

## Eindhoven University of Technology

### MASTER

#### **Business capability mapping for service-dominant companies a case study at a financial leasing company**

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# Business capability mapping for service-dominant companies: a case study at a financial leasing company

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*Master Thesis*

In partial fulfillment of the requirements for the degree of

**Master of Science  
in Innovation Management**

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## **Abstract**

This master thesis describes the design of an approach for a business capability map: how should each service-oriented company create a business capability map, and compare different business lines in terms of business capabilities and processes? This design will be applicable for all service-dominant businesses, or businesses that are transiting into a more service-dominant environment. The establishment of this design started by the use of two aspects: the literature review and findings from the as-is analysis at De Lage Landen B.V. (DLL), a financial leasing company, a subsidiary company of the Rabobank, that is transiting into a more service oriented company. The two business lines of DLL involved in this thesis are mobility solutions and leasing.

The most important outcomes of the literature review are the BASE/X framework of Grefen (2013) and the business capability map of Ulrich (2015). The BASE/X framework provides a basis for structural agility by coupling stable elements as a service-dominant strategy and business services to fluid elements as business models and service compositions. The business capability map of Ulrich provides a building block approach to business capabilities, discusses how capabilities relate to the business architecture as a whole, and offers an approach for using capabilities as a basis for planning and executing a business/IT transformation program. These two approaches were combined and extended on the findings resulting from the as-is analysis conducted at DLL. This resulted in a conceptual framework, which described the different steps to be taken in order to come to a business capability map including the comparison of different business lines. Next, this conceptual framework is used to develop a business capability map at DLL for the two business lines. From this execution, a conclusion is formed, resulting in a new theoretical framework that focuses on service-oriented companies. Future research should indicate if the framework is applicable for every service-oriented company.

The results of the new framework indicate that the identity and a clear vision of the structure of a business form the basis for the building of the business capability map, and a service composition for each business line combined with value streams can help with the comparison of different business lines. By using this framework, service oriented companies will be able to create a business capability map for the whole enterprise, and will be able to compare different business lines in an organization. The business capability map will provide a common language for an organization, enables a refreshing view when making investment choices, serves as a baseline for strategic planning, change management, and impact analysis. The comparison of different business lines included in the approach ensures possibilities for re-use of capabilities across the business processes of the business lines.

## Preface

This master thesis is the conclusion of all the studies followed in the master program Innovation Management at Eindhoven University of Technology (TU/e). The thesis is executed as a case study at De Lage Landen B.V. (DLL) and is supervised by the IS (Information Systems IE&IS) and the ITEM (Innovation, Technology, Entrepreneurship & Marketing) departments at the faculty of Industrial Engineering & Innovations Sciences (IE & IS). This internship is the last phase of the master: Innovation Management.

This master thesis gave me the opportunity to work with the knowledge that I have acquired during my master Innovation Management. Two topics of this master were of special importance: servitization and business information systems. These topics provided the basic information that helped defining the approach for a business capability map. The approach of the business capability map is the main objective of this thesis. The design of such an approach asks for a design-oriented view. Here, my previous education of engineering architecture was very useful. I look back on an exciting project, which resulted in personal development, especially when it comes to an academic attitude and working a more structured way.

Although this project was an individual assignment, many people helped completing this project. Therefore, I would like to thank the people that helped realizing this project.

First of all, I would like to thank my first supervisor working at the Information Systems IE&IS department at Eindhoven University of Technology, prof. dr. ir. Paul Grefen. He always pushed me in the right direction with his constructive criticism. He also taught me to work in a structured way and taught me to visualize processes in order to make them more clear. I also want to thank my second supervisor working at the Innovation, Technology, Entrepreneurship & Marketing department at Eindhoven University of Technology, dr. Myriam Cloodt. She supported the development of the report, and helped me with the methodology of the approach. Her positive attitude helped me stay motivated throughout the whole project.

Furthermore, I would especially thank my two supervisors at DLL, John van de Voorde and Hans Tonneijk. They both supported me with a lot of constructive criticism and they provided me with the practical implications of the topic.

At last, I would especially thank my supporting parents and all my friends (with a special thanks to Thei Savelkoul) that helped me to stay motivated during my whole study.

Edwin Tange,

Eindhoven, January 2016

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## 1. Introduction

This chapter discusses the background, problem and objectives of this research. At the end of this chapter, an overview of the report structure is given.

### 1.1. Theoretical background

In all the different domains of the market nowadays, it becomes difficult to stay ahead of the competition. An upcoming trend to stay ahead of the competition is servitization. Servitization is winning ground, and more and more companies are making this shift. This service revolution started in the 1990's. Multiple industries have undergone the shift towards servitization. Due to a lower demand, an intensified competition and lower profit margins, manufacturing companies slowly changed their strategy from pushing products, to providing solutions (Cohen, 2006). Companies started to realize that services, which include all the activities from product delivery to the end of a product's life cycle, are a lucrative business (Wagner & Lindemann, 2008).

Servitization is first mentioned by Vandermerwe and Rada (1988), which is the innovation of an organization's capabilities and processes to better create mutual value through a shift from selling products to selling product-service systems (Baines, 2009).

However, servitization brings along challenges for a company. The design of a service dominant approach is significantly different to the design of a product oriented approach since, by their nature, services are time-intensive activities. This may discourage companies from expanding the service dimension, particularly because they need to take account of competition outside the usual domain from unexpected rivals including their own suppliers, distributors, and customers. According to Baines & Lightfoot (2009) the challenges top management face are threefold: challenges in service design, organisation strategy and organisation transformation. Manufacturing companies that decide on a service-oriented strategy have to adapt the necessary organisational structures and processes (Gebauer and Fleisch, 2007). Especially, there are challenges in defining the organisation strategy necessary to support the customer allegiance required to deliver a combination of product and services (Wise and Baumgartner, 1999). These challenges ask for a new way to look at an organization.

Business capabilities can be considered the building block of a new way to look to an organization. Business capabilities found its origin in 1985. Michael Porter was the first to describe core capabilities as what gives a company one or more competitive advantages in creating and delivering value to its customers (Porter, 1985). From here, different management fashions emerged that use capabilities to structure an organization. Examples are competitive forces approach, strategic conflict approach and resource-based approach. The latest approach that emerged is business capability mapping. While business capabilities has received a vast amount of attention in the literature, the use of a business capability mapping has received much less attention. This is due to the newness of this approach. The first and only to describe the use of business capability mapping is William Ulrich. According to Ulrich (2015) the business capability map provides a link between business architecture and IT architecture. Capabilities can provide business with a common language and can ensure that a firm will spend money to ensure that a given capability is supporting the business. They serve as a starting point for strategic planning, impact analysis, and change management. Although Ulrich describes how to build a business capability map, it does not explain how to properly compare different lines of businesses (LOB's), or handles service-dominant business strategy. Therefore, a coherent body which describes the steps to be taken to build a business capability map, including comparing different LOB's for service oriented companies is lacking in the academic literature. Developing these steps is necessary for companies that want to develop a business capability map. Hence, there exists a gap in the business capability literature. This research will try to close or limit this gap.

## 1.2. Business context

This research is conducted during an internship at De Lage Landen (DLL) at Eindhoven. DLL is a multinational company, that works in more than 35 countries and serves nine specialist sectors with equipment manufacturers, dealers and distributors. DLL is a fully owned subsidiary of the Rabobank Group. Nowadays, the company has about 5,500 members worldwide. The main objective of the company is to deliver financial solutions for the entire asset life cycle. They also deliver mobile solutions, factoring and consumer finance. The focus of this research engages in two of the most important lines of businesses (LOB) of DLL, namely leasing and mobility solutions. Leasing is the largest LOB. Its financial products are offered in three different regions: Europe, America and Asia. It offers multiple financial products, for example financing lease, operational lease and full service lease. The leasing product proposition is offered to various vendor types, for example equipment manufacturers, dealers and distributors. The LOB mobility solutions is executed via Athlon. Athlon became part of DLL in 2006 and is an international provider of operational car leasing and mobility solution, active in ten European countries. Athlon focuses on all businesses and non-profit organisations with a need to organize the mobility for professional as well as secondary-benefit purposes. Their portfolio exists of 250.000 contracts.

## 1.3. Problem statement

As stated in the theoretical background, many companies nowadays are transiting from a product-oriented company into a more service-oriented company. The reason for this change in the business strategy is mainly to meet customer expectations and to stay ahead of the competition. This change results in many consequences for an organization. According to Baines & Lightfoot (2009) the challenges top management face are threefold: challenges in organisation transformation, organisation strategy and service design. Companies need a shift of corporate mind set in order to take on services. Another aspect of organization transformation is the physical environment. There are also challenges in defining the organisation strategy necessary to support the customer allegiance required to deliver a combination of product and services (Wise and Baumgartner, 1999). Companies that decide on a service-oriented strategy also have to adapt the necessary organisational structures and processes (Gebauer and Fleisch, 2007). This includes adapting their IT-landscape as well.

Thus, companies face significant challenges when transiting into a service-oriented company. A way of dealing with these challenges is making use of a business capability map. The business capability serves as an essential communication medium between a business and an organization's ability to transform itself through the use of IT. Capabilities within a capability map provide business with a common language and represent a business-focused abstraction of the singular functions and information that IT systems must provide — in other words, a fundamental representation of the business requirements (Ulrich, 2015).

A business capability map can be the key to tackling the different challenges of the servitization process. However, adapting a business capability map brings along challenges as well. Many organizations struggle when adapting a capability map. The main reason is, as stated in the theoretical background the gap in the business capability literature. At the moment not many articles are related to business capability mapping.

DLL, a financial leasing company that is transiting into a service-oriented company, is working on such a business capability map. However, DLL also found out that adapting a business capability map brings along challenges as well. First of all, there exists a gap in the business capability literature. Secondly, different LOB's have different business processes, as they serve different overall business goals. However, different LOB's make use of similar capabilities though. The fact that their capability sets are not yet harmonized limits possibilities for re-use of capabilities across the business processes of the two domains. The limitation for the re-use can result in an inefficient IT-landscape and

inefficient business operation. The problem that has been the motivation for this research, has therefore been formulated as:

**The research problem:** Currently, DLL and other service-dominant businesses are struggling when adapting a business capability map, and face difficulties when comparing the business capabilities and business processes between different business lines.

## 1.4. Assignment

This section will discuss how the assignment is handled in order for the research to make a contribution to solve the problem statement mentioned in the previous chapter.

The problem statement shows that many companies are struggling with adapting the business capability map. In order to derive a solution to this problem, the regulative model cycle of Van Strien (1997) is used. This cycle is a predefined set of steps to reach a solution to operational problems. It consists of five stages: problem analysis, problem diagnosis, design, intervention and evaluation.

