development.

**Potential activities**

Comparing the activities of the studied cases with the activities identified in the literature review brings forward some differences. From the four activities as described by Davies (2004), systems integration, operational services and financing are found to be part of Heijmans’ activities. Business consulting was not found to be one of the Heijmans activities. Therefore, this activity is regarded as a potential activity that can be added to increase the servitization of the activities of Heijmans. Another potential activity is the operational services in the project-led solution business model. From the cases it was found that the post-project services in this category were product-oriented. To increase the level of servitization, this offering could be added with operational services. In line with the option to include operational service activities, the company should also include service development activities in the project-led solution business model. This is needed to extent the service offering in the post-project phase.

<table>
<thead>
<tr>
<th>Key Activities</th>
<th>Business model 1: Transactional Project Delivery</th>
<th>Business model 2: Project-led Solution</th>
<th>Business model 3: Lifecycle Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-project phase</td>
<td>Cost calculation, (Business consulting), Product development.</td>
<td>Cost calculation, (Service development), product development, design for maintenance; Systems engineering.</td>
<td>Cost calculation, Systems engineering, design for maintenance; Lifecycle costing; Service development.</td>
</tr>
<tr>
<td>Project-delivery phase</td>
<td>Procurement; production; systems integration.</td>
<td>Procurement; production; Assessing failure risk; maintaining own equipment; systems integration.</td>
<td>Procurement; production; systems integration, design for function; financial services.</td>
</tr>
<tr>
<td>Post-project phase</td>
<td>(Operational services); Risk driven maintenance (FMECA).</td>
<td>Risk driven maintenance (FMECA).</td>
<td>Operational services.</td>
</tr>
</tbody>
</table>

Table 4.8 Key activities

4.3.8 Key partnerships

The resources and the activities that are not part of the internal organization are procured from external parties. The element key partnerships is defined as the network of suppliers and partners that enables the provider to offer the value proposition (Osterwalder & Pigneur, 2009). In the literature review, the following variables are identified that describe the key partnerships in relation to servitization: contractor’s sourcing strategy, intensity of supplier relationship and information exchange. From the within case analysis it is found that subcontracting is one of the main aspects of a contractor’s business model. 70 To 80 percent of the work is subcontracted to suppliers. It is found that suppliers can have different roles in the studied cases. There is the traditional buyer-supplier relationship; there are general partnerships with direct competitors, co-makers and risk-bearing partners. Besides the suppliers, there are many parties involved in the construction value chain. In every construction project, the architect, the construction engineer, the building physics advisor, the contractor and the client have to work together. Between the studied cases, these parties had different roles and responsibilities. This subsection will analyze the differences in partnerships between the different servitized business models.

**Co-makers**

In the integrated projects, it is not only the contractor who is involved earlier in the project. Also the suppliers of the contractor are involved earlier and longer. Heijmans involved partners in the tender to bring in their expertise to make a better offering. These partners are called co-makers. Co-makers commit themselves to a
contractor from the design phase. They perform their part of the design and if the contractor wins the contract, then the co-makers obtain their part of the work. A co-maker is bounded by contract to prevent this key partner from cooperating with other tendering parties. In the Municipal Office Rotterdam, two external co-makers and one internal co-maker were attracted. A British company specialized in steel constructions was attracted for the construction. A Dutch specialist in façades was involved and the internal co-maker was Heijmans civil engineering for the underground parking. In the Frederik Barracks project, the façade was also subcontracted during the tender to a co-maker who was specialized in façades. Involving these co-makers in the tender creates commitment from the partners and spreads the responsibilities over the specialized parties.

Risk-bearing partners
In the most advanced project, the Military Museum Soesterberg, the contractors not only have to deliver a building, but also operate and finance it. This requires resources that are not available at Heijmans. To operate a building, activities like cleaning, catering, ICT and security are needed. Therefore, these activities are outsourced to suppliers. In the case of the Military Museum there is one party for the catering, one for the ICT and one for the cleaning and security. Two of these partners are risk-bearing partners. They invest in the design phase in order to obtain the work.

Financial partners
The increased need for capital in the lifecycle solution business model requires Heijmans to cooperate with a bank. If Heijmans is unable to find a bank that is willing to provide a loan, projects like the Military Museum Soesterberg are not an option since Heijmans’ own resources are insufficient. Thus, for more advanced service offerings with a lifecycle solution business model, contractors with limited resources need a financial partner.

Facility management organizations
In one case, the military Museum Soesterberg, Heijmans takes over customer processes. Examples are already mentioned in the subsection key activities: catering, cleaning and security. These activities are non-core activities of a construction company like Heijmans and are outsourced to specialized companies. Security and cleaning are activities that are outsourced to a facility management organization and catering is outsourced to a catering company. More servitized offerings that involve taking over customers’ processes, requires new non-core activities which brings in the need for new partnerships.

Contractor’s sourcing strategy
In the literature it was found that on the left side of the continuum, providers should outsource their service activities to suppliers as it is not their core-business. On the right side of the continuum, providers should insource their service activities or outsource it to equity-based partners, because of the strategic importance of services in their business model (Rappacini et al., 2010). In all cases, services are to a large extend outsourced to service suppliers (70 to 80 %). It is confirmed in case 4 that in lifecycle solutions, the service suppliers become equity-based partners. However, the insourcing of strategic important services was not found in any of the cases and is a direction for improving current practice. Catering, security and cleaning, the soft facility management, are services that become core-business for providers in lifecycle solutions.

Intensity of supplier relationship
As a result of the use of co-maker and risk-bearing partnerships, the intensity of the supplier relationship increases. In projects with a transactional project delivery business model, the provider and the subcontractors operate as separate organizations with their own (often conflicting) interests (case: Meander MC, COA, MSD Organon, Eindhoven airport, Jeroen Bosch Hospital). In the project led solutions, the relation becomes stronger. Co-makers are suppliers that are involved earlier in the project and have a shared interest with the provider to make the work a success (case: Frederik Barracks, Municipal Office Rotterdam). However, the operational linkages as described by Rappacini et al. (2010) were not found in any of the cases. In lifecycle solutions, the supplier relationship further intensifies. The risk-bearing partners invest in the project through a special purpose vehicle. Therefore, the relationship is defined as a strong strategic integration.
Role of the architect

Between the project business models, the role of the architect is different. In more servitized business models, the architect is a subcontractor of Heijmans. This was the case in the projects Frederik Barracks and Military Museum Soesterberg. In these projects, Heijmans had the design responsibility, but design is traditionally not a core activity and therefore outsourced to an architect. In the other cases, the architect is directly contracted by the client. Because the architect and the contractor have different interests, there is often a tension between these two parties.

<table>
<thead>
<tr>
<th>Key partnerships</th>
<th>Business model 1: Transactional Project Delivery</th>
<th>Business model 2: Project-led Solution</th>
<th>Business model 3: Lifecycle Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key partnerships</td>
<td>Suppliers; subcontractors</td>
<td>Architect; advisors; suppliers; subcontractors; co-makers.</td>
<td>Architect, advisors, fm organizations; financial partners; suppliers; subcontractors; co-makers; risk-bearing partners.</td>
</tr>
<tr>
<td>Contractor’s sourcing strategy</td>
<td>Outsourcing of non-core business services;</td>
<td>Outsourcing of non-core business services;</td>
<td>Outsourcing to equity based partners; insource service provision.</td>
</tr>
<tr>
<td>Intensity of supplier relationship</td>
<td>Weak; arm’s length relationships; basic information exchange; transactional.</td>
<td>Medium; strategic integration; operational linkages with service suppliers.</td>
<td>Strong; strategic integration; equity based partners; integration of capabilities;</td>
</tr>
<tr>
<td>Role of the architect</td>
<td>Contracted by client</td>
<td>Subcontracted by contractor</td>
<td>Subcontracted by contractor</td>
</tr>
</tbody>
</table>

Table 4.9 Key partnerships

4.3.9 Cost structure

The cost structure of a business model is the sum of the costs of all the other elements (Osterwalder & Pigneur, 2009). The cost of a project depends on the scope of the project and is mostly determined during the design in the pre-project phase. The following subsection will discuss the variables through which servitization has an effect on the cost structure of project business models.

Scale and Scope

The cost structure used to be dominated by economies of scale. The more projects are being realized the more discount is obtained by the procurement department. However, with differentiation strategies, customized solutions will be more cost efficient if the scope of the offering is increased. For example, in the cases MSD Organon, COA and Jeroen Bosch Hospital the contracts are split up in construction elements, electrical installations and mechanical installations and are divided among different contractors. This is inefficient, because you need three contract managers, three service desks and more service employees. If these three disciplines are combined in one contract costs can be reduced. Even more efficient use of the service infrastructure can be realized if the scope of services is extended with for example cleaning, catering and energy as is the case with the Military Museum Soesterberg.

Lifecycle Costs

The total cost of a building is more than just the realization costs. Per case, a different approach is used for lifecycle costs. At the two maintenance contracts, MSD Organon and COA, the lifecycle costs are the responsibility of the client and Heijmans has no influence on the lifecycle costs. At the two traditional projects, Eindhoven Airport and Meander MC, Heijmans gave advice during the final design phase to reduce lifecycle costs. However, because Heijmans is not responsible for the lifecycle costs, not much attention is paid to it. This is different for the integrated contracts. With the Frederik Barracks, the Municipal Office, the Jeroen Bosch and the Military Museum, Heijmans has benefit by reducing part of the lifecycle costs. Lifecycle costs that are calculated are dependent on the scope and duration of the contract. At the Frederik Barracks, the Municipal Office and the Jeroen Bosch Hospital, the design is aimed at reducing maintenance costs. The Military Museum is a different story, because the scope of the project is much wider, lifecycle costs include energy costs, maintenance costs, gardening and soft facilities (cleaning, catering etc.). In that lifecycle solution, 50% of the total costs are made during the use phase. Although a large extent of the total costs are covered with this type of lifecycle cost calculation, not all costs are calculated. For example the residual value or the recycling costs
were not part of the contract and therefore were not part of the calculation. It can be concluded that servitization reduces lifecycle costs, this effect is stronger for lifecycle solutions than for project-led solutions and lowest in the transactional project delivery.