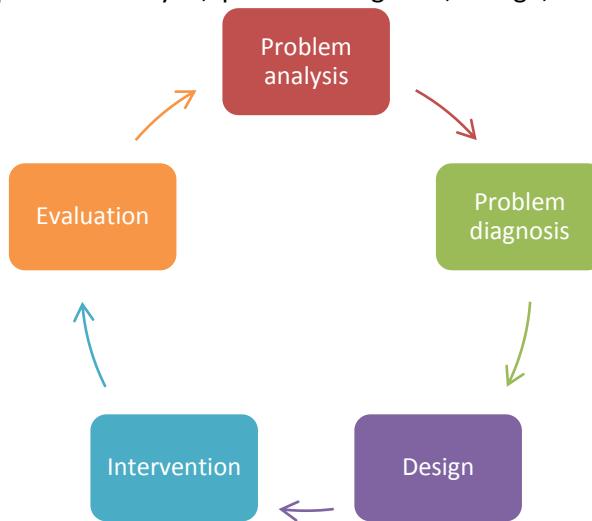


Figure 1 regulative model cycle (Van Strien, 1997)

The first step is the problem analysis. The problem in this case, is the fact that most service-oriented companies are struggling when adapting a business capability map, and face difficulties when comparing the business capabilities and business processes between different LOB's. This first step is coupled to the research problem mentioned in the previous section.

The second step is the problem diagnosis. This step consists of an analysis of the current and desired situation. This includes validation of the problem statement, exploration and validation of causes and effects, determine requirements, and exploration of solution directions (Van Strien, 1997). This will be achieved by firstly performing a literature study, followed by an as-is analysis of the current situation at DLL. The literature study deals with two topics: servitization and business capabilities. The as-is analysis will analyze different aspects at DLL, namely strategy, the business capabilities and processes, and value streams. This step results in two research objectives:

**Research objective 1:** identify the different aspects related to building a business capability map at a service-oriented company.

**Research objective 2:** analyze the different aspects related to building a business capability map at DLL.

The third step is the design phase. Now that the problem analysis and diagnosis have been made, an approach can be created in order to find a solution to the problem. This will be achieved by developing a conceptual framework based on the findings of the literature study and the as-is analysis. This step results in the following objective:

**Research objective 3:** make recommendations for service-oriented companies that want to build a business capability map, by providing them with a conceptual framework to build a business capability map.

The fourth step is the intervention. This means implementing the design of step three in order to get feedback on the implementation process. This will be achieved by executing the conceptual framework of step four at DLL. The feedback of the implementation will consist of conclusions for the design, explaining the strong and weak points and more. This step results in the following objective:

**Research objective 4:** create feedback on the conceptual framework, by the execution of the conceptual framework at DLL.

The fifth step is the evaluation of the project. First, the execution of the design will be evaluated. This will result in a new theoretical framework. After this step, the whole project will be evaluated by deriving the conclusion, making recommendations and more. This step results in the following objective:

**Research objective 5:** developing a new theoretical framework for service-oriented companies that want to build a business capability map, by using the evaluation of the executed design at DLL.

The research thus consists of five research objectives. The next chapter explains how these research objectives will be achieved by use of five different research steps.

### 1.5. Thesis outline

The first aspect of this thesis is introducing the reader to the topic. It starts with the research field and the aim of the study. The aim of the study is based on the business context, which tells us something about the company DLL and the problem statement. This introduction forms the first chapter. After the introduction, the research method of the thesis is explained. After this research method, a description of the literature review is provided. The literature review deals with two main topics: servitization and business capabilities. These two topics are necessary to come to the theoretical framework at the end of the chapter. This chapter therefore presents the theoretical background that was used. The fourth chapter deals with the analysis of the current state of the capability map at DLL. This as-is analysis is necessary to understand the situation, but will also help to define the conceptual framework. This conceptual framework is described in chapter five. The next chapter, chapter six, contains the second part of the design phase. Here, the conceptual theoretical framework is tested at DLL. This will test the applicability of the framework for DLL, and at the same time it will reveal the strong and weak points of the framework. This will be necessary to develop the new theoretical framework. Therefore, chapter six is relevant for people who want to learn how to use the theoretical framework when coming to a business capability map. The next chapter, chapter seven forms the final framework. It starts with the analysis of the executed framework. Eventually, the final framework is made to build a business capability map for a servitization company. Finally, the last chapter will focus on the conclusion of the research project. Here, the business problem will be central. It will also show the recommendations for DLL in order for the company to come to a good and functional business capability map.

	<b>Research stage</b>	<b>Research Objective / Question</b>	<b>Chapter</b>
Develop an approach for business capability mapping	Problem analysis		1. Introduction
			2. Research method
	Problem diagnosis	1	3. Literature review
		2	4. As-is analysis
	Design phase	3	5. Conceptual framework
	Intervention	4	6. Execution Framework
Evaluation		5	7. New theoretical framework
			8. Conclusion

Table 1 Report structure

## 2. The research method

This chapter discusses what will be achieved in this thesis, but especially how this is realized. This chapter consists of three topics: the research questions, strategy and data collection methods. The first chapter discusses the research steps that have been taken to achieve the objectives that were formulated in chapter 1.4.

### 2.1. Research design

The research design consists of five comprehensive research steps. The research steps are coupled to the research questions. The research questions arise from the research objectives obtained in chapter 1.4. Each research question corresponds to one research objective. For example, research question 1 is obtained from research objective 1:

#### Research step 1: theoretical analysis

**RQ 1:** What are the important aspects of servitization and business capability mapping?

The first question addresses the important aspects that are involved in business capability mapping. A literature review has been conducted as a theoretical starting point for this research. In order to address the aspects more specifically this step is divided in two topics: servitization and business capabilities. This first step is a starting point for the as-is analysis of research step two.

Mentioned below are the activities that are performed during this research step.

	<b>Research activities</b>	<b>Deliverable</b>	<b>Resources</b>
1	Literature review servitization	General description servitization	Current literature
2	Literature review business capabilities	General description business capabilities	Current literature

## Research step 2: empirical analysis

**RQ 2:** What is the current situation according to business capability mapping for the two business lines at DLL: mobility solutions and leasing?

This second question is an analysis of the current situation. Besides the discussion of the current business capabilities of the two domains at DLL, an important aspect is how these capabilities are mapped and addressed at DLL. How are the business capabilities used to form business processes? Other important aspects derived from research step one will be taken into account as well. Below the activities that are performed during this research step are listed.

Research activities		Deliverable	Resources
1	Analysis of strategy documents for leasing and mobility solutions	Assessment of the strategy documents	DLL documents
2	Analysis of business capabilities for leasing and mobility solutions	List of current capabilities including the assessment	DLL documents
3	Analysis of business processes for leasing and mobility solutions	List of current processes including the assessment	DLL documents
4	Analysis of value streams for leasing and mobility solutions	List of current value streams including assessment	DLL documents
5	Analysis of the current steps of the business capability mapping	Description and assessment of the steps	DLL documents

## Research step 3: conceptual design

**RQ 3:** How can the previous results be assembled into a framework for business capability mapping?

In the third question, the conceptual framework for business capability mapping is defined. This step elaborates on research step 1 and 2. First, an approach for the servitization process and business capability mapping is selected. These two approaches will be combined and enhanced by the information of the analysis in research step 2. This will result in a conceptual framework for business capability mapping for service-oriented companies.

Research activities		Deliverable	Resources
1	Describe servitization approach	Servitization framework	Current literature
2	Describe business capability mapping approach	Business capability map framework	Current literature
3	Describe specifications of approach	Specifications framework	Research activities 1 & 2
3	Build a conceptual approach	Conceptual framework	Research activities 1, 2 & 3

#### Research step 4: design testing

**RQ 4:** How will the conceptual approach of research question three work at DLL, followed by a gap analysis?

In the fourth question, the approach is executed. This will show the robustness of the design. What are the strong and weak points of the design? The two lists of the desired capabilities and processes for both domains arise from this execution. After this, a gap analysis between the two domains is performed. Below you find the activities that are performed during this research step.

Research activities	Deliverable	Resources
1 Execution of approach	Description of the executed approach	
2 Describing desired capabilities & processes mobility solutions	List of desired capabilities & processes mobility solutions	
3 Describing desired capabilities & processes leasing	List of desired capabilities & processes leasing	
4 Gap analysis	Gap analysis between the two domains	

#### Research step 5: Final design

**RQ 5:** How should a service oriented company create a business capability map, and compare different business lines in terms of business capabilities and processes?

The last question consists of the formulation of recommendations to close the gap arising from the execution of the approach at DLL. This step will result in a design that can be used to compare different business lines, focussed on the business capabilities and processes. This design will be applicable for multiple domains. This design must contribute to increased re-use of capabilities of different business lines. Below the activities that are performed during this research step are listed.

Research activities	Deliverable	Resources
1 Analysis of approach	Conclusions of approach Inclusive a list of strong and weak points	
2 Recommendations to close the gap	List of recommendations	
3 Overall design to compare different business lines	Description of overall design	
4 Conclude thesis	thesis	

In order to show the structure in this process, a schematic representation of the process is made, see Figure 2. The inner blocks show the activities that need to be conducted. The colours of the blocks indicate the phase of the research of these activities. The sequence of these blocks is displayed by the blue arrows. The red arrows indicate knowledge sharing between different activities and the black blocks show the main chapters and research questions of the thesis report.

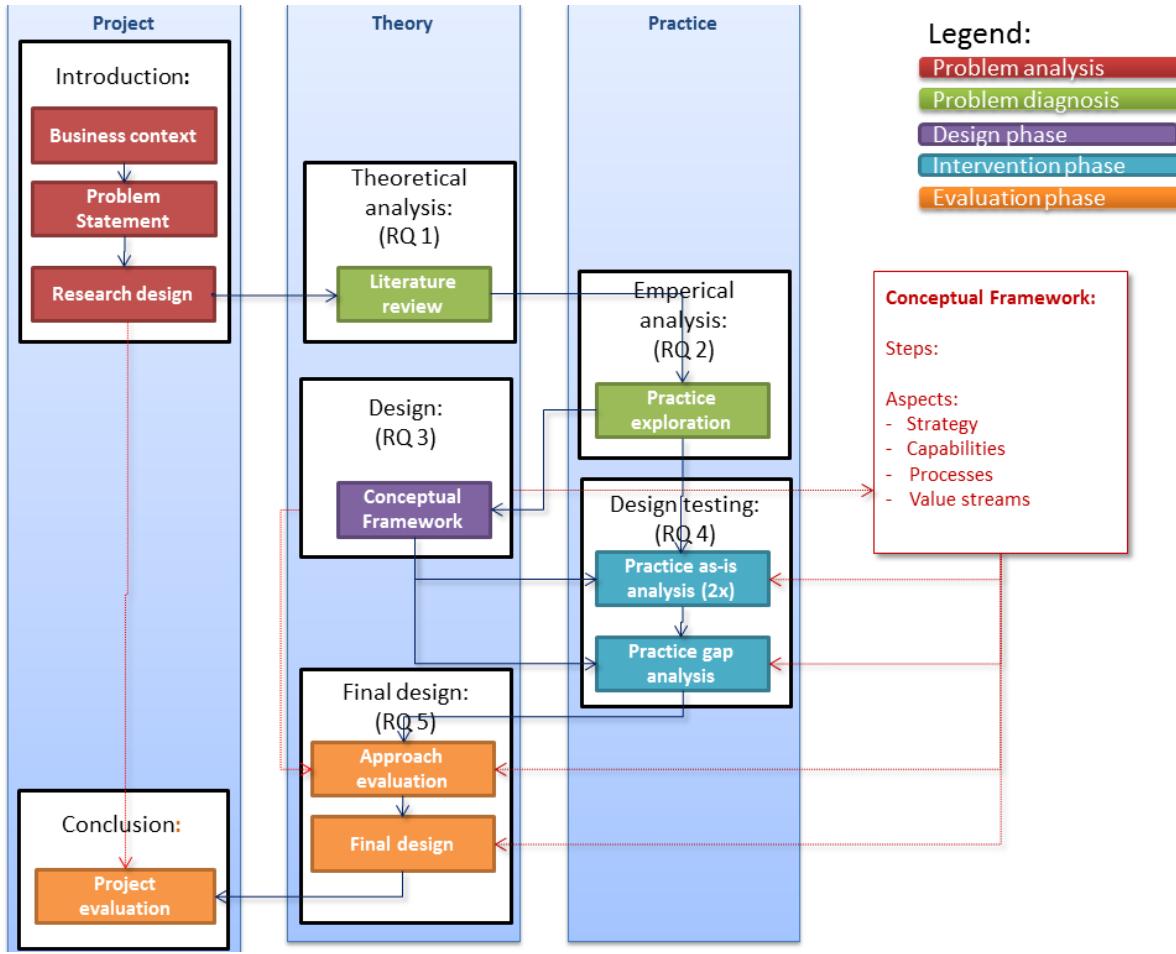


Figure 2 Schematic representation project

## 2.2. Research Strategy & methods

The previous chapter described the research questions that form the basis of this thesis. In this chapter it is explained how the knowledge required for answering these questions has been gathered and processed.