Cost of capital
The cost of capital is a cost factor that is present in every construction project. Interim interest is the interest during a construction project that occurs when there is a difference in time between the realization of a construction element and the payment by the client. In the project where the client obtains the building through a transaction, the client is responsible for the finance. In the case Military Museum Soesterberg the contractor has to finance the complete building, which has major impact on the cost of capital for the contractor.

Cost of Realization
Realization time is an important cost factor. First, the shorter the realization time, the lower the realization costs. In addition, contractors can face penalty costs in case of delays. Penalties were part of the contract in all the studied cases. The effects of servitization on realization costs is positive. In project-led solutions and lifecycle solutions, the contractor has the choice to make investments in the realization that payoff during the buildings lifecycle. For example the application of LED lights at the Military Museum Soesterberg increases the initial investment compared to traditional light bulbs. However, LED lights have a longer lifespan which reduces replacement costs and use less energy which reduces energy costs. In the project-led solutions, it was also found that the contractor chose for investment in realization to reduce lifecycle costs. In the case Jeroen Bosch Hospital, more expensive boilers and pumps were applied which require less maintenance. The effect on realization costs is stronger for lifecycle solutions than for project led solutions, because share of lifecycle costs is higher in the total costs compared to project-led solutions.

Cost of Design
The different role of the architect in the projects has consequences for the cost structure. In the Jeroen Bosch project, the Eindhoven Airport project, the Meander project and partly in the case of the Municipal Office project, the architect is contracted directly by the client. In these cases, the architect had a leading role in the design and thus for the cost of the building. In the integrated contracts Frederik Barracks and Military Museum, the architects are contracted by Heijmans, which provides Heijmans with more control over the costs of the building. Because the design has become part of tenders for integrated contract, tender costs are higher for integrated contracts. Contractors who lose a call for tenders are being compensated by clients for their tender costs. However, the compensation is not sufficient to cover all costs. As an effect of servitization, contractors become design responsible which makes the tender costs increase.

<table>
<thead>
<tr>
<th>Cost structure</th>
<th>Business model 1: Transactional Project Delivery</th>
<th>Business model 2: Project-led Solution</th>
<th>Business model 3: Lifecycle Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economies of scale</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Economies of scope</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Realization costs</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Capital costs</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Lifecycle costs</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Tender costs</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Efficiency of product usage</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Cost of uncertainty</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
</tbody>
</table>

Table 4.10 Cost structure
4.4 Conclusion

4.4.1 Design of the framework
After having described the effects of servitization on the different categories of project business models, this paragraph will conclude the cross-case analysis with the design of the final framework as presented in table 4.11. The previously presented tables per business model element are put together in one table. The final framework is the answer to the third research question.

For the element customer segments, the case study confirmed that the variables customer’s sourcing strategy, perceived complexity and customer’s capabilities are related to servitization. Moreover, two new variables are identified in the case study: control over design and planning horizon.

The implications of servitization on project value propositions take place in the pre- and post-project phase. In more advanced service offerings, the value proposition before the project consists of design services. Post-project value propositions change from repair service on request to guaranteed performance with prevention of failures in the project-led solution and to the availability of a functioning building with a reduced need for capital in the lifecycle solution. Optimizing customers’ processes, reducing customers’ operating risk and providing use of or access to a product are identified as potential value propositions for Heijmans.

Channels is an element that was given little attention in existing servitization literature. The case study found one new variable with regard to channels in relation to servitization of project business, namely the demand specification. Servitized project make use of abstract output specification while traditional projects have detailed statements of work.

The effect of servitization on customer relationships is described with the variables duration, intensity and the newly added variable share of wallet. Servitization makes the duration of customer relationships longer, of higher intensity and increases the share of wallet per customer. Shared revenues and co-development were confirmed by case study evidence. However, interactive customer relationships are identified as a new to the company.

The revenue model in project business models consists of transactional or relational revenues in different combinations in the three project lifecycle phases. Servitization changes the revenue model from purely transactional to purely relational, which is a confirmation of theory. The following revenue models were identified: cost-plus pricing, pay-for performance and equipment availability, gain sharing and pay-per-usage, which is in line with theory.

Implication of servitization on a PBO’s key resources is described by the variables technology, human resources, knowledge and skills and capital need, which is in line with the conceptual framework. Technology changes from meeting customer needs towards meeting the providers need for reliability and quality. Servitization increases the need for higher educated human resources and increases the need for knowledge of the customers’ business. Financial capital and feedback from use are resources needed for advanced service offerings.

In service oriented project business models, the key activities are expanded from the traditional construction activities as cost calculation, procurement and production, with new activities in the pre- and post-project phases. Systems engineering, design for maintenance and design for function are new activities in the pre-project phase. Activities in the project-delivery phase remain unchanged. Post-project activities are operational services, risk driven maintenance and financial services. Service development, operational service and business consulting are identified as points of interest for Heijmans.

Servitization has effect on key partnerships through the variables as identified in literature: key partnerships, contractor’s sourcing strategy, information exchange and intensity of supplier relationship. New variables that are identified in the case study are the type of partnership and role of the architect.

In the cost structure of project business models, servitization has effect on the following variables as identified in both theory and practice: economies of scope, capital costs, lifecycle costs, efficiency of product usage and cost of uncertainty. Realization costs and tender costs are newly identified in the case study and added to the final framework.
4.4.2 Testing the framework 2.0

The final framework (table 4.11) with the modified variables should have a better fit with the data than the conceptual framework. Therefore, on the next page, the final framework is used to position the cases again. The same method as in paragraph 3.5 is used to calculate the goodness of fit. In the conceptual framework, the difference between in line scores and out of line scores was more than one third of the inline scores resulting in a goodness of fit of 0.37. In the modified framework variables that turned out to be irrelevant are removed and variables that are newly identified in the cross-case analysis are added. The result is a goodness of fit of 0.71, which indicates that the framework 2.0 is much better able to categorize project business model on the product-service continuum.

### Positioning of the cases 2.0

#### Service as add-on

<table>
<thead>
<tr>
<th>Customer Segment</th>
<th>Business model 1: Transactional Project Delivery</th>
<th>Business model 2: Project-led Solution</th>
<th>Business model 3: Lifecycle Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sourcing strategy</strong></td>
<td>Shared expertise; Customer who want ownership [case: 1,2,6,8];</td>
<td>Reliance on supplier; Customers who want ownership [case: 3,5,7];</td>
<td>Reliance on the supplier; customers prefer no assets on balance sheet [case: 4];</td>
</tr>
<tr>
<td><strong>Control over design</strong></td>
<td>High [case: 1,2,5,6,8];</td>
<td>Medium [case: 7];</td>
<td>Low [case: 3,4];</td>
</tr>
<tr>
<td><strong>Perceived Technical Complexity</strong></td>
<td>Low perceived technical complexity [case: 1,2,6,8];</td>
<td>High perceived technical complexity [case: 3,4,5,7];</td>
<td>High perceived technical complexity [case: 3,4,5,7];</td>
</tr>
<tr>
<td><strong>Organizational complexity</strong></td>
<td>High organizational complexity [case: 1,2,5,6,8];</td>
<td>Low organizational complexity [case: 3,4,7];</td>
<td>Low organizational complexity [case: 3,4,7];</td>
</tr>
<tr>
<td><strong>Customer’s Capabilities</strong></td>
<td>High capabilities; own technical staff; own facilities managers [case: 1,2,6,8];</td>
<td>Medium capabilities; no technical staff; own facility managers [case: 3,5,7];</td>
<td>Low capabilities; focused on core business [case: 4];</td>
</tr>
<tr>
<td><strong>Financial Planning horizon</strong></td>
<td>Short term planning [case: 1,2,6,8];</td>
<td>Medium term planning [case: 3,4,5,7];</td>
<td>Long term planning [case: 4];</td>
</tr>
<tr>
<td><strong>Customer maturity</strong></td>
<td>Low maturity [case: 1,2,6,8];</td>
<td>Medium maturity [case: 3,5,7];</td>
<td>High maturity [case: 4];</td>
</tr>
</tbody>
</table>

#### Value Proposition

<table>
<thead>
<tr>
<th>Pre-project phase</th>
<th>Post-project phase</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Service as add-on</strong></td>
<td><strong>Service as add-on</strong></td>
</tr>
<tr>
<td><strong>Value Proposition</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Business model 1: Transactional Project Delivery</strong></td>
<td><strong>Business model 2: Project-led Solution</strong></td>
</tr>
<tr>
<td><strong>Pre-project phase</strong></td>
<td><strong>Post-project phase</strong></td>
</tr>
<tr>
<td><strong>Intensity</strong></td>
<td>Low intensity; transaction based [case: 1,2,6,8];</td>
</tr>
<tr>
<td><strong>Share of wallet</strong></td>
<td>Low [case: 1,2,6,8];</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>Short term (&lt;5yrs) [case: 1,2,6,8];</td>
</tr>
</tbody>
</table>

### Channels

<table>
<thead>
<tr>
<th>Demand specification</th>
<th><strong>Service as add-on</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business model 1: Transactional Project Delivery</strong></td>
<td><strong>Business model 2: Project-led Solution</strong></td>
</tr>
<tr>
<td><strong>Channels</strong></td>
<td><strong>Pre-project phase</strong></td>
</tr>
<tr>
<td><strong>Channel</strong></td>
<td><strong>Demand specification</strong></td>
</tr>
<tr>
<td><strong>Intensity</strong></td>
<td>Low intensity; transaction based [case: 1,2,6,8];</td>
</tr>
<tr>
<td><strong>Share of wallet</strong></td>
<td>Low [case: 1,2,6,8];</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>Short term (&lt;5yrs) [case: 1,2,6,8];</td>
</tr>
</tbody>
</table>

### Revenue Model

<table>
<thead>
<tr>
<th><strong>Pre-project phase</strong></th>
<th><strong>Post-project phase</strong></th>
<th><strong>Pre-project phase</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue Model</strong></td>
<td><strong>Pre-project phase</strong></td>
<td><strong>Post-project phase</strong></td>
</tr>
<tr>
<td><strong>Business model 1: Transactional Project Delivery</strong></td>
<td><strong>Business model 2: Project-led Solution</strong></td>
<td><strong>Business model 3: Lifecycle Solution</strong></td>
</tr>
<tr>
<td><strong>Project delivery phase</strong></td>
<td><strong>Post-project phase</strong></td>
<td><strong>Pre-project phase</strong></td>
</tr>
<tr>
<td><strong>Transaction revenues</strong></td>
<td>Transactional sales revenues + Relational service revenues [case: 1,2,6,8];</td>
<td>Relational revenues; product as a service [case: 4];</td>
</tr>
<tr>
<td><strong>Post-project phase</strong></td>
<td>Transactional sales revenues + Relational service revenues [case: 1,2,6,8];</td>
<td></td>
</tr>
</tbody>
</table>

---

43
<table>
<thead>
<tr>
<th>Key Resources</th>
<th>Technology</th>
<th>Human Resources</th>
<th>Knowledge and Skills</th>
<th>Financial capital need</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Meet customer requirements [case: 1,2,6,8];</td>
<td>Higher educated employees [case: 3,4,5,7];</td>
<td>Knowledge of customer’s business [case: 3,4,5,7];</td>
<td>Low [case: 1,2,6,8];</td>
</tr>
<tr>
<td></td>
<td>Customer requirements + Own requirements for reliability</td>
<td>Higher educated employees [case: 3,4,5,7];</td>
<td>Knowledge of customer’s business [case: 3,4,5,7];</td>
<td>Medium [case: 3,5,7];</td>
</tr>
<tr>
<td></td>
<td>and quality [case: 3,4,5,7];</td>
<td></td>
<td></td>
<td>High [case: 4 ];</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Key Activities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-project phase</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Systems engineering; design</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>for maintenance; assessing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>failure risk [case: 3,5,7];</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project-delivery phase</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>Financial services [case: 4];</td>
<td></td>
</tr>
<tr>
<td>Post-project phase</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Maintaining own equipment; risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>driven maintenance (FMECA) [case: 3,5,7];</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Key Partnerships</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Key partnerships</td>
<td>Suppliers; subcontractors [case: 1,2,6,8];</td>
<td>Architect; advisors; suppliers; subcontractors [case: 3,5,7];</td>
<td>Architect, advisors, fm organizations, financial partners; suppliers; subcontractors [case: 4];</td>
<td></td>
</tr>
<tr>
<td>Contractor’s sourcing strategy</td>
<td>Outsourcing of non-core business services [case: 1,2,3,4,5,6,7,8];</td>
<td>Outsourcing of non-core business services [case: 1,2,3,4,5,6,7,8];</td>
<td>Outsourcing to equity-based partners [case: 4];</td>
<td></td>
</tr>
<tr>
<td>Intensity of supplier relationship</td>
<td>Weak; arm’s length relationships; transactional; basic information</td>
<td>Strong; strategic integration [case: 3,5,7];</td>
<td>Strong; strategic integration; integration of capabilities and knowledge [case: 4];</td>
<td></td>
</tr>
<tr>
<td></td>
<td>exchange [case: 1,2,6,8];</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Role of the architect</td>
<td>Contracted by client [case: 1,2,5,6,8];</td>
<td>Subcontracted by contractor [case: 3,4,5,7];</td>
<td>Subcontracted by contractor [case: 3,4,5,7];</td>
<td></td>
</tr>
<tr>
<td><strong>Cost Structure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economies of scope</td>
<td>Low [case: 1,2,6,8];</td>
<td>Medium [case: 3,5,7];</td>
<td>High [case: 4];</td>
<td></td>
</tr>
<tr>
<td>Realization costs</td>
<td>Low [case: 1,2,6,8];</td>
<td>Medium [case: 3,5,7];</td>
<td>High [case: 4];</td>
<td></td>
</tr>
<tr>
<td>Capital costs</td>
<td>Low [case: 1,2,6,8];</td>
<td>Medium [case: 3,5,7];</td>
<td>High [case: 4];</td>
<td></td>
</tr>
<tr>
<td>Lifecycle costs</td>
<td>High [case: 1,2,6,8];</td>
<td>Medium [case: 3,5,7];</td>
<td>High [case: 4];</td>
<td></td>
</tr>
<tr>
<td>Tender costs</td>
<td>Low [case: 2,6];</td>
<td>Medium [case: 1,8,5,7];</td>
<td>High [case: 3,4];</td>
<td></td>
</tr>
<tr>
<td>Efficiency of product usage</td>
<td>Low [case: 1,2,6,8];</td>
<td>Medium [case: 5,7];</td>
<td>High [case: 3,4];</td>
<td></td>
</tr>
<tr>
<td>Cost of uncertainty</td>
<td>Low [case: 1,2,6,8];</td>
<td>Medium [case: 3,5,7];</td>
<td>High [case: 4];</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1= 26</td>
<td>5= 6</td>
<td>1= 0</td>
<td>5= 5</td>
</tr>
<tr>
<td></td>
<td>2= 27</td>
<td>6= 27</td>
<td>2= 1</td>
<td>6= 1</td>
</tr>
<tr>
<td></td>
<td>3= 1</td>
<td>7= 1</td>
<td>3= 27</td>
<td>7= 31</td>
</tr>
<tr>
<td></td>
<td>4= 1</td>
<td>8= 26</td>
<td>4= 9</td>
<td>8= 3</td>
</tr>
<tr>
<td><strong>Goodness of fit</strong></td>
<td>210 – 61</td>
<td>0,71</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.11 Final framework + positioning of the cases 2.0
5. Conclusions and Reflection

This master thesis studied the implications of servitization for a project-based firm’s business models. First, the research started with a literature review to identify the different stages on the product service continuum, resulting in a conceptual framework that describes servitization of project-based organizations. The framework consists of categories of project business models on the horizontal axis and business model elements on the vertical axis. Servitization literature was used to identify the characteristics of the project business models per element. However, it turned out that the servitization literature provided insufficient insight in the consequences of servitization for project business models, hence empirical research was needed. A single embedded case study was performed at Heijmans, a Dutch construction company. A selection of eight cases was analyzed in order to identify the characteristics of the different project business models. First, a within-case analysis provided in-depth knowledge about the different cases, which resulted in a distribution of the cases in the conceptual framework. Second, a cross-case analysis is performed to compare the cases on business model elements to find a pattern in consequences of servitization. Together, this is used to modify the conceptual framework of the literature review and to adapt it to the Dutch construction industry.

This final chapter reports the conclusions of this study. First, in paragraph 5.1 the answers to the research questions are described. Secondly, paragraph 5.2 defines the contributions of this study for theory and in 5.3 the managerial implications are discussed. Thirdly, the recommendations for the management of Heijmans non-residential building are presented in paragraph 5.4. And finally, the limitations and future research are discussed in paragraph 5.5.

5.1 Answering the Research Questions

**RQ1: What are the different stages on the product-service continuum for a project-based organization when moving from offering products to offering product-service systems?**

New types of customers cause a variation in customer needs over different segments. This forces the project-based organization to operate multiple business models and to hold multiple positions on the product service-continuum. The continuum is not a representation of the stages of servitization of a project-based firm, but it is a distribution of projects on the continuum representing the project-based organizations’ project portfolio. Servitization means the amount of projects with a business model that belongs to the service side of the continuum increases and the amount of projects with a business model on the product side of the continuum decreases. This study followed Kujala et al. (2011) in their range of project business models. A project-based organization has three main categories of project business models: transactional project deliveries, project-led solutions and lifecycle solutions. In the transactional project delivery, the provider sells the product in a transaction. Services before and after the project are possible on request of the customer and are paid for per service activity or time unit. In the project-led solution, sale of the project delivery is still the core of the offering. However, services are exchanged in a relational revenue model providing the client with a fixed fee for performance or availability. The lifecycle solution consists of an integrated offering of products and services in which the client pays a fee for the performance of the complete system. Within these three main categories, variations are possible ranging from product-oriented to customer’s process-oriented offerings. A project’s business model can be analyzed with the nine business model elements of Osterwalder (2004) which are: customer segments, value proposition, channels, revenue model, customer relationships, key resources, key activities, key partnerships and cost structure.

**RQ2: What is the current position of the construction projects of Heijmans on the product-service continuum?**

The within-case analysis studied eight cases of which six construction projects and two maintenance contracts. In paragraph 3.2, these cases are positioned in the conceptual framework. It was found that four cases have business models that are part of the transactional project delivery, three cases have project-led solution
business models and one case is characterized by a lifecycle solution business model. Within the transactional project deliveries, all four cases are product-oriented offerings. No professional services are identified in these cases that are aimed at improving the customer’s processes. The same counts for project-led solutions, all three cases are product-oriented offerings. Transactional sale of the project delivery is combined with a maintenance offering that guarantees the technical performance of the building. However, the design responsibility that was part of two of the project-solutions can be described as a professional service, but was integrated in the project delivery. In the category lifecycle solutions, only one case was identified. In this case, the contractor has to take over the customer’s processes and thus can be described as a customer’s process-oriented offering.