### 2.2.1. Theoretical analysis

The introduction addresses the problem analysis of this research. After the problem analysis, the problem diagnosis is performed. This step starts with a literature review. This review deals with two topics, namely servitization and business capabilities. These two topics form the basis for the conceptual framework for business capability mapping for service-dominant companies. For both topics, the research is performed in a breadth manner. The goal is to create an overall understanding of the topic and indicate aspects that are important for business capability mapping for service-oriented companies.

The main source of information for this theoretical analysis is the academic literature, collected from three databases: The website [www.scholar.google.com](http://www.scholar.google.com), the ProQuest – ABI/INFORM databases (offered by the TU/e Library), and the website [www.scopus.com](http://www.scopus.com). A more detailed explanation of the search strategy can be found in chapter 3.1.

### **2.2.2. Empirical analysis**

After the literature review, the as-is analysis is performed. For performing this analysis, the empirical data is collected by using the single case study approach (Yin, 2003). In order to follow a structured approach, the guidelines by Eisenhardt (1989) are used. The context of this case study is the financial leasing industry, characterised by a service-oriented approach. The aim of this analysis is to make the connection between the theory and the practical implication of the business capability map. The main unit of analysis within this context is the organization of DLL. The two sub units of analysis are the LOB's leasing and mobility solutions. The selection for the cases is based on practical reasons. The two business lines are the two business lines that at the moment are more engaged in developing the capability map. This analysis is part of an exploratory research. An exploratory research can be seen as an attempt to lay the foundations for a new angle on a topic that will lead to future studies.

The analysis is based on both qualitative and quantitative data. In order to obtain stronger evidence in this analysis, triangulation is used. Triangulation indicates that two or more methods are used. In this analysis, qualitative questionnaires and semi-structured face-to-face interviews are used as well as quantitative archival sources and documentation (Eisenhardt, 1989). The questionnaires are sent to the involved enterprise architects in forming the business capability map. The aim of these questionnaires is to get more insight into the different aspects involved in the business capability map (strategy documents, value streams, business processes, and business capabilities). Besides these questionnaires, semi-structured interviews are executed with collaboration of the enterprise architectures. The aim of these interviews is to get more insight in the process of the business capability mapping. All the sources and documentation that are involved in this analysis concern the aspects of the business capability map.

### **2.2.3. Conceptual design**

This conceptual design phase is built upon the information of the theoretical and empirical analysis. It starts with the selection of an approach for business capability mapping. The selection is derived from the theoretical analysis. Another important aspect is the servitization process. Also for this aspect an approach is selected. This is also performed in the theoretical analysis. These two approaches are then combined. From here, the information of the as-is analysis is used to ensure the practical implications of the design. Because of the combination of two approaches, too many uncertainties arise. Therefore, this design is considered a conceptual design. The final design will arise from the design testing, explained in the following chapter.

### **2.2.4. Design testing**

For performing this design testing, the same main unit of analysis as well as sub units are used as the empirical analysis: the main unit of analysis within this context is the organization of DLL. The two sub units of analysis are the LOB's leasing and mobility solutions.

The empirical analysis deals with the current situation of the business capability map of DLL. It only observes the different aspects that are important when dealing with the capability map. In this to-be analysis, the conceptual framework is executed. Every step will be analyzed. This will show which steps of the framework are correct and will help build the new theoretical framework of the business capability map.

### **2.2.5. Final design**

In this analysis, the execution of the theoretical framework of the previous chapter serves as the input of this chapter. The different steps, including those of the BASE/X framework are discussed with the two persons working on the capability map at DLL. This discussion results in recommendations for the framework, which will serve as the input for the new framework.

### 3. Literature review

A literature review is conducted as a first step of this research. It provides a good starting point for the development of the conceptual framework for business capability mapping for service-oriented companies. It forms the basis for the following research question:

**RQ 1:** What are the important aspects of servitization and business capability mapping?

This chapter provides an overview and evaluation of the literature that is related to this research. The literature review consists of two topics: servitization and business capabilities. Chapter 3.1 will first discuss and motivate how the literature survey has been conducted for the two topics. Chapter 3.2 discusses the servitization topic in short and form the important aspects of this topic. Chapter 3.3 discusses business capabilities and ends with the important aspects of this topic.

#### 3.1. Search methodology

This chapter describes how the literature survey has been conducted for the two topics. The literature study deals with two topics, namely servitization and business capabilities. These two topics form the basis for the conceptual framework for business capability mapping for service-dominant companies. The goal for the different topics are as follows:

- See how the process of servitization works on an operational level.
- See how business capabilities can be used on an operational level.

To guide the process of the literature review, a roadmap is made, see Figure 3. The process of this roadmap is explicitly related to the two goals stated above.

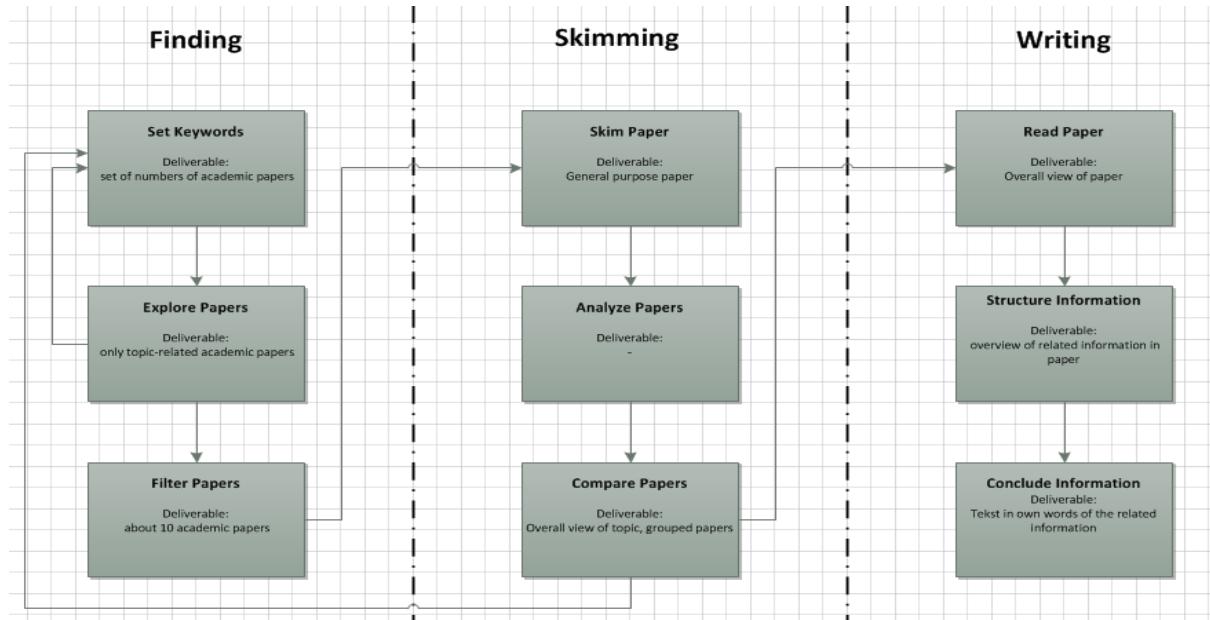


Figure 3 Roadmap literature review

##### 1. Finding

The literature review starts with an exploratory research. The finding process can be found in the left column of the roadmap. First, the keyword search strategy are used for finding relevant papers. Three different search engines are used for performing the search strategy:

- The website [www.scholar.google.com](http://www.scholar.google.com)

- the ProQuest – ABI/INFORM databases (offered by the TU/e Library)
- the website [www.scopus.com](http://www.scopus.com)

To restrict the number of potential articles found from the different search engines, different combinations of keywords are used.

To help the process of selecting the right papers, the number of citations of an article is an important aspect. The more often papers are cited, the higher the probability that the paper contains valuable information. Once, a broad understanding of the selected articles is formed, the right articles are selected. Papers that are unrelated or of insufficient quality will be set aside. After this, the selection of the papers is refined and eventually new key terms can be made to fulfil the focus of the search. This process is repeated until the complete topic is covered and all the required information is found and the right papers are selected.

The deliverables of this first step will be a set of roughly ten academic papers for each sub goal.

## **2. Skimming**

After this first selection, the papers are skimmed. The skimming process can be found in the middle column of the road map. By skimming the papers (reading the abstract, intro and conclusion) a general purpose and content of the article is created. From here, a conclusion is made if the selected papers are indeed interesting, innovative and topic related. The articles are grouped into categories. If in this stage of the process information is missing, or other papers indicate that there is information that is important as well, the process is repeated with new keywords or the snowballing technique is used to find missing information.

The deliverable of this step is a list of papers, grouped by categories and notes about the papers for both topics

## **3. Writing down results**

This last process can be found in the right column of the road map. Here, the findings of the papers are written down. Important in this step is to be specific, to explain new definitions, identify trends or patterns and gaps in the literature, develop pros and cons for certain topics and come up with examples for specific topics. The deliverable of this step is chapter 3.2 for the servitization topic and chapter 3.3 for the business capability topic.