RQ3: What are the implications of servitization for project business models of Heijmans?

To provide an answer to this question, the business model concept of Osterwalder (2004) was applied on the project level. According to this approach, a project business model can be presented in nine elements. These elements are used to compare the cases and to find implications of servitization. For the element ‘customer segments’, the case study confirmed that the variables customer’s sourcing strategy, perceived complexity and customer’s capabilities are related to servitization. Moreover, two new variables are identified in the case study: control over design and planning horizon. For the element ‘value proposition’, the effects of servitization take place in the pre- and post-project phase. In more advanced service offerings, the value proposition is expanded with design services, guaranteed performance and availability of a functioning building with a reduced need for capital. Optimizing customers’ processes, reducing customers’ operating risk and providing use of or access to a product are identified as potential value propositions for Heijmans. For the element ‘channels’, the case study found one new variable in relation to servitization of project business, the demand specification. Servitized project make use of abstract output specification while traditional projects have detailed statements of work. The implications of servitization on the element ‘customer relationships’ is described with the variables duration, intensity and the newly added variable share of wallet. Servitization makes the duration of customer relationships longer, of higher intensity and increases the share of wallet per customer. Shared revenues and co-development were confirmed by case study evidence. However, interactive customer relationships are identified as a new to the company. The element ‘key activities’ in project business models consists of transactional or relational revenues in different combinations in the three project lifecycle phases. Servitization changes the revenue model from purely transactional to purely relational, which is a confirmation of theory. The following revenue models were identified: cost-plus pricing, pay-for performance and equipment availability, gain sharing and pay-per-usage, which is in line with theory. Implications on the business model element ‘key resources’ is described by the variables technology, human resources, knowledge and skills and capital need, which is in line with the conceptual framework. Technology changes from meeting customer needs towards meeting the providers need for reliability and quality. Servitization increases the need for higher educated human resources and increases the need for knowledge of the customers’ business. Financial capital and feedback from use are resources needed for advanced service offerings. For the business model element ‘key activities’, traditional construction activities as cost calculation, procurement and production, are expanded with new activities in the pre- and post-project phases. Systems engineering, design for maintenance and design for function are new activities in the pre-project phase. Activities in the project-delivery phase remain unchanged. Post-project activities are operational services, risk driven maintenance and financial services. Service development, operational service and business consulting are identified as points of interest for Heijmans. For the element ‘key partnerships’, servitization has effect through the variables as identified in literature: key partnerships, contractor’s sourcing strategy, information exchange and intensity of supplier relationship. New variables that are identified in the case study are the type of partnership and role of the architect. For the element ‘cost structure’ of project business models, servitization has effect on the following variables as identified in both theory and practice: economies of scope,
capital costs, lifecycle costs, efficiency of product usage and cost of uncertainty. Realization costs and tender costs are newly identified in the case study and added to the final framework.

5.2 Theoretical Implications
This study contributed by bridging the gaps between the servitization literature, the business model literature and the project management literature. In the servitization literature and the business model literature, limited attention was given to project-based organizations. The existing body of knowledge is extended with the findings of the single embedded case study. Firstly, the three categories of project business models on the product-service continuum as identified in the article of Kujala et al. (2011) are confirmed by this study, which means their categories of project business models in the power and utilities industry are also found in the construction industry. Secondly, the addition of the nine business model elements of Osterwalder and Pigneur (2009) to the product-service continuum of Oliva and Kallenberg (2003) provided a new framework. Using the business model concept of Osterwalder and Pigneur (2009) on the project level is a new application of the concept. Thirdly, per business model element, variables are identified in the literature review and the case analysis that are related to servitization of PBO’s. The new variables that are confirmed in the case study form a contribution to the servitization literature.

This extensive study of one company provided insight in how servitization affects the business model of a project based organization. However, because the data only comes from one company, the findings cannot be generalized into a theory for all project-based organizations. The scientific contribution should be seen as a first step towards a general theory.

5.3 Managerial Implications
In the within-case analysis, eight cases are mapped on the conceptual framework as developed in the literature review. It was found that the projects of Heijmans have business models in the categories transactional project deliveries, project-led solutions and lifecycle solutions. Since the strategic objective of Heijmans is to make a move towards services (Report of the executive board, 2011), the distribution of projects over the different categories is expected to change. The amount of transactional project deliveries will decrease, while the number of project-led solutions and lifecycle solutions will increase. In this context the framework is a useful tool, because mapping all Heijmans’ non-residential projects and maintenance contracts on the framework will provide insight in the current status of servitization of the company. By setting a target distribution of projects over the different categories for the coming years, the servitization of project business can be monitored and managed. For example in deciding which tenders to subscribe for. Moreover, it would be interesting for Heijmans to map the total revenues per business model category and the average profit margins to clarify the effects of servitization on the project results. Hypothetically, the effects of servitization can be negative for the company since reducing lifecycle costs of projects and optimizing the usage of buildings results in lower maintenance expenses and reduces the size of buildings. With this effect, servitization would cannibalize Heijmans’ own product business. This potential negative effect of servitization emphasizes the need for monitoring and measuring which is enabled by the framework developed in this study. However, at the moment no results are available of lifecycle solutions since the realization of the first project in this category starts in 2013. In addition, the population of project-led solutions is too small to make a statement about the effects in a quantitative manner. Multi-case studies are needed to increase the size of the population of advanced service offerings to study the quantitative effects on revenues and margins.

The business model elements on the vertical axis of the framework enable the user to compare the characteristics of projects in a structured way. This type of analysis provides better insight in opportunities of improving the PBO’s business model.
5.4 Recommendations

Based on the analysis of the servitization of non-residential building projects of Heijmans, six recommendations for the management of Heijmans will be proposed in this paragraph. These six are summarized in figure 5.1, divided in short term actions, medium term actions and long term actions. The sequential order in the recommendations enables the company to experience the benefits of the “low hanging fruits” early on, while implementation of longer term actions require more rigorous changes to the organization.

![Figure 5.1 Recommendations for Heijmans](image)

To start with, servitization is not possible without customers who demand advanced service offerings. Therefore, Heijmans should proactively convince customers to outsource their hard and soft facility management to the contractor. Moreover, customers have to be convinced to specify their demand in more abstract terms, which will provide Heijmans more space to develop a solution that meets the customer need. The first option is to educate customers through participating in seminars for principals or by one-on-one meetings with potential customers. The second option to convince customer is during market consultations organized by customers. Another option is to make an unsolicited proposal to the customer in a tender. By calculating a more servitized alternative solution and prove that the proposal better meets the customer’s needs.

The second short-term action is to implement customer-centric performance metrics. It is found that servitized project types include customers’ process-oriented offerings. This requires a change in performance metrics from short term revenues and margins on project deliveries towards metrics that are focused on the business of the customer. Examples of these customer-centric performance metrics are employee productivity, workplace absenteeism, energy usage and customer satisfaction. Linking these performance indicators with the revenue model creates incentives for the contractor to improve the customer’s business. In the current system, past performance of a contractor is not used as an award criterion. Measuring customer satisfaction for example can be used to convince potential customers for selecting Heijmans. In the construction literature this idea is called Performance Information Procurement System (PIPS).

The third recommendation for the management of Heijmans is to benefit from the long term relationship with its customers by collecting data during the use phase. Feedback from use can provide the company with valuable knowledge about costs of maintenance and operations, but also knowledge of the performance of the building for the customers’ business. This knowledge is useful to make evidence-based design choices in future projects, which improves the customer’s business and reduces lifecycle costs. Because the positive effects of this action will require some time to collect data, this action is categorized in the medium-term actions.

Another mid-term action is to initiate business consulting activities. Consultancy and advice on housing choices enables Heijmans to get involved earlier in the decision-making. Moreover, consultative selling is a potential
channel for obtaining new work. Examples of themes for consultancy are alternative workplace strategies (i.e. “Het Nieuwe Werken”), energy usage (i.e. “BREEAM” assessments), safety and security.

Long-term actions are actions that require serious investments both finance and human resources. The first action for the longer term is to develop financing capabilities. It is found that the need for financial resources increases when the company is servitizing towards lifecycle solutions. In the current practice, the financial resources for lifecycle solutions are arranged by the department called Heijmans Public Private Partnerships (PPP). However, in the current situation Heijmans is dependent on bank loans and these banks charge high risk premiums on their loans which make financing expensive. Because the availability of financial resources is of strategic importance, Heijmans should develop own financing capabilities. This is seen in other capital goods industries in which manufacturers offer equipment leasing. Examples are the financial services divisions of Renault, called the RCI Banque and of General Electric, called GE Capital. These companies issue corporate bonds to raise money and even offer saving accounts.

The final recommendation for Heijmans’ management is to use the recently established business development department to develop new business models in the category lifecycle solutions. The idea of ownerless consumption provides many directions for the company. A new project type that receives much attention these days is the energy service company (ESCO). In these projects, contractors own and operate energy systems at the customer’s site and deliver energy. Another interesting development in the market is the flexible office solution (i.e. Regus) in which the customer pays per time unit usage of office space. Finally, another example of ownerless consumption are the relocatable buildings for semi-permanent application (i.e. Jan Snel or Neptunus). By taking these solutions as an example, Heijmans can become a true service provider that retains the ownership of equipment.

5.5 Limitations and Future Research

Because the research was performed using a single embedded case study approach, the study is limited to the project types of Heijmans. Therefore, the findings cannot be generalized to other companies in the construction industry as these companies might use other project business models. Moreover, the chance that construction companies in other countries use other types of projects business models is even higher. Future research could compare the level of servitization in other construction companies preferable in different countries. Moreover, future research can compare other project based organizations in the manufacturing industry, off-shore industry or the power and utilities industry to provide a general framework of servitization for project based firms.

While this study only focused on the provider’s side of servitization, it would be interesting for future research to involve the customers’ perspectives. To get a better understanding of the phenomenon from the customers’ side, customers should be interviewed about their motivation for demanding servitized offerings and what they expect from providers of servitized projects. This information about customer demand is needed for companies to estimate the market potential of servitized offerings in the future. At this moment it is uncertain whether the movement towards services remains limited to a few advanced customers or that this will become common practice in the coming years.

Finally, quantitative research is needed to further study the servitization of project business. For quantitative research, a larger sample of projects is needed from multiple companies. By collecting survey data at customers of projects, the effects of servitization on for example customer satisfaction can be studied. Another direction for quantitative research is to collect data of energy usage from different type of projects to study the environmental effects of servitization. Also the effects on project costs and revenues require quantitative research. Financial numbers of a large sample of projects in different categories should be compared to make a statement of the financial effects.

It is clear that although the framework provides insight in the servitization of project-based organizations, at the same time new questions arise.
Bibliography


PMI (2004) A guide to the project management body of knowledge, USA: Project Management Institute PMI.


Appendices

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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSS</td>
<td>Product-Service System</td>
</tr>
<tr>
<td>PPP</td>
<td>Public Private Partnership</td>
</tr>
<tr>
<td>GFA</td>
<td>Gross Floor Area</td>
</tr>
<tr>
<td>PBO</td>
<td>Project-Based Organization</td>
</tr>
<tr>
<td>CoPS</td>
<td>Complex Products and Systems</td>
</tr>
<tr>
<td>MEAT</td>
<td>Most Economically Advantageous Tender</td>
</tr>
<tr>
<td>SOW</td>
<td>Statement of Work</td>
</tr>
<tr>
<td>MAMP</td>
<td>Multiannual Maintenance Planning</td>
</tr>
</tbody>
</table>
Figure C.1: Organization chart Heijmans Non-residential Building & Technical Services
Appendix D  Systematic Review Architecture

Figure D.1: Systematic review architecture (source: Denyer, 2006)
## Appendix E  Journal Quality Assessment

### Table E.1 Categorization of used sources

<table>
<thead>
<tr>
<th>Type of source</th>
<th>Quantity</th>
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<td>Books</td>
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<tr>
<td>Conference papers</td>
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</tr>
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<td>Doctoral dissertations</td>
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<td>Government reports</td>
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<td>Scientific Journals</td>
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### Table E.2 Journal quality assessment

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<th>5-Year impact factor</th>
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<td>-</td>
<td>-</td>
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<td>Industrial Marketing Management</td>
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<td>European Management Journal</td>
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<td>Business Horizons</td>
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<td>Harvard Business Review</td>
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<td>Industrial and Corporate Change</td>
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<td>European Journal of Innovation Management</td>
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<td>-</td>
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<td>Management Decision</td>
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<td>International Journal of Service Industry</td>
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<td>2.402</td>
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<td>Management</td>
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<td>CIRP Annals – Manufacturing Technology</td>
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<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Journal of Quality in Maintenance Engineering</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Research Policy</td>
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<td>Organizational Dynamics</td>
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<td>The McKinsey Quarterly</td>
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<td>-</td>
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<tr>
<td>Organization Studies</td>
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<td>2.339</td>
<td>3.590</td>
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<tr>
<td>MIT Sloan Management Review</td>
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<td>1.452</td>
<td>2.317</td>
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<tr>
<td>Strategy and Leadership</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Journal of Manufacturing Technology Management</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Journal of Engineering Manufacture</td>
<td>1</td>
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<td>-</td>
<td>-</td>
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<tr>
<td>Strategic Management Journal</td>
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<td>6.818</td>
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## Appendix F  Business Model Literature

<table>
<thead>
<tr>
<th>Authors</th>
<th>Definition of business model</th>
<th>Business model elements</th>
</tr>
</thead>
</table>
| Chesbrough & Rosenbloom (2002) | “We offer an interpretation of the business model as a construct that mediates the value creation process.” | - Value proposition  
- Market segment  
- Structure of value chain  
- Cost structure and profit potential  
- Position within value network  
- Competitive strategy |
| Osterwalder (2004) | “A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams.” | - Target customer  
- Value proposition  
- Distribution channel  
- Relationship  
- Revenue model  
- Core competency  
- Value configuration  
- Partner network  
- Cost structure |
| Shafer et al. (2005) | “Business is fundamentally concerned with creating value and capturing returns from that value, and a model is simply a representation of reality. We define a business model as a representation of a firm’s underlying core logic and strategic choices for creating and capturing value within a value network.” | - Strategic choices (e.g. customer, value proposition, capabilities, pricing, competitors, offering, strategy)  
- Create value (incl. resources/ assets, processes/activities)  
- Capture value (incl. cost, financial aspects, profit)  
- Value network |
| Chesbrough (2007) | “The business model performs two important functions: value creation and value capture. First, it defines a series of activities, from procuring raw materials to satisfying the final consumer, which will yield a new product or service in such a way that there is net value created throughout the various activities. Second, a business model captures value from a portion of those activities for the firm developing and operating it.” | - Value proposition  
- Target market  
- Value chain  
- Revenue mechanism  
- Value network or ecosystem  
- Competitive strategy |
| Johnson et al. (2008) | “A business model, from our point of view, consists of four interlocking elements that, taken together, create and deliver value.” | - Customer value proposition  
- Profit formula  
- Key resources  
- Key processes |

Table F.1 Overview of business model literature
Appendix G

Interview Guideline

Name interviewee: 
Project: 
Date: 

Interview Guideline

Introduction
The research in general. Mater thesis: the servitization of project business.
Purpose of the interview and the use of the collected data: To investigate the current position of the selected cases on the conceptual framework.
Other matter: confidentiality, audio record, expected duration.

Background of the interviewee
What is your current function in the organization and what was the function at the time of the project?

Subjects and Questions
1. Customer
Can you give a description of the customer in the project?
What is the market segment and what are the specific characteristics of this market segment?
How would you describe the capabilities of the customer with regard to facility management?
How would you describe the customer’s sourcing strategy?
How would you describe the relationship with the customer, before, during and after the project?

2. Demand
What is demanded by the customer in this project?
(Design, Construction, Electrical/Mechanical Installations, Maintenance, Operations)
How was the customer need formulated/specifed? (PvE, VO, DO)
Did the specified demand leave room for design choices of Heijmans?
Was there any influence of Heijmans on the customer demand?

3. Offering
Which activities/deliveries are offered by Heijmans before the project, during the project and after the project?
Were there any products or services offered that were not demanded by the customer?
Advice/Consultancy/Design/Training/Maintenance/Operations/Finance/etc..
Did the offering provide the customer a solution with the lowest lifecycle cost? Why?

4. Tender
Can you elaborate on the tender method?
Why did the principal choose for this type of procurement?
Was the principal obliged by European legislation to apply a certain procurement method?
What were the award criteria? What was the competitive advantage of the proposal of Heijmans?
Did the tender method affect the offering? And how?

5. **External organization**
   - Who were the other stakeholders in the project and what were their roles?
   - How was the relationship with the other stakeholders?
   - Was there any type of partnership?
   - Was there a shared interest among stakeholders, or conflicting interests?
   - How is the customer involved in the project? What was the role of the customer?
   - Was the cooperation with other companies typical for this case or a standard way of working?

6. **Internal organization**
   - Can you describe the processes that took place in the company before, during and after the project?
   - Which departments are involved at which time in the process?
   - Was the services department involved during the design?
   - Can you give an example of how the service aspects changed the design?
   - Would you describe the internal organization as standard or was there anything specific for this type of project?

7. **Contract**
   - What is the type of contract that is used and why?
   - Would you describe the contract as a call-off contract a performance based contract or an effort based contract?
   - Did the contract involve Service Level Agreements (SLA’s)?
   - What is the duration of the contract?
   - What are the Key Performance Indicators of the contract?
   - What are the incentives for the user and for the provider?

8. **Revenue Model**
   - Can you describe the revenues that are generated from the project? Before, during and after the project?
   - Which part generates the most revenues?
   - Are the revenues certain from the start of the project or dependent on performances?
   - Is there a strategy of Heijmans to increase the revenues from the project?

9. **Results**
   - How is the outcome of the project assessed?
   - How is the success of the project measured?
   - Would you call this project a success for Heijmans and for the customer? Why?

**Reflection**
- Do you have any additions to the topics that have been discussed?
- What do you think about this interview? Was it what you had expected?
Appendix H  Detailed Case Descriptions

*Case I Meander Medical Centre*

The project started in 2008 when two merged hospitals in Amersfoort initiated a public tender for the realization of a new to build hospital. The scope of the project is the realization of 113,000 m$^2$ GFA (gross floor area) with a contract value of 175 million euro. The project can be described as traditional, since Heijmans is only responsible for the realization and not for the design or maintenance of the building. Nevertheless, the initiator tried to involve Heijmans in a building team to make use of the construction expertise of Heijmans in the design phase. The building contract was signed in May 2010 and commissioning is planned for September 2013.