### **3.1.1. Search strategy servitization**

For the first topic the first keywords that are filled in in the search engines are ‘servitization’. This resulted in about 4000 papers. It is impossible to explore all these papers and therefore a selection is made using the number of citations of the paper as well as relevant titles. This resulted in a list of ten academic papers. These papers are skimmed and analyzed. Now a general purpose of the topic is created and the relative papers are grouped. After skimming and analyzing the papers, six papers are selected that cover the general topic of servitization. The keywords that are filled in in the second search process is ‘servitization drivers challenges’. This resulted in about 1600 papers. From this list, one paper is selected that covers the focus of the search. Arising from the challenges of servitization, one missing part of the literature review is the environment of servitization. Therefore, the following key words were formed: ‘service organisation’ and ‘surroundings’. The keywords that are used in the third search process are ‘servitization’ combined with ‘service transition’ and ‘blueprinting’. This resulted in about sequentially 200 and 180 papers. This resulted in three papers that are relevant for the topic. All these steps result in a list of ten academic papers that are used to cover the topic of servitization. These ten papers form the basis of this topic, however through the use of snowballing, other papers are used as well, see reference chapter.

### 3.1.2. Search strategy business capabilities

For the second topic, the first keywords that are used in the search engines are ‘business capabilities’. This resulted in about 7000 papers. From here, a selection is made based on the number of citations of the paper as well as relevant titles. This resulted in a list of ten academic papers. These papers are skimmed and analyzed. Now a general purpose of the topic is created and the relative papers are grouped. After skimming and analyzing the papers, five papers are selected that cover the general situation of business capabilities. However from skimming the papers, the understanding emerged that resource-based view plays a role in the beginning of business capabilities. Therefore, “resource-based view” and “business capabilities” were new key words. This resulted in about 800 papers, resulting in one paper added to the list. From here, a more general purpose of the topic is created. Because business capabilities is a broad definition, more specific keywords are used to find the related papers. The keywords that are used in the second search process are ‘business capabilities’ combined with ‘enterprise architecture’ and ‘information systems’ and ‘information technology’. This resulted in consecutively 800, 3000, and 3500 papers. From this list one paper is selected that covers the focus of the search. The last focus is placed on the process of developing business capabilities and mapping them. In this search process the used keywords were: “business capability map”, which resulted in 70 results and “capability deployment”, which resulted in 500 papers. After skimming the relevant papers, only one paper was deemed relevant. All these steps result in a list of ten academic papers that will be used to cover the topic of business capabilities.

### 3.1.3. terminology

Before the servitization topic is described, terms that may cause confusion are defined. In the topic of business capabilities, many terms are used with different definitions. Therefore, the following table lists the definitions of the terms used in this thesis.

term	Definition
<b>Business capability</b>	Business capabilities, or simply a “capability,” defines <i>what</i> a business does. It does not communicate or expose <i>where</i> , <i>why</i> , or <i>how</i> something is done (Ulrich, 2015)
<b>Business service</b>	Business services define the business capabilities of an organization, i.e., the core functionalities a business organization offers to its (commercial) context (Grefen, 2013)
<b>Business resource</b>	Business resources are a general category that came in two categories: material or human resources that provide a firm the means to perform its business processes
<b>Value stream</b>	Value streams depict <i>how</i> a business achieves value for an internal or external stakeholder. They are defined as an end-to-end collection of activities that create a result for a customer (Whittle, 2004)

Table 2 Terms thesis

## 3.2. Servitization

According to Baines and Lightfoot (2009) servitization is the innovation of an organization’s capabilities and processes to shift from selling products to selling integrated products and services that deliver value in use and tend to emphasize the potential to maintain revenue streams and improve profitability. In servitization two different approaches exist: goods-based servitization and service-dominant business: goods-based servitization starts from goods and adds services to increase the value. Service-dominant business takes services (or rather value-in-use created by the execution of services) as a starting point and only involves goods when they are necessary for the realization and execution of these services. This research only deals with service dominant businesses.

According to Baines and Lightfoot (2009), there are three factors that drive companies to a servitization strategy: financial, strategic and marketing. Wise and Baumgartner (1999) made an

estimation that, according to the sector the company is in, it is possible to double the revenue of your company, despite a possible drop in sales. Adding services to products is labor dependent and less visible since these activities happen in the back office of a company. Therefore, services are more difficult to imitate (Oliva and Kallenberg, 2003). By using relationship-based customer interaction instead of transaction-based customer interaction, the relationship with a customer will stay more stable. The probability of retaining the customer therefore increases (Baines and Lightfoot, 2009).

The challenges top management faces are threefold: challenges in service design, organisation strategy and organisation transformation (Baines & Lightfoot 2009). Manufacturing companies that decide on a service-oriented strategy have to adapt the necessary organisational structures and processes (Gebauer and Fleisch, 2007). Specifically, there are challenges in defining the organisation strategy necessary to support the customer allegiance required to deliver a combination of product and services (Wise and Baumgartner, 1999). Adopting a downstream position, such as the provision of installed base services, organisations have to be service oriented and create valuable services (Oliva and Kallenberg, 2003). One way to tackle these challenges is by making use of the BASE/X framework. Although, other articles deal with the servitization process, in this thesis the BASE/X framework is chosen as the best fit for this process, mainly because this framework delivers a complete approach. The BASE/X framework is a structure for the development of a new service-dominant business: business strategy, business models, their operationalization in service compositions, business services, and their implementation in state-of-the-art automated service management platforms (Grefen, 2013).

### 3.3. Business capabilities

The term business capabilities is already encountered in this literature review when handling the business service layer of the BASE/X framework. Here, business capabilities are stated as "the core functionalities a business organization offers to its (commercial) context" (Grefen, 2013). In order to introduce business capabilities and processes, the first thing to do is introduce resource-based view of the firm.

Resource-based view aims to provide a sustainable competitive advantage. This advantage can be achieved by managing the resources of a company such that their outcomes cannot be imitated by competitors. Therefore, resources must be rare, valuable, inimitable, non-tradable and non-substitutable as well as firm-specific (Barney, 1986). According to Amit & Schoemaker (1993), resources can be divided into resources and capabilities, where resources are tradable and non-specific to the firm, while capabilities are firm-specific and are used to engage these resources within a firm. An extension on this theory, as well as an alternative is capability management. Capability management or capability-based view (CBV) enables description and discussion on the dynamism of the new technology development and its conversion in products that modify the market structure, and induces the own firms' growth (Gusbetti, 2013). The approach is based on the theory of the firm as a collection of capabilities that may be exercised to earn revenues in the marketplace and compete with other firms in the industry. However, according to (Gusbetti, 2013) this CBV is limited or relatively unresearched.

The terms resources, capabilities and business processes are recurrent terms in these theories. Many different definitions exist. To make it more clear, the following definitions will be used in this literature review:

'Resources' and 'capabilities' are used interchangeably and refer to the tangible and intangible assets firms use to develop and implement their strategies. A capability can be seen as an assembly of people, process and technology for a specific purpose. It defines *what* a business does. It does not

communicate or expose *where, why, or how* something is done — only what is done (Ulrich, 2015). ‘Business processes’ are actions that firms engage in to accomplish some business purpose or objective. Thus, business processes can be thought of as the routines or activities that a firm develops in order to get something done (Nelson 1982). An example of a business process is the process of delivering products or services to customers.

According to Leonard (1995), business capabilities can be subdivided into three different groups: core capabilities, enabling capabilities and supplemental capabilities. Core Capabilities aim to provide competitive advantage for a firm. These capabilities are built up over time and are difficult to imitate, due to sustained and long organizational learning. According to Leonard (1995), these capabilities consist of four dimensions: employee knowledge and skill, Physical technical systems, managerial systems and values and norms. Supplemental Capabilities are defined as those that are nice to have but are not essential. They add value to core capabilities but could be imitated. Enabling capabilities are important to a company as a minimum basis for competition, but convey no particular competitive advantage. In other words enabling capabilities are those which a firm has to do, in support of its normal operations and core capabilities, but which are not themselves core capabilities.

#### **Resource-based approach:**

The resource-based approach is already mentioned in the introduction of business capabilities. It sees firms with superior systems and structures being profitable not because they engage in strategic investment that may deter entry and raise prices above long run costs, but because they have markedly lower costs, or offer markedly higher quality or product performance (Teece, 1997). Important in this approach is that a company knows what the strong and weak points are and to find and create a competence that is really distinctive. Especially in the short run, firms stuck to some degree on what they have and have to live with what they lack: it takes time to develop new competences, some assets are not tradable and they possess a certain reputation that needs acceptance from the customer. This approach is more fixed: First identify your firm’s unique resources, then decide in which markets those resources can earn the highest rents to finally decide whether the rents from those assets are most effectively utilized by integrating into a related market, selling the relevant intermediate output to related firms or selling the assets themselves to a firm in related business (Teece, 1980).

#### **Dynamic capabilities**

The question of how firms achieve and sustain competitive advantage can also be answered by developing dynamic capabilities. According to Teece (1997), dynamic capabilities are the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. They reflect an organization’s ability to achieve new and innovative forms of competitive advantage given path dependencies and market positions. The end product of a company (goods or services) are based on utilizing the competences that it possesses, which will depend on its capabilities over time. The dynamic capabilities are especially relevant for innovation-based competition, price/performance rivalry, increasing returns, and the ‘creative destruction’ of existing competences. According to Teece (1997), the dynamic capability approach has similarities of three other approaches or management fashions: competitive forces approach, strategic conflict approach and resource-based approach.

#### **Competitive forces:**

The competitive forces approach found its origin in the 1980s, pioneered by Porter (1980). He formulated the approach as ‘relating a company to its environment’. Five industry level forces: entry barriers, threat of substitution, bargaining power of buyers, bargaining power of suppliers, and

rivalry among industry incumbents determine the profit potential of a certain industry, see Figure 4. This approach helps to find a position in an industry from which it can best defend itself against competitive forces: First pick an industry based on its attractiveness, then choose the entry strategy based on the competitor and finally acquire or obtain the assets or knowledge to compete in the market.

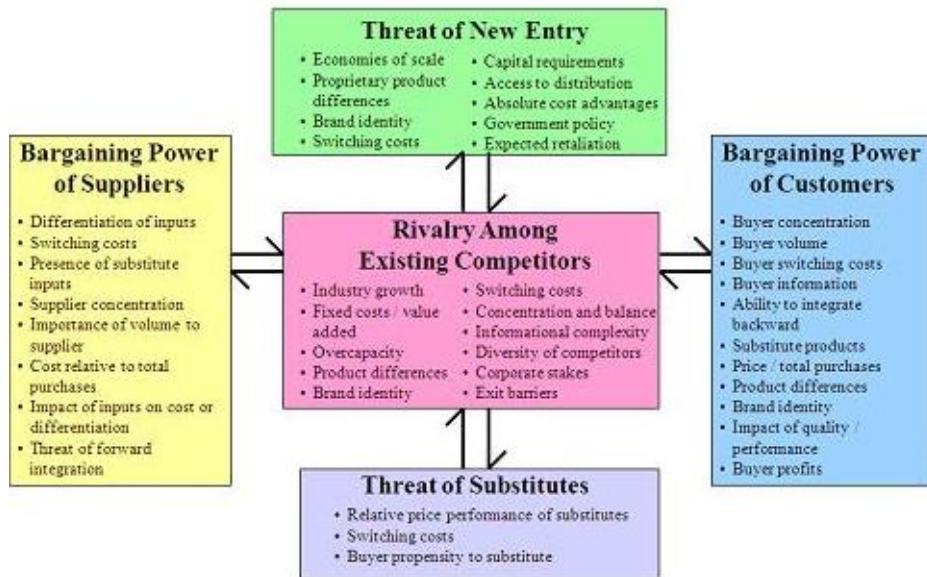


Figure 4 Five forces model (Porter, 1980)

#### Strategic conflict:

The strategic conflict approach utilizes the tools of game theory to analyze the nature of competitive interaction between rival firms. It deals with rival firms and how a firm can influence the market environment by influencing the behaviour and actions of rivals, and thereby increase its profits (Teece, 1997).