The project was organized by a building committee that worked by order of the board of directors of the client. This building committee is in charge to coordinate the users (the doctors, nurses and patients), the architect, the design engineer, the building contractor and the technical advisors and is responsible that the building will meet the (end-)user’s needs. Together with external advisors, they started around 2006 with the formulation of the list of requirements. Next, after a design competition they selected an architect who made the conceptual design together with the design engineer and technical advisors. In 2008, the client initiated a call for tenders with a selection based on least price. Subscribers are asked to give a price for the realization of the building according to the conceptual design. Heijmans for the construction and Burgers Ergon for the technical installations together won this selection. In the last design stage, from conceptual design to final design and to detailed drawings the budget of the hospital decreased so the design had to be changed to decrease the price. Within the notion of the building team Heijmans theoretically had the ability to influence the design with their construction expertise. Nevertheless, in practice, the architect was unwilling to change his design to lower the price; therefore conflicts occurred within the triangle of client, architect and contractor. The next citation characterizes these conflicts:

“There had been conflicts. An architect like that sticks to his design. While we said, you have to kick the architect, if you want to do it for this budget. The architect keeps designing something more expensive. So if you don’t kick the architect, then we need more money to realize it. That is the role of the client…. At the end he needs to invest more, but in return he will get a nicer building…. If he (the client) had managed the process better, or had let us manage the process, then he had to pay a lower price for the hospital.”

During this last design phase, before the start of the realization, Heijmans asked Ballast Nedam to participate in a general partnership (i.e. vof) to spread the risk and to increase capacity. The design phase is closed with a construction contract (i.e. aannemingsovereenkomst). This contract contains the description of what has to be delivered, when it has to be delivered and at which price. During the realization phase, the general partnership (i.e. vof) has to procure the building material and assemble the components on the construction site. Up to 80% of the work is outsourced to subcontractors. The prefab concrete elements are manufactured at Bestcon, which is the concrete plant of Heijmans. Other elements are procured from suppliers, for example the prefab bathrooms. During the realization phase, additional work occurred: a pharmacy of 1.5 million euro, the underground and overground infrastructure and a bicycle shed. The realization of the fixed facilities, like desks and closets, are still under negotiations. Additional revenues on top of the sum of the construction contract did occur. The hospital is also in negotiation with Heijmans to outsource the maintenance for a period of 15 year. About why the client did not include the maintenance in the tender:

“On one side, he (the client) wants to outsource the maintenance and hand over the responsibility to a contractor who can invest in the realization to save costs during the maintenance phase. However, on the other side he (the client) wants to decide about all the details of the finishing of the building. That does not match with each other. That makes it difficult to introduce a Design-Build-Maintain at this type of customers.”
**Case II MSD Organon**
The second case is an example of a call-off maintenance contract. At a location in Oss, Heijmans building services maintains three industrial facilities of MSD Organon. The project covers only the maintenance of the construction, for mechanical and electrical installations other contractors are involved. The facilities are used for production and for R&D. About 8000 people work in these buildings. For the client it is important that the production facilities meet the GMP (Good Manufacturing Practice) norms and are always operational. The building needs to be available at any time.

MSD Organon organized a call for tenders for this maintenance contract. The selection criterion was price, but they also considered response time to failure, professionalism of the engineering department and the capacity of the contractor. The contract is an agreement of the response times, the hourly wages and the surcharge on subcontracting and material.

The interaction with the customer is organized with a mailbox system for maintenance tickets. About 2500 to 3000 maintenance tickets are received per year, which can be anything ranging from a door-handle to small rebuildings up to 25,000 euro. The maintenance contract with MSD Organon can be described as reactive and transactional, because the payments are based on the actual costs of every intervention plus a percentage fee. Constantly, 8 construction workers and 3 foremen are available to answer the ticket stream and to conduct small projects. Some work is performed in-house, other work is subcontracted to one of the 20 permanent subcontractors, depending on the type of work and the availability of employees.

When a work exceeds the size of a maintenance ticket it becomes a project. The difference is that for a project, a list of requirements has to be formulated, an offer has to be prepared and a construction contract has to be made with a fixed price for a certain delivery. Man hour and cost control become important. About the difference between the ticket stream and the projects one interviewee explained:

**“With the ticket stream you have to be smart, in planning. More important is that you have access to the customer, so you can score projects. That is where the profit is made. Not the ticketstream with its low margins. If you look at the projects, especially 1 on 1, including the engineering, those can have nice results.”**

Nevertheless, the maintenance contract is not a guarantee to obtain all the work. With large projects, the client always calls for tenders to get the best offer.

**Case III Jeroen Bosch Hospital**
In 's-Hertogenbosch, three locations of a hospital moved into one new to build hospital. The principal called for tenders in 2006, at that time, Burger Ergon was not yet part of Heijmans. The work was split up in a construction part, a mechanical installations part and an electrical installations part. Burgers Ergon was selected for the mechanical installations part. The selection was based on lowest price. The project included not only the realization, but also 10 years maintenance of the installations. Based on the statement of work (SOW), which is the final document of the design phase, Burgers Ergon had to price the realization of the work and the 10 years maintenance. The fact that Burgers Ergon was not involved in the design phase had consequences for the efficiency of the maintenance phase. One of the interviewees stated the following:

**“At the Jeroen Bosch Hospital, we (Burgers Ergon) had a very limited contribution of expertise. Only over the maintenance phase. Deers was the technical advisor who wrote the SOW. In some cases we decided to differ from the SOW. For example, we chose for a higher quality, more expensive pump, in order to decrease the costs during the maintenance phase. That efficiency gain was realized.”**

Although the project can be described as traditional, design and realization are separated; the maintenance phase makes this case interesting. The maintenance contract is one of the first performance based contracts of Burgers Ergon. Normally, a SOW for maintenance prescribes which activities have to be performed and how often. For example, air filters have to be checked three times a year. These type of contracts, 90% of Burgers
Ergon’s maintenance contracts are effort based contracts. A performance based contract is different and consists of several components. One is the technical condition according to the NEN2767. On a range from 1 (brand new) to 6 (rubbish) the condition is specified. In this case the installations have to be at all-time above level 3. The technical performance is also described in the performance contract. For example the temperature range, the light intensity and the throughput for air-ventilation. Another part are the service level agreements, about accessibility and response times. There is a bonus-malus system on mean time to repair.

To increase the efficiency of maintenance efforts, a pilot is initiated to test risk driven maintenance. With Failure Mode, Effects and Criticality Analysis (FMECA), Burgers Ergon investigates which installation components are linked with each other and what are the consequences in case of failure of one of the components. The result is that some components need preventive maintenance and other components are only replaced in case of failure, this method should save maintenance costs.

Besides maintenance, Burgers Ergon is also obliged to make monthly reports of energy and water usage and of failures and repair times.

**Case IV Frederik Barracks**

The customer demanded the complete story, design, realization and maintenance of an accommodation for 547 officers that includes the guardhouse for all of the barracks. The current buildings have to be demolished and the building site has to be prepared. Then, the building has to be realized within a specified time frame. The customer had provided some constraints about the design. About the type of façade they had in mind and the open ground level with a building on legs. The customers’ demand included a maintenance period of 30 years.

In this case, the contracting party is different from the user. The Ministry of Defense is represented by the DVD (Dienst Vastgoed Defensie) who is the official principal for the project. They formulated the demand specification and are the contact point during the project.

The procurement method for this project was a restricted tender. Out of all the subscribers, 5 parties were selected to participate in the tender. These parties were asked to submit a design based on the output specification and the submission requirements. For this project, the submission requirement was a preliminary design plus (VO+). The interviewee stated the following about the working with an output specification:

> “You only receive an output specification on basis of which you have to understand the customer and make a design. In the past, the architect used to spend a week at someone’s place to find out how a person lives and how to design an optimal house. Now, we only receive a few pages of information.”

The preliminary design is then assessed according to the Most Economically Advantageous Tender (MEAT) method. This means that both price and quality of the design are assessed. Price counted for 60% and quality for 40%. The assessment criteria for quality were sustainability, functionality and aesthetics. Heijmans scored this project on price, the difference in price compensated for the average score on quality. The building turned out to be 8 million cheaper than the 34 million estimated by the client. This was achieved by designing a very compact building, a short realization time and prefabrication of elements. The following citation describes the result of the design phase:

> “Moreover, it is a good-looking building, not just a blockbox. You have to distinguish yourself with your design, so you don’t go short on that. You only try to be cleverer.”

The design team consisted of the following parties: an architect, a structural engineer, a building physics consultant and co-making suppliers. The co-makers are suppliers that participate in the tender, they are responsible for part of the design and in case the project is won, the participating supplier has the right to realize the work. Maintenance can also be part of the co-makership.
Most of the risk of the 30 years maintenance phase is transferred to suppliers. For example the elevator company, they deliver the elevator including 30 year maintenance. The maintenance contract can be described as performance based, just as with the Jeroen Bosch Hospital. Payments are based on performance.

“The revenue model was to give an all-in price and an ingenious design and realization in combination with 30 years maintenance. So mostly efficiency.”

The departments of Heijmans that are involved in the realization of the project are Burgers Ergon for the technical installations, Bestcon for the prefab concrete elements, Infra for the groundwork and Heijmans Non-residential building for the construction.

Case V Military Museum Soesterberg
Two Dutch military musea, the Army Museum Delft and the Military Aviation Museum Soesterberg are combined at one new location, which is the existing airport Soesterberg. The end-users are the museum foundation, the visitors and the employees. However, the client in this project is the owner of the musea, the Ministry of Defense represented by the Government Buildings Agency. The ambition of the museum is to become one of the top 15 musea of the Netherlands with 200 thousand visitors annually. This project is the ultimate integrated project, with Design, Build, Finance, Maintain and Operate.

“For the customer it is not about the product, as long as it looks good and meets the minimum requirements, it is about the use phase and the operations of the building. The client wants to welcome 200 thousand visitors a year in this building. The fact that we have to stack bricks and mortar is unimportant for the client.”