#### Dynamic capabilities approach:

The potential of this approach lies in the short coming of the resource-based approach: the fact that it does not promote managerial strategies for developing new capabilities. Dynamic capabilities focus on the ability to achieve new forms of competitive advantage. The term 'dynamic' refers to the capacity to renew competences so as to achieve congruence with the changing business environment; certain innovative responses are required when time-to-market and timing are critical, the rate of technological change is rapid, and the nature of future competition and markets is difficult to determine. The term 'capabilities' emphasizes the key role of strategic management in appropriately adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competences to match the requirements of a changing environment.

The approach starts with identifying which distinctive and difficult-to-replicate advantage can be built, maintained, and enhanced. In order to determine the distinctive capabilities of a firm, a distinction is made between processes, positions, and paths. Or stated in other words: 'the competitive advantage of firms lies with its managerial and organizational processes, shaped by its asset position, and the paths available to it' (Teece, 1997). The process refers to the way things are done, the position refers to its current technology, intellectual property, customer base, and network relations and path refers to strategic alternatives available to the firm, and the presence or absence of increasing returns and attendant path dependencies.

### **Business capability mapping:**

The business capability map plays an important role in strategic planning for business as well as for business/IT alignment. “Business capability mapping *is* the process of modelling *what* a business does to reach its objectives (its capabilities), instead of *how* it does it (its business processes)” (Cook, 2007). Because literature is still quite naïve in this field, only one relevant article can be found that describes the process of building a business capability map. The article of Ulrich (2015): The Business Capability Map: The “Rosetta Stone” of Business/IT Alignment. According to this article, a capability map is a blueprint for a given business or company. It creates a common language for businesses to document and visualize capabilities within the context of various analysis or planning activities. There are several factors that make the business capability an essential aspect of strategic and transformational planning: it provides commonality of views across business units; it provides commonality of views between business and the IT organization; it allows executive teams to view the situation from a holistic perspective; it avoids shot-in-the-dark solutions (address issue that is not fully understood); it uses ‘heat maps’ to show underperforming or in need of attention capabilities (Ulrich, 2015). According to Ulrich (2015) there are four aspects that are important when building a business capability map: information, organization, value streams, and resources. The information aspect refers to documents that help building a business capability map, for example industry templates. The organization aspect refers to a clear and common view for companies with different lines of businesses (LOB’s). Different LOB’s need to collaborate and consolidate their thinking. This can be achieved by clear strategy documents. Resources are a general category that includes technologies, funding, and other assets as appropriate. Value streams depict *how* a business achieves value for an internal or external stakeholder. They are defined as an end-to-end collection of activities that create a result for a customer. Value streams are a very high-level view of value accretion, broken into stages. Value stream stages further decompose into business processes, which typically define the details below various stages of a given value stream.

### **3.4. Conclusion**

This literature review is conducted as a first step of this thesis. It serves a theoretical starting point for the business capability framework and provides the relevant aspects for building a business capability map for service-oriented companies. The following research question has been answered in this chapter: What are the important aspects of servitization and business capability mapping?

The BASE/X framework of Grefen (2013) showed that for the servitization process the following aspects are important: business strategy, business models, service compositions, and business services. The article of Ulrich (2015) showed that there are four aspects that are important when building a business capability map: information like industry templates, organization (which refers to clear defined strategy documents), value streams, including business processes, and resources.

In the next chapter, these aspects are analyzed for DLL.

## 4. As-is analysis

This chapter aims to investigate the situation as it is now regarding the aspects and decisions of the business capability map at DLL. This chapter deals with the following research question:

**RQ 2:** What is the current situation according to business capability mapping for the two business lines at DLL: mobility solutions and leasing?

In the previous chapter the following important aspects were highlighted: business strategy, business models, service compositions, and business services regarding the servitization process, and information, organization, value streams, and resources for business capability mapping. However, only the aspects that are suitable for analysis at DLL are explained. These are: business capabilities, strategy, value streams and business processes. This is done for two different business lines at DLL, namely leasing and mobility solutions. In chapter 4.1 a method is created in order for other companies to analyze the different aspects that are important for the business capability map. For the business capabilities, business processes, value streams, and the strategy of a company, different tables are created in order to analyze these aspects. By using these tables, a company will see if the concerned aspect (capabilities, processes, value streams, and strategy) is sufficient or in need of some adjustments. The adjustments are also presented in the tables. Chapter 4.3 begins with the description of the steps already performed at DLL regarding the business capability map, followed by an analysis of the four aspects at DLL. This chapter serves as input for the conceptual framework.

### 4.1. General analysis tools

In this analysis, the important aspects derived from chapter three are investigated. These are the business strategy, business capabilities, business processes, and value streams. DLL is already busy trying to develop business capability maps. At this moment in time, they only defined the capabilities and processes and of course the strategy. So first a method is created to analyze the different aspects, after that the different aspects and the process of the business capability map at DLL is analyzed. The results are shown below.

#### 4.1.1. Business Capabilities

According to Leonard (1995), business capabilities can be subdivided into three different groups: core capabilities, enabling capabilities and supplemental capabilities. Core Capabilities aim to provide competitive advantage for a firm. These capabilities are built up over time and are difficult to imitate, due to sustained and long organizational learning. According to Leonard (1995), these capabilities consist of four dimensions: employee knowledge and skill, physical technical systems, managerial systems and values and norms. Supplemental Capabilities are defined as those that are nice to have but are not essential. They add value to core capabilities but can be imitated. Enabling Capabilities are important to a company as a minimum basis for competition, but convey no particular competitive advantage. In other words Enabling Capabilities are those which a firm has to do, in support of its normal operations and Core Capabilities, but which are themselves not Core Capabilities.

In order to analyze the current business capabilities DLL has already defined, the following criteria table is used. The criteria table is based on the criteria table for services (Grefen, 2013), and adjusted using the knowledge on business capabilities from the literature review.

Class	Name	Criterion	If fails
How	Right grammar	Is the capability defined as a noun, instead of a verb?	Rename capability
	Right definition	Is the capability defined as a business term instead of a technical term?	Rename capability
	Right sequence	Is the sequence of the capability logical	Replace capability

		for the capability above and/or below the current capability?	
<b>why</b>	Right context	Does the capability fit in the context of the defined business strategy?	Redesign capability
	Right goal	Does the capability transform the state of the customer perception of the value-in-use?	Delete as business capability, consider as capability
<b>What</b>	Right size	Is the capability easily combinable in multiple service compositions?	Too large: split up capability Too small: combine capability
	Right scope	Is there no functional overlap with existing capability(s)?	Re-scope capability(s)
	Stability	Is the capability stable, instead of volatile?	Make the capability stable
	Right relationship	Does the capability have relationships to IT deployments and future-state IT architecture?	Delete capability
<b>Who</b>	Right actor	Is there a clear single actor (role) performing the capability?	Split up capability per actor
	Right beneficiary	Is there a single beneficiary (role) for whom the capability is performed?	Split up capability per beneficiary
<b>When</b>	Right start	Is there a clear starting point in time for the execution of the capability?	Scope capability down to delimited period
	Right end	Is there a clear ending point in time for the execution of the capability?	Scope capability down to delimited period

Table 3 Criteria business capabilities

#### 4.1.2. Strategy

In order to define capabilities and processes, the strategy of the organization must be clear. The strategy of an organization will enable an organization to achieve its long-term objectives. It is the process of specifying the organization's mission, vision and objectives, developing policies and plans, often in terms of projects and programs, which are designed to achieve these objectives, and then allocating resources to implement the policies and plans, projects and programs. These specifications need to be documented, so that employees of an organization are aware of the purpose of the organization. For example, these documents can be used when defining business capabilities and processes.

The strategy of an organization depends on the purpose of an organization. In this thesis a distinction is made between service-dominant and manufacturing companies. From current literature regarding defining the strategy of both companies, Table 4 is composed. For the analysis of the strategy of the company, first the documents of the company that define the strategy must be gathered.

Class	Name	Criterion	If fails
<b>Market relationship</b>	Exogenous	Is the value delivered to the customer clear?	
		Is the empowerment of the customer clear?	
	Endogenous	Is it clear which partners the company or business line is working with?	

		Is it clear which processes/capabilities are outsourced?	
<b>Business competences</b>	Value	Is it clear if the company makes use of co-creation?	Define particular strategy class
		Are the pricing schemes defined for the different business lines?	
	Collaboration	Is it clear if the company relies on co-production?	
		Is it clear if the company uses service integration?	
		Is it clear if the company makes use of knowledge sharing?	
<b>Business resources</b>	Actors	Are all the customers, partners and employees clear for the organization?	
	infrastructure	Are all the service flows clear?	
		Is the general purpose of the information systems clear?	

Table 4 Criteria business strategy

#### 4.1.3. Business Processes

A business process is a collection or combination of related and structured activities or modules within an enterprise which describes their logical order and dependence. It serves a particular goal for a particular customer or group of customers. According to McHugh (1993) a business process is best defined as "a set of linked activities that take an input and transform it to create an output. Ideally, the transformation that occurs in the process should add value to the input and create an output that is more useful and effective to the recipient either upstream or downstream." These business processes can be subdivided into three classes:

- Management processes. These processes control the operation of an enterprise.
- Operational processes. These processes consist of the core business of an organization and create the primary value stream.
- Supporting processes. These are the processes that support the core processes.

Management processes relate to the enabling capabilities, operational processes relate to core capabilities and the supporting processes relate to the supplemental capabilities which can be found in the framework of Ulrich (2015). A business process consists of different characteristics. From these characteristics, derived from the articles of McHugh (1993) and Vanderfeesten (2007), Table 5 is constructed to analyze a certain business process.

Class	Name	Criterion	If fails
<b>How</b>	Right cohesion	Is the cohesion between different modules in the process sufficient?	Redesign process
	Right coupling	Are all the interconnections between different modules clear?	Re-consider interconnections
	Right complexity	Is the design of the process as simple as possible?	Make it simpler.
	Right modularity	Does the process not consist of too few or too many modules?	Too few: more modules, Too many: less modules
	Right description	Are all the terms in the modules clear?	Rename modules
<b>why</b>	Right output	Does the output of the process create useful and effective value to the recipient?	Transform or delete process

	Right goal	Does the process serve a clear goal?	Transform or delete process
<b>What</b>	Right size	Is the process embedded in an organizational structure?	Replace process or delete process
	Right scope	Is it clear which functions the process fulfills?	Find function or delete process
<b>Who</b>	Right actor	Is there a clear actor performing the process?	Find actor or delete process
	Right beneficiary	Is there a beneficiary for whom the process is performed?	Find beneficiary or delete process
<b>When</b>	Right start	Is there a clear starting point in time for the execution of the business process?	Scope process down to delimited period
	Right end	Is there a clear ending point in time for the execution of the business process?	Scope process down to delimited period

Table 5 Criteria business processes

#### 4.1.4. Value streams

Value streams are a high-level view of value creation and consist of several stages or activities. The stages or activities further decompose into business processes, which define the details below the stages. They depict how a business achieves value for an internal or external stakeholder. Value streams are not the same as business processes because they represent high-level views that add-up all paths, rolled up into an executive friendly view of decision structures or information. Value streams use a wide range of capabilities and otherwise capabilities can be mapped to each stage of the value stream. Below, a table is provided to analyze a certain value stream.

Class	Name	Criterion	If fails
<b>How</b>	Right grammar	Are the stages of the value stream defined as a high level view?	Rename value stream stages
	complete	Are all the activities necessary to deliver the product or service present and available?	Reconsider stages
	Right sequence	Is the sequence of the value stream stages logical?	Replace stages
<b>Why</b>	Right context	Does the value stream fit in the context of the defined business strategy?	Redesign or delete value stream
	Right goal	Does the value stream represent how a company achieves value?	Redesign or delete value stream
<b>What</b>	Right size	Are the stages of the value stream decomposable into business processes?	Redesign stages
	Right relationship	Does the value stream have relationships to IT deployments and future-state IT architecture?	Delete value stream
<b>Who</b>	Right actor	Is there a clear actor(s) (role) performing the value stream?	Delete value stream
	Right beneficiary	Is there a single beneficiary (role) for whom the value stream is performed?	Delete value stream
<b>When</b>	Right start	Does the value stream begin with a stakeholder that triggers the first stage?	Redesign stages

	Right end	Does the value stream ends when the product or service is delivered to the stakeholder?	Redesign stages
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Table 6 Criteria value streams

## 4.2.DLL

Now that the aspects to analyze the different aspects in business capability mapping are clear, the analysis is executed for DLL. The analysis starts with the description of the steps that are already taken by DLL. From here, the four aspects will be analyzed. In order to analyze the current situation, first a questionnaire is sent to the employees of DLL that are involved with building the business capability map. These questionnaires can be found in appendix 5. Once these questionnaires were filled in a meeting was conducted with the enterprise architects working for DLL. These employees explained which steps were already taken in the process of creating the business capability map, where the questionnaires were used to guide the conversation.

### Step 1: decision-making

For DLL, and this goes for every company that wants to build a business capability map, the first step is to discuss if it is a good and profitable idea to make the map. Here, the reason why you want to build such a map is important, as well as the advantages and disadvantages. DLL chose to hire an external company that deals with the architecture of information systems. The external company explained that such a map would be ideal for building a road map and it would support DLL's view to increase the customer's perspective. According to the enterprise architects of DLL, the main objectives of the the capability map (incl. functions, processes and services) is to support the back-in-the-box strategy and determine and support re-usability and rationalization within the boxes (business capabilities or business functions).

The final decision was made after an enterprise architecture board meeting with all the involved persons:

- All the senior business representatives from each business unit;
- The internal department Continuous Process Improvement (CPI);
- The external company: for the architecture of information systems;
- The external company: a business solution specialist.

Now the process of building the business capability map begins.

### Step 2: define level 1 capabilities

The start of the business capability map involves a lot of business meetings. The same persons that were involved in step 1 participate in these meetings.

DLL chose to begin with building the map for only one business line: leasing. Although a start is made for the leasing business line, the final business capability map is for the whole organization of DLL. For the level one and level two capabilities, the company also had a look into the business line mobility solutions. Therefore, the starting point was a complete list of the business processes, as well as the product catalogue. The product catalogue is a list of DLL that describes all the products and services that are delivered to the customer. This catalogue is later used by the enterprise architects to help define the business service catalogue by the business solution specialist. For DLL, these documents helps to visualize what is required within the company in order to build the capability map.

In order to see how the capabilities must be structured, DLL used best practice, in particular the subdivision of Ulrich (2015), see Figure 83 Service organization level 1 capability map.

Another important aspect in these meetings is the DLL corporate mid-term plan: a plan made by the internal department corporate strategy. This document is then confirmed and approved by the executive board. Then, the executive board processes the input from the extended leadership group (about 30 employees, including all the important leaders from important business units, corporate functions, and the executive board) and convert them into the mid-term plan. The extended leadership group can be seen as the owners of the business capabilities. Also a mid-term plan is made for the different LOB's . All the mid-term plans are made for three years and are checked and revised every year. From all these documents the corporate IT strategy is made. This document is used to form the Enterprise BIG picture. The company already defined BIG pictures for leasing, mobility solutions, asset management, financial operations, and customer interaction. These documents were also used to define the different capabilities. For example, the BIG picture for leasing uses the enterprise BIG picture as a starting point. The business services were used, as well as the corporate services and business intelligence, see .

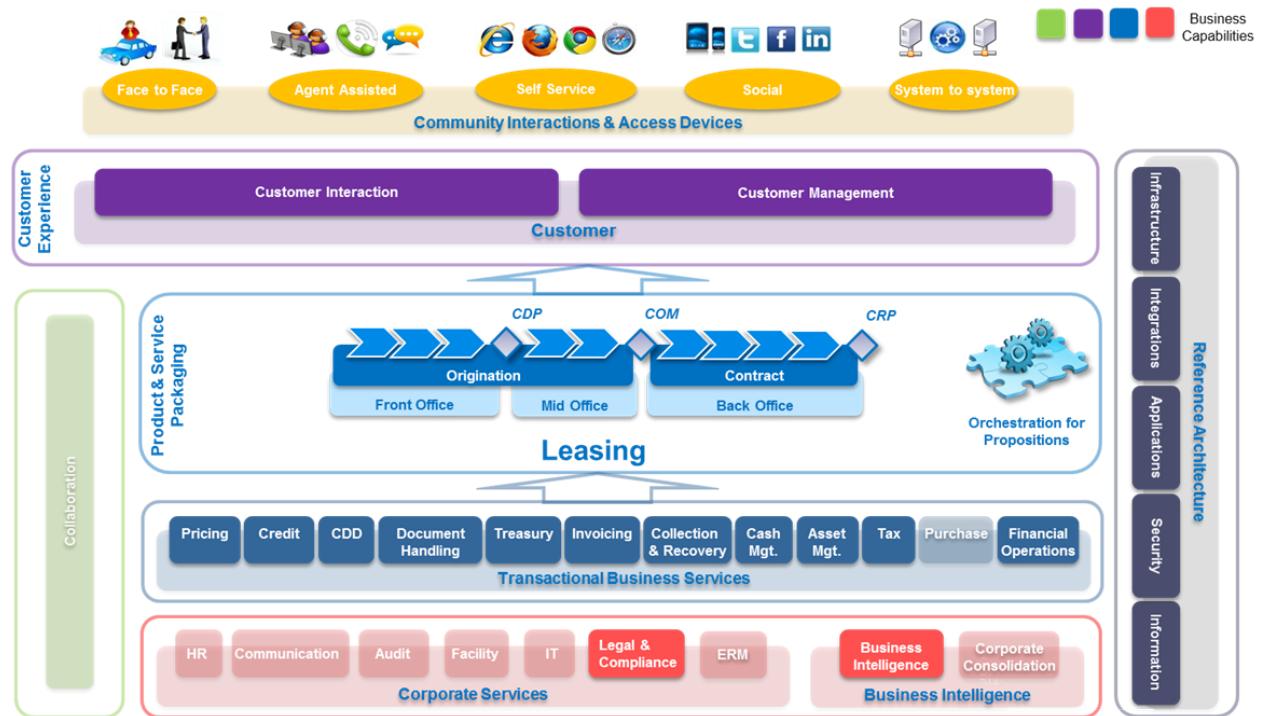


Figure 5 Enterprise BIG picture

So, especially from the business processes and the business service catalogue of leasing, as well as the BIG picture, the internal information for the company is gathered. In order to structure the different capabilities, the subdivision from Ulrich (2015) is used. From here, a draft version is made for level 1 capabilities. The draft version is first created in Microsoft Excel. Eventually, all the stakeholders accepted the level 1 capabilities after a few meetings. Once accepted, the capabilities are transformed into Abacus. The Abacus tool set helps to capture the interconnected structure of a business, where large datasets can be imported, modeled, analyzed, and represented in a visual format. It helps to understand ones IT landscape and easily creates links between different aspects, for example the value streams, business capabilities and processes (Avolution, 2015). DLL uses Archimate, a tool that offers a common language for the description of business processes, IT systems and more. This helps all the different stakeholders to communicate in the same way. For example, in Archimate a business capability defined in this thesis is the same as a business function in Archimate.

### Step 3: define level 2/3 capabilities

The composition of the level 2 and level 3 capabilities starts from the already created list of the level 1 capabilities. So the starting point here was the previous level of capabilities. To gather the internal information of the company the list of business processes and the business service catalogue were also used. They first defined the level 2 capabilities that were added to the draft version from the level 1 capabilities. They started defining the level 3 capabilities once all the stakeholders accepted the level 2 capabilities. At the moment, they are actively reviewing with the involved stakeholders in order for everybody to accept the level 3 capabilities before adding the more detailed business capabilities.

#### 4.2.1. Capabilities

In the previous chapter it can be seen that DLL is already busy developing a capability set for different business lines in the organization. In this chapter the current defined capabilities for the business lines leasing and mobility solutions are analyzed. The company already defined about 200 capabilities, all level 1, level 2 or level 3 capabilities. Due to time restrictions it would be impossible to analyze all the capabilities, therefore a representative set of capabilities is analyzed. The company already built a capability map. Here, they make use of the same distinction in capabilities. A distinction is made between strategic, core and supporting capabilities. These level 1 capabilities are the same for both business lines. The differences in business lines occur after the level 3 capabilities. The current state of the business capability map can be seen in Figure 6. The set consists of capabilities in different classes and different levels. A distinction is made between the different lines of businesses between DLL: leasing and mobility solutions. However, this distinction is not yet carried out in the business capability map.