The procurement process, a competitive dialogue, started in September 2010. After subscription, Heijmans was selected together with two other parties to participate in the competitive dialogue. This means that during the design phase, the candidates have conversations with the client. During these conversations, the provider can adapt his design, but the client can also change his specifications. The client has tried to formulate his demand in an output specification. However, there are some exceptions. One interviewee stated the following about the requirement to clean the facades four times a year:

“The customer had difficulties with the formulation of output specifications. There are technologies on the market that make it unnecessary to clean windows four times a year. Cleaning the outside façade costs 18 workdays with one man... A special Nano coating can bring a thin layer on the windows that repels dirt.”

Another interviewee about the output specification:

“They (the client) don’t describe how many square meters need to be build. Instead, they describe that the collection needs to be presented in a good and attractive fashion.”

The provider in this project is a Heijmans consortium under the management of Heijmans PPP (Public Private Partnerships). PPP arranges the finance with the bank and engages with Heijmans Non-residential building. Non-residential building forms an M&O part and an EPC part that both consist of nonresidential building, infrastructure and Burgers Ergon. See figure...

During the operations phase, the Heijmans consortium will be responsible for the security, ICT, cleaning, catering, internal mail distribution, parking management, the ticket distribution and the exploitation of the museum shop. In addition, it is required to deliver reports on customer satisfaction, environmental management and occupational health.
The winning tender will be chosen on MEAT. The assessment is based for 100% on qualitative aspects. Because the price is fixed on 107 million net present value, all the parties have to offer maximum quality for the same budget. Assessment criteria for this project are architecture, landscape, museum interior and optimal reuse of the existing airport facilities. What is remarkable is the neglect of service quality in the assessment criteria, because the division of costs for the EPC and the M&O is 50/50. One of the interviewees about the assessment criteria:

“The funny thing is, I’m working on something (M&O) for one year now, even though it won’t be part of the final assessment... The other chapters won’t be assessed. We don’t receive additional credits for it.”

The sixth dialogue product will be the final result of the competitive dialogue and will be the contract document. The decision on which party will win the work will be made in March 2012.

Case VI Municipal Office Rotterdam
The sixth case is a project that was in tender at the time of the interview. Later, in December 2011, it turned out the tender was successful and the contract was awarded to Heijmans.

The municipality of Rotterdam initiated a call for tenders for a new to build municipal office. The contract was awarded on basis of MEAT criteria, consisting of 85% price and 15% qualitative criteria.

The client had three ambitions, international appearance, 24/7 livability and sustainability. This project can be described as an engineer, build and maintain project. The client attracted an architect and advisors to make a preliminary design. On basis of this preliminary design, contractors had to give a price to realize the design. The winning contractor is obliged to take-over the contracts and continue the design process with the same team of advisors and the architect. Over the reason why the client chose for this approach the interviewee stated the following:

“We have to take-over all the advisors. In the past, clients had problems with the traditional cooperation. Advisors and architects made a design after which a contractor calculates a price. Then, in the realization phase, contractors find errors in the design and ask for more money. That is what the client wants to prevent from happening. Let the contractor take-over all the responsibility, then the client knows that what has been designed will be realized for the agreed price.”

Part of the contract are office spaces, 90 apartments and an underground parking with a total floor space of 43.000 square meters. The client asked for one provider who can offer the construction, the mechanical and electrical installations. Besides the final design and realization, also a maintenance period of 15 years is part of the contract. For the maintenance, the department services was involved to find optimizations in the design. One example of the input from services mentioned by an interviewee is the following:

“We had regularly meetings with someone from services. They give advice on which material to use. For example, the architect had designed etched windows with the etched surface on the outside. Cleaning of the façades is part of the maintenance contract. Therefore, in order to reduce maintenance costs, it would be better to turn the etched surface to the inside. This would reduce the amount of dirt that sticks to the windows.”

The fact that the project is tendered after the preliminary design phase provides Heijmans more room for input in the design. Cost optimizing changes in the design can increase the project’s profit for Heijmans. However, change of the design should be within the limits of the demand specification. Otherwise, the architect and the client would have to agree on the proposed changes. Some of these cost optimizations are already calculated in the tender price. This brings in a risk, because if the client and the architect stick to their plans, the costs can’t be reduced and the profit will decrease.
The value of the contract is 95 million euro. The realization is planned to start in 2013 and commissioning is planned at the end of 2014, this is one year earlier than the client expected.

**Case VII COA**

The service building department of Heijmans provides maintenance services at one third of the locations of COA (Central Agency for the Reception of Asylum Seekers) throughout the Netherlands. The COA provides accommodation for asylum seekers during the asylum procedure and prepares the asylum seekers for staying in the Netherlands or for return to their country of origin. For this public organization, Heijmans maintains the construction elements in a call-off contract. In 2009 the COA initiated a call for tenders. The awarding was based on a combination of quality and price (the interviewee did not remember the exact numbers). In a tender for a call-off contract, the client specifies a list of activities and the contractors have to give a price for these activities. For example, the price of one squared meter plasterwork or paintwork. That is for the price element of the awarding. The qualitative aspect is the contractor’s organization for the repair service. How the contractor processes maintenance calls. For these qualitative aspects they formulated a list of slas.

The contract had a maximum lead time of 4 years, but also a maximum budget. The maximum budget was reached after two years and thus initiated the COA a new tender in 2011. Heijmans servicebuilding participated again in this tender and at the time of the interview they were still waiting for the outcome. The demand of the customer is changing in time. The interviewee stated the following:

“What they (COA) want in the future is the following. Now they are in a transition period in which they change to one contractor (for the construction elements) instead of three. After this, the client wants to contract one party for both the construction and the installations. This is what is called maincontracting. One contractor who performs the complete maintenance. Moreover, the contractor has to manage everything, the subcontractors. The client wants to have one contract point.”

The COA has its own technical staff. They specify what the contractor should do. Their in-house technical staff also makes the multi annual maintenance plans. Besides the maintenance tickets, the agreements in the call-off contract are also used for small projects. About the revenues from this contract the following is stated:

“The COA contract has a basis of maintenance tickets for repairs. Because of the scale of the contract, many locations, there is a high number of repairs. However, the repairs are not the most interesting part of the contract. Once you are bounded to a customer, you will also obtain the project work. And the preventive maintenance.”

A large share of the work is subcontracted to suppliers. At the servicebuilding department, they make use of three national suppliers for glazing, for the sewerage and for the roofing. Other suppliers come from the regional dependence. They want to build long term relationships with these suppliers. You know what they charge and what their service levels are. Not everything is performed by suppliers, Heijmans servicebuilding also has maintenance staff. It depends on the situation and the type of work whether a supplier is called or not.

**Case VIII Eindhoven Airport**

The last case is a project that is obtained in November 2011. The contract covers the realization of an extension of the terminal and the realization of a hotel with 120 rooms. Total value of the project is 12 million euro.

The airport is for 51% owned by the N.V. Schiphol Group. The municipality of Eindhoven and the province North Brabant both have a 24,5% share in the ownership of Eindhoven Airport. The airport is used for both civilian as for military air traffic. Because the airport wants to expand their capacity a new flight terminal is
needed. The existing terminal has also been built by Heijmans in 2005. The project at that time was described as a success, because the project was realized under budget and the contractors made a good margin. The relationships with the client and with the partners from that project have been maintained. This resulted in a ‘warm acquisition’ for the new project. Because the project was cut in two parts, one with a commercial part and one public part, the European threshold for public procurement was not reached. The project was obtained in a direct agreement with the client.

The project organization can be described as a building team. The contractors are involved with the project after the preliminary design and have to work together with the architect and advisors to realize the project within time and budget. About the success of the building team, the interviewee stated the following:

“First you write your starting margin. Then, you can talk about all the risks. Normally (in traditional projects), you have to consider the risks that you find and calculate them in your offering. In a building team, risk can be eliminated or you can charge for it.”

Heijmans was part of the building team for the construction elements. The client makes use of separate contractors for the construction, the electrical installations and for the mechanical installations. Other partners in the building team were the architect, the project management bureau, a construction engineer and a technical installation advisor.

The client has no structured approach for maintenance of the construction elements. In case a failure occurs they contact a contractor and probably Heijmans. The maintenance is more interesting for the technical installations, because construction elements have long lifecycles and maintenance costs are low. The interviewee answered the following on the question why maintenance is not an interesting business for construction elements:

“Multiannual maintenance plans are good to retain your customer and maybe good for continuity and if you have a large amount of them it might be good for liquidity of the organization because you are secured of a steady stream of revenues. However, to make loads of money, no, forget it. Just no.”