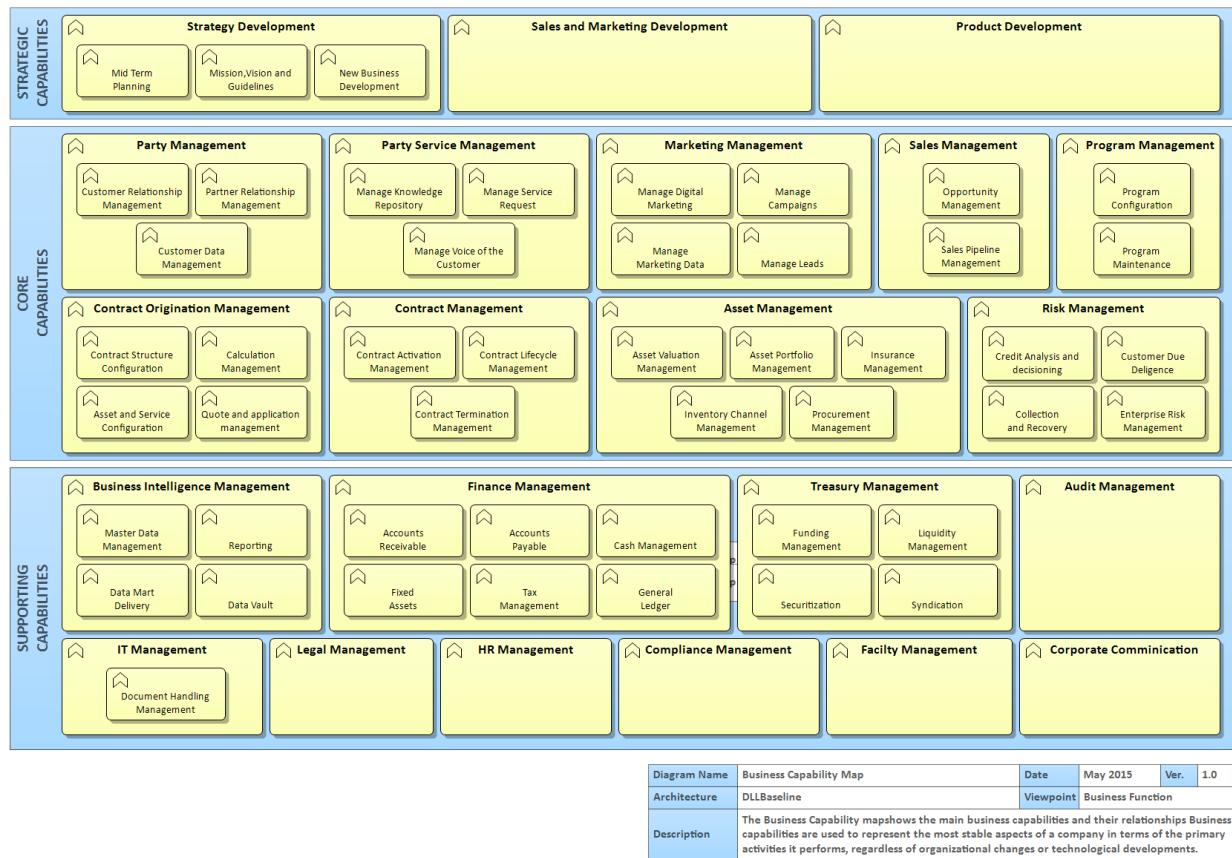


Figure 6 Business capability map DLL

Class	Name	Customer relationship management	Delete customer profile	Contract management	Manage parties data quality
<b>Capability Level:</b>	Level 1	Level 3	Level 1	Level 3	
<b>How</b>	Right grammar	Yes	Yes	Yes	Yes
	Right definition	Yes	Yes	yes	No
	Right sequence	Yes	Yes	Yes	Yes
<b>why</b>	Right context	Yes	Yes	Yes	Yes
	Right goal	Yes	Yes	Yes	Yes
<b>What</b>	Right size	Yes	Yes	Yes	Yes
	Right scope	Yes	Yes	Yes	Yes
	Stability	Yes	Yes	Yes	Yes
	Right relationship	Yes	Yes	Yes	Yes
<b>Who</b>	Right actor	Yes	Yes	Yes	Yes
	Right beneficiary	Yes	Yes	Yes	Yes
<b>When</b>	Right start	Yes	Yes	Yes	Yes
	Right end	Yes	Yes		

Table 7 Analysis capabilities leasing

Class	Name	Vehicle ordering	Execute pre-order checks	Fuel reporting	Create service card transactions report
<b>Capability level:</b>	Level 2	Level 3	Level 2	Level 3	
<b>How</b>	Right grammar	Yes	No	Yes	No
	Right definition	Yes	No	No	No
	Right sequence	Yes	Yes	Yes	Yes
<b>why</b>	Right context	Yes	Yes	Yes	Yes
	Right goal	Yes	Yes	Yes	Yes
<b>What</b>	Right size	Yes	Yes	Yes	Yes
	Right scope	Yes	Yes	Yes	Yes
	Stability	Yes	Yes	Yes	Yes
	Right relationship	Yes	Yes	Yes	Yes
<b>Who</b>	Right actor	Yes	Yes	Yes	Yes
	Right beneficiary	Yes	Yes	Yes	Yes
<b>When</b>	Right start	Yes	Yes	Yes	Yes
	Right end	Yes	Yes	Yes	Yes

Table 8 Analysis capabilities mobility solutions

From the criteria tables above, it can be concluded that the capabilities are well defined. However, in order to differentiate between business capabilities and value streams and business processes, it is

best to use only nouns for the capabilities, where verbs are used for the other two aspects. This also controls the fact that a capability must only define what a business does, instead of how a business does something.

#### 4.2.2. Strategy

In order to analyze the strategy of DLL, first the documents that define the strategy are gathered, see . The overall strategy is defined in the enterprise big picture. Here, the information is kept more superficial. The strategy defined for leasing and mobility solutions, however is much more elaborated. The big picture for leasing includes aspects as vision statements, key partners, activities, and resources, customer relationships, revenue streams and more. The big picture for mobility solutions is less extensive and includes aspects as vision and ambition, context analysis, planning, gap analysis, etc. Below, you can see how these two documents are assessed. From here, it can be concluded that both business lines are well explained in terms of the strategy.

Class	Name	Leasing	Mobility solutions
Market relationship	Exogenous	Yes	Yes
		Yes	Yes
	Endogenous	Yes	Yes
		Yes	Yes
Business competences	Value	Yes	Yes
		Yes	Yes
	Collaboration	Yes	Yes
		Yes	Yes
		Yes	Yes
Business resources	Actors	Yes	Yes
	infrastructure	Yes	Yes
		Yes	Yes

Table 9 Analysis strategy documents DLL

#### 4.2.3. Business processes

The business processes are also defined for DLL. Here, again a distinction is made between the two business lines in the organization: leasing and mobility solutions. Both business lines consist of about 500 different business processes ranging from different functional domains like contract management to vehicle disposal. Here, also a few processes are analyzed by the table defined in the previous chapter.

Class	Name	Cash application	Document contract	FIN – High level FLow
How	Right cohesion	Yes	Yes	No
	Right coupling	Yes	Yes	Yes
	Right complexity	No	Yes	Yes
	Right modularity	Too many	Good	Good
	Right description	Yes	Yes	No
why	Right output	Yes	Yes	No
	Right goal	Yes	Yes	No
What	Right size	Yes	Yes	Yes
	Right scope	Yes	Yes	Yes
Who	Right actor	Yes	Yes	Yes
	Right beneficiary	Yes	Yes	Yes
When	Right start	Yes	Yes	No
	Right end	Yes	Yes	No

Table 10 Analysis business processes leasing

Class	Name	Create technical inspection	Create fuel report	Set up clauses
How	Right cohesion	Yes	Yes	Yes
	Right coupling	Yes	Yes	Yes
	Right complexity	Yes	Yes	Yes
	Right modularity	Good	Good	Good
	Right description	Yes	Yes	Yes
why	Right output	Yes	Yes	Yes
	Right goal	Yes	Yes	Yes
What	Right size	Yes	Yes	Yes
	Right scope	Yes	Yes	Yes
Who	Right actor	Yes	Yes	Yes
	Right beneficiary	Yes	Yes	Yes
When	Right start	Yes	Yes	Yes
	Right end	Yes	Yes	Yes

Table 11 Analysis business processes mobility solutions

It can be concluded that the business processes of DLL, for the different business lines are well defined and structured. This can be coupled to the fact that the business processes of DLL are designed by an external company specialised in business processes.

#### 4.2.4. Value streams

The value streams are less familiar for DLL. Before the building of the business capability map the company made use of value chains. According to DLL, these are high-level views with a set of activities that summarize all the activities in a single business line, see Appendix 5: questionnaires. This results in two value chains: one for leasing and one for mobility solutions. However, when building the business capability map, some value streams for leasing were developed and placed in Abacus. For mobility solutions, a beginning is made with defining the value streams. The value streams are assessed below.