And:

“Construction elements have to be solid. Customers expect no problems. If you build a roof, it has to function for 30 years. You can come twice a year to remove the leaves and see if everything is at place, but you won’t earn a penny with that. It makes no sense.”
## Appendix I  Data Extraction Table

<table>
<thead>
<tr>
<th>Case I Meander Medical Centre</th>
<th>Case II MSD Organon</th>
<th>Case III Frederik Barracks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customer segment</strong></td>
<td>Healthcare; Low resources; Own technical staff; High organizational complexity.</td>
<td>Pharmaceutical Industry; Own facility managers; Uncertainty about future; Own technical staff.</td>
</tr>
<tr>
<td><strong>Value proposition</strong></td>
<td>Advice during the final design phase; Engineering of installations; Realization of the construction + installations; Fixed cost for realization; Timely project delivery.</td>
<td>Maintenance of the construction; Reactive maintenance; Quick repair service.</td>
</tr>
<tr>
<td><strong>Channels</strong></td>
<td>Awarding on MEAT; Both price and quality; based on the realization of the preliminary design.</td>
<td>Work is obtained through a framework agreement; Awarding based on MEAT, criteria are sla’s and pricelist.</td>
</tr>
<tr>
<td><strong>Customer relationships</strong></td>
<td>Extended relationship in the pre-project phase; Involvement in the design phase; A maintenance contract is under negotiation.</td>
<td>Relationship through a call-off contract (4 yrs); Service desk; SLA’s.</td>
</tr>
<tr>
<td><strong>Revenue model</strong></td>
<td>Efficient realization; Procurement; Reduced lead time; Additional work.</td>
<td>Transactional revenues; Cost plus percentage fee; Surcharge on man-hours, equipment and material; Small projects.</td>
</tr>
<tr>
<td><strong>Key resources</strong></td>
<td>Project management skills; Prefab concrete plant; Production capacity; Knowledge on cost calculation; Experience with realization of hospitals.</td>
<td>Engineering skills; Service capacity; Service desk.</td>
</tr>
<tr>
<td><strong>Key activities</strong></td>
<td>Calculation; Advice during design phase; Procurement; Production.</td>
<td>Engineering; Planning; Reactive Maintenance; Cost control.</td>
</tr>
<tr>
<td><strong>Key partnerships</strong></td>
<td>General partnership with a direct competitor due to capacity constraints and for risk reduction; 70 to 80% of the work is performed by subcontractors.</td>
<td>Subcontractors; Network of service suppliers for specialized tasks.</td>
</tr>
<tr>
<td><strong>Cost structure</strong></td>
<td>The role of the architect is crucial in the cost structure; Penalty in case of delays; Production costs.</td>
<td>Man-hours; Material; Servicedesk; Subcontractors.</td>
</tr>
<tr>
<td>Customer segment</td>
<td>Case IV Military Museum Soesterberg</td>
<td>Case V Jeroen Bosch Hospital</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td></td>
<td>Government; Government Building Agency; Outsourcing of operations and maintenance; No technical staff/facility managers.</td>
<td>Healthcare; Outsourcing of maintenance; No technical staff; High organizational complexity.</td>
</tr>
<tr>
<td>Value proposition</td>
<td>Design, Realization, Finance, Operations and Maintenance (25 yrs); Fixed cost for availability; Guaranteed availability.</td>
<td>Realization and Maintenance of mechanical installations; Timely project delivery; Fixed cost for realization; Monitoring of performance; Guaranteed performance; Fixed cost for availability.</td>
</tr>
<tr>
<td>Channels</td>
<td>Competitive dialogue; Awarding based on MEAT after preliminary design; Only qualitative aspects; Demand specified in an output specification.</td>
<td>European restricted tender; Awarding based on lowest price for realization and maintenance of the final design; Demand specified in a list of activities and sla’s.</td>
</tr>
<tr>
<td>Customer relationship</td>
<td>Long term relationship because of O&amp;M contract (25 yrs); Performance defined in kpi’s; High share of wallet.</td>
<td>Long term relationship because of maintenance contract (10 yrs); Medium share of wallet.</td>
</tr>
<tr>
<td>Revenue model</td>
<td>Relational revenues; Monthly payments for availability of a functioning system; Fixed percentage of ticket sales (visitors&gt;200.000); Income from catering; Additional work.</td>
<td>Relational maintenance revenues; Transactional project sales; Monthly payments for performance; Bonus/malus on KPI’s; Additional work.</td>
</tr>
<tr>
<td>Key resources</td>
<td>Capital needed; Operational service employees: security, cleaning, shop employees; Maintenance service employees: gardeners, handymen etc.; Knowledge about customer’s business; Engineering skills.</td>
<td>Service capacity; Production capacity; Knowledge on customer’s processes; Remote monitoring system.</td>
</tr>
<tr>
<td>Key activities</td>
<td>Service design/development; Design for maintenance; Procurement; Systems engineering; LCC, FMECA; Maintaining own equipment.</td>
<td>Calculation; FMECA, risk driven maintenance; Preventive and reactive maintenance.</td>
</tr>
<tr>
<td>Key partnerships</td>
<td>Architect and advisors are subcontractors of Heijmans; Risk-bearing partners for soft facilities; Co-makers; Financial partner.</td>
<td>20 to 30 subcontracted service suppliers; General partnership with direct competitor because of limited capacity.</td>
</tr>
<tr>
<td>Cost structure</td>
<td>High tender cost because of design activities; Cost of capital; Cost of facility management; Realization vs. lifecycle is 50/50; More efficient use of product.</td>
<td>Lifecycle cost from providers perspective; Interim interest.</td>
</tr>
<tr>
<td>Customer segment</td>
<td>Case VII Municipal Office Rotterdam</td>
<td>Case VIII Eindhoven Airport</td>
</tr>
<tr>
<td>-----------------</td>
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<td>-----------------------------</td>
</tr>
<tr>
<td></td>
<td>Government; Local government; Outsourcing of Maintenance; No technical staff.</td>
<td>Commercial/Semi-government; 49% Local Government, 51% N.V. Schiphol Group; Own technical staff.</td>
</tr>
<tr>
<td>Value proposition</td>
<td>Final Design (engineering), Realization and Maintenance (15 yrs); Timely project delivery; Fixed cost for realization and maintenance; Guaranteed performance.</td>
<td>Realization of the construction; Cooperation with the architect and advisors in the design phase; Timely project delivery; Fixed cost for realization.</td>
</tr>
<tr>
<td>Channels</td>
<td>European restricted tender; Awarding based on MEAT; 85% price and 15% quality; Demand specified in a preliminary design.</td>
<td>Direct agreement; the public part of the work is below the European threshold; Demand specified in a preliminary design.</td>
</tr>
<tr>
<td>Customer relationship</td>
<td>Long term relationship through maintenance contract (15 yrs).</td>
<td>Customer retention through informal relationships; Short contractual relationship during realization (2 yrs.).</td>
</tr>
<tr>
<td>Revenue model</td>
<td>Transactional revenue from project delivery; Relational revenue from maintenance.</td>
<td>Efficient realization; Procurement; Transactional revenue from project delivery; Reduced lead time.</td>
</tr>
<tr>
<td>Key resources</td>
<td>Production capacity; Service capacity; Use-phase knowledge.</td>
<td>Customer relationship; Experience with previous project of the same customer.</td>
</tr>
<tr>
<td>Key activities</td>
<td>Calculations; Design for maintenance; Project management; Risk estimation.</td>
<td>Calculations; Work planning; Building team advice; Risk estimation.</td>
</tr>
<tr>
<td>Key partnerships</td>
<td>Architect and advisors subcontracted by Heijmans; Co-makers were attracted in the tender phase.</td>
<td>Members of the building team: architect, advisors, installation contractors, management bureau.</td>
</tr>
<tr>
<td>Cost structure</td>
<td>Cost reduction by shorter project lead-time; Cost optimizations in the final design phase; Penalty in case of delays.</td>
<td>In the pre-project phase: work planning and calculations; Interim interest during construction; Penalty in case of delays.</td>
</tr>
</tbody>
</table>

Table I.1 Data extraction table
Appendix J  Procurement Methods

This section will elaborate on the procurement methods that are common in the Dutch construction industry. In the construction industry there is a difference between an offer and a bid. Providers have to develop value propositions as a bid in a competitive tendering process. To avoid the costly process of competitive bids, providers try to develop long-term partnerships with customers for whom they can make offers rather than bids (Brady et al., 2005). Above a certain threshold, Public organizations are bounded by European procurement legislation.

European procurement legislation

The awarding of contracts for public work in the Netherlands is bounded by legislation from the European Union. The European rules regarding procurement are refined in a national regulation: called the ‘Aanbestedingsreglement Werken’ (ARW 2005). Only construction projects for public institutions that exceed a certain threshold are bound by this legislation. However, the same procedures for public tenders are also used by commercial parties to ensure clarity of the procedures and to obtain the best offers.

To evaluate the tender offers, a method called contract awarding is used. Two types of contract awarding exist: Least Price or Most Economically Advantageous Tender (MEAT). The second consists of a combination like price, quality and technology.

Within the Dutch construction industry, the following tender procedures are used:

- **Public tender**: The tender is announced in advance. Every provider that meets certain criteria of suitability is allowed to subscribe. The awarding organization has to choose the provider with the highest scoring offer on a set of previously known award criteria. This procedure is suitable for very specific orders where the contract is awarded by least price.

- **Restricted tender**: The tender is announced in advance. This procedure starts with a selection of at least five interested providers by a prequalification. Selected providers are invited to subscribe. With restricted tenders, contracts are awarded to the most economically advantageous offer and is suitable for projects that involve integrated design tasks.

- **Direct agreement**: In case of smaller orders that do not reach the threshold of European procurement, the awarding organization can decide which providers to invite for subscription, without making the tender public. The awarding organization is not allowed to negotiate with the subscribed providers before the contract is awarded. This procedure is similar to the restricted tender after the prequalification.

- **Negotiated procedure with preliminary announcement**: The awarding organization publicizes the tender and selects at least three providers. With one or more of these providers a negotiation will start to set the conditions of the assignment. This procedure is only allowed under extraordinary conditions like: in case of illegitimate or unacceptable subscription, in case of uncertain conditions that make pricing impossible, or in case of research and development.

- **Negotiated procedure without preliminary announcement**: The tender is not announced and the awarding organization is allowed to negotiate with just one provider. This procedure is allowed under specific circumstances: absence of subscribers, technical or artistic reasons, exclusive rights, urgency reasons, or in case of complementary orders.

- **Competitive dialogue**: Candidates are invited by the awarding organization to take part in a dialogue. Participating providers make proposals which are treated confidentially by the awarder. This procedure is common in complex orders in which a partnership in the form of a DBFMO is aimed for.

- **Framework agreement**: Over a period of approximately four years, conditions for the awarding of orders are fixed. In case of a framework with multiple contractors, the orders are awarded by direct agreement contracts during the specified period.