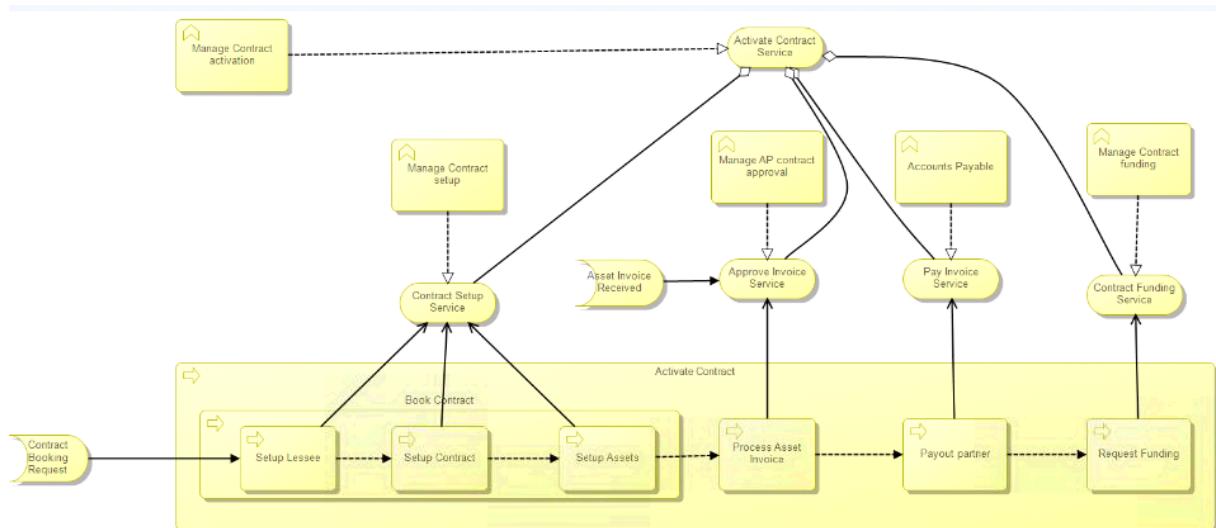


Figure 7 Value stream leasing: activate contract

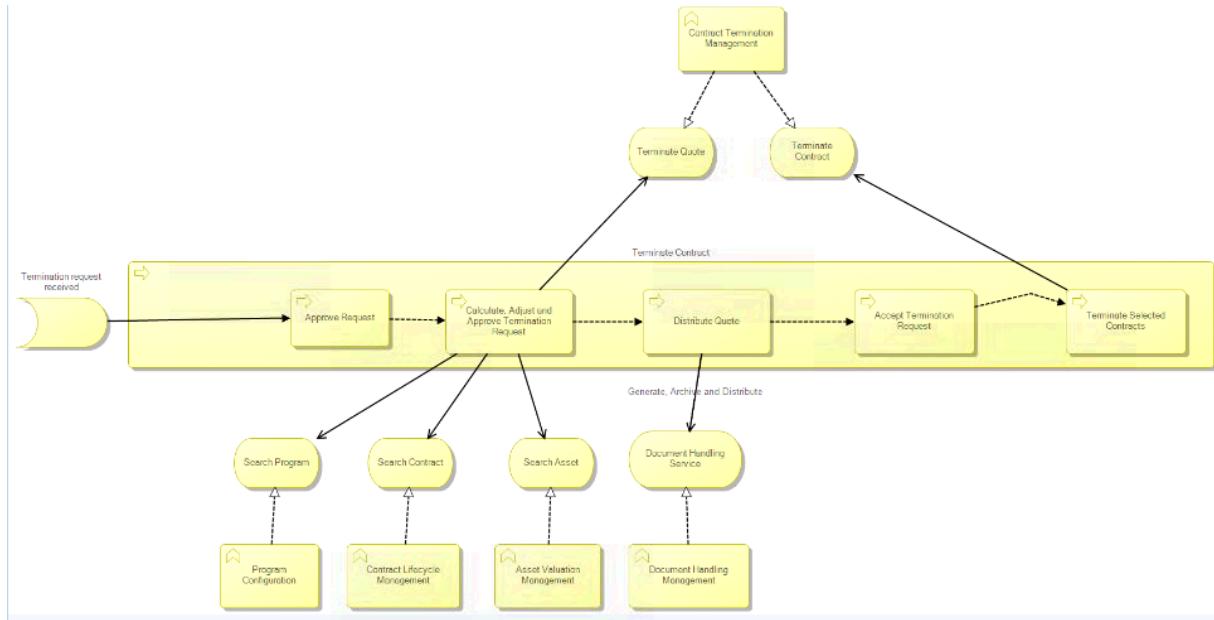


Figure 8 Value stream leasing: terminate contract

## Leasing

Class	Name	Activate contract	Terminate contract
How	Right grammar complete	yes	Yes
	Right sequence	yes	Yes
	Right context	yes	yes
why	Right goal	yes	yes
	Right size	yes	yes
What	Right relationship	yes	yes
	Right actor	yes	yes
Who	Right beneficiary	yes	yes
	Right start	yes	yes
When	Right end	yes	yes

Table 12 analysis value streams leasing

## Mobility solutions

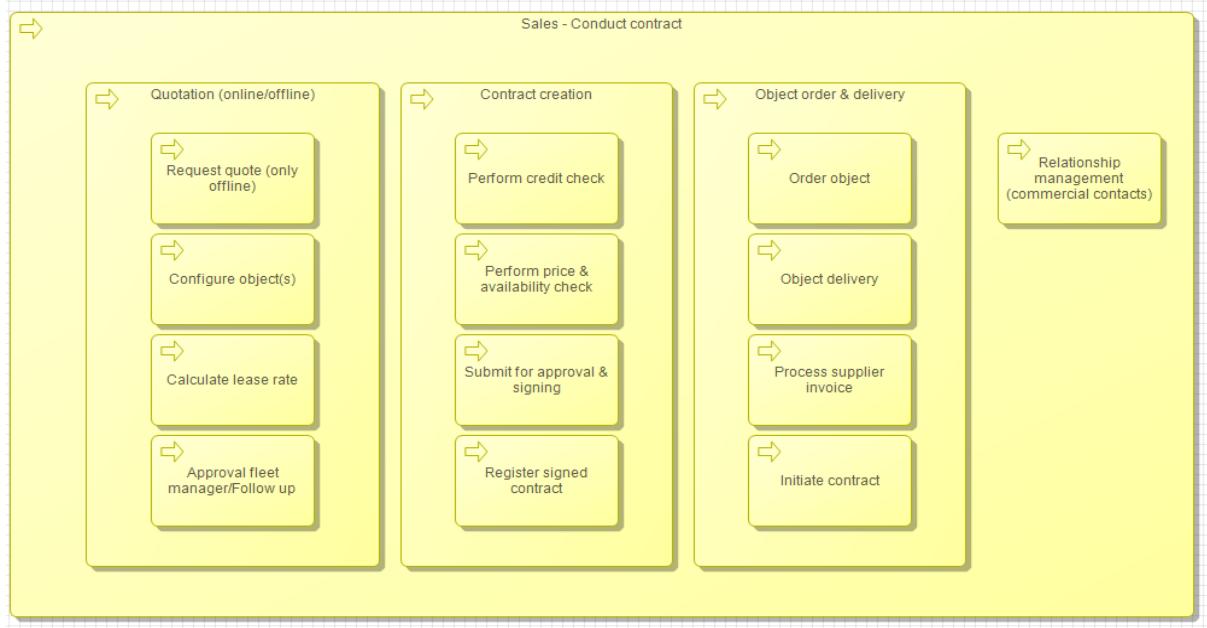


Figure 9 Value stream mobility solutions: sales conduct contract



Figure 10 Value stream mobility solutions: contract termination and remarketing

Class	Name	Sales conduct contract	Contract termination and remarketing
How	Right grammar complete	Yes	Yes
	Right sequence	No	No
	Right context	Yes	Yes
why	Right goal	No	No
	Right size	No	No
What	Right relationship	No	No
	Right actor	Yes	Yes
Who	Right beneficiary	Yes	Yes
	Right start	No	No
When	Right end	No	No

Table 13 Analysis value streams mobility solutions

The analysis of the value streams shows that DLL is busy developing the value streams. This is reflected in the state of the value streams. The value streams for leasing are well formed, but not all of the value streams are developed already. The value streams for mobility solutions are started and need some more attention. The value streams shown in Figure 9 are more a summary of the different functional domains. It can be concluded that the value streams need extra work in order to complete them. The value streams conclude the as-is analysis.

## 5. Conceptual design

In this chapter, the conceptual framework for business capability mapping is defined. This step elaborates on the two previous research questions and deals with the following research question:

**RQ 3:** How can the previous results be assembled into a framework for business capability mapping?

To help service-oriented companies in successfully implementing a business capability map, first a conceptual framework is developed. This is the third research step. The design is derived from two already existing frameworks. The selection for these two frameworks is conducted in chapter three:

- The BASE/X framework of Grefen (2013); The BASE/X framework described in this document is a structure for the development of new service-dominant business: business strategy, business models, their operationalization in service compositions, business services, and their implementation in state-of-the-art automated service management platforms.
- The article 'The business capability map' of Ulrich (2015): This article discusses how capability mapping enables business analysis and business/IT architecture alignment. Among the topics discussed are capability mapping, IT architecture transformation, the use of capabilities to specify service-oriented architecture (SOA), and the transformation of core IT architectures.

First, the specifications of the conceptual business capability framework are described.

### 5.1. Functional and structural specifications

Specifications have been derived from the literature review and the as-is analysis. These specifications describe the characteristics of the framework. A distinction is made between functional specifications and structural specifications. The functional specifications specify what functions the framework should fulfill, the structural specifications specify how the model should be structured.

#### 5.1.1. Functional specifications

The business capability framework has to provide a helpful tool for service-oriented company's in successfully implementing a business capability map in their organization. Based on the previous chapters, the following functional specifications have been formulated:

- The business capability framework should indicate through what steps service-oriented companies can implement the business capability map in their organization;
- The business capability framework should provide help with analyzing aspects of business capability mapping for service-oriented companies;
- The business capability framework should provide guidelines for formulating business capabilities;
- The business capability framework should explain how business capabilities can be linked to business processes;
- The business capability framework should explain how value streams can be linked to business capabilities and business processes;
- The business capability framework should provide an explanation on how to compare business capabilities between different business lines;
- The business capability framework should indicate how to differentiate between different business lines;
- The business capability framework should indicate relevant literature as reference work.

These specifications describe on a lower level of hierarchy what functions the framework should fulfill. Next, the structural specifications are explained.

### 5.1.2. Structural specifications

The structural specifications describe the structure of the framework. To provide a helpful tool for solving both problems, the following structural specifications have been formulated:

- The business capability framework should indicate through what steps service-oriented companies can implement the business capability map in their organization;
- The business capability framework should indicate and motivate the steps to be taken at the different business layers of an organization;
- The business capability framework should include integration of business strategy, business models and service compositions;
- The business capability framework should have a clear structure when it comes to linking different aspects in the business capability map;
- The business capability framework should incorporate business capabilities with business- and enterprise architecture;
- The business capability framework should indicate relevant literature as reference work.

## 5.2. Conceptual framework

This chapter describes the different steps to be taken in order to come to a business capability map for an organization including making the link with business processes and including business- and enterprise architecture. It is an extended version of the approach described by Ulrich (2015) combined with the BASE/X framework of Grefen (2013). In this chapter, the conceptual framework is derived. The revised framework can be found in chapter seven. This will be done after testing this framework.



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### Step 1: Apply BASE/X Framework

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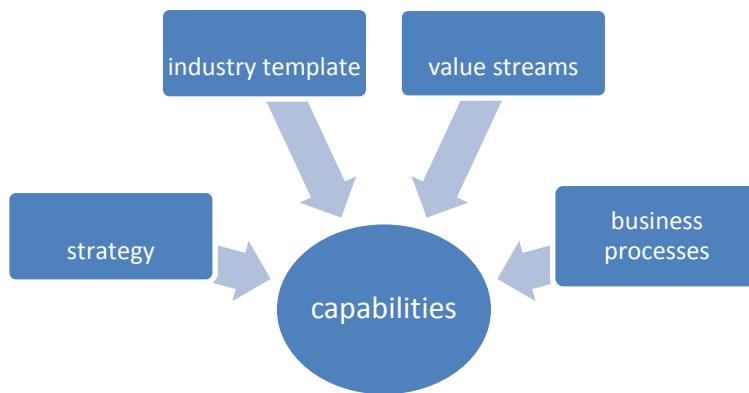
This step involves performing the different steps of the four layers of the BASE/X framework. The steps are explained in Appendix 3.

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### Step 2: Gather information

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Without information, it will be difficult to define all the capabilities of an organization. The first step in building a capability map begins with gathering four aspects that help determine out of which capabilities a company exists.



**Figure 11 Information to determine capabilities**

How these different aspects can be formed and how they will be helpful for building the capability map can be found in appendix 1. Below a summary is made of how these aspects can help.

#### **Strategy:**

The strategy canvas created in step 1, helps define the capabilities especially in terms of limitations. For example, the business resources will show what capabilities are beyond the range of the organization.

#### **Industry template:**

A matching industry template, can help the developer of a business capability map, by giving them a list of capabilities to start with. In this case, the developer does not need to begin from scratch. For a senior manager of an LOB it is easy to determine whether a capability is used by the LOB or not.

#### **Value streams:**

First of all, value streams decompose into business processes. The value streams are less relevant for defining capabilities, however they are very useful for analyzing the capabilities afterwards. This can be done with the bottom-up approach. Most important, value streams form the mapping between business capabilities and business processes.

#### **Business processes:**

Business processes can be used as information for the capabilities. It is important that the business processes are not copied into a capability.

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#### *Step 3: map the business capabilities*

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#### **Rules and characteristics:**

Before mapping the capabilities, the rules and characteristics of the capabilities are explained. First of all, the approach defines a capability as 'a particular ability or capacity that a business may possess or exchange to achieve a specific purpose or outcome'. Before defining capabilities, one must keep the following principles in mind.

### Capability principles

1. Capabilities define what a business does, not how a business does something.
2. Capabilities are nouns, not verbs.
3. Capabilities are defined in business terms, not technical terms.
4. Capabilities are stable, not volatile.
5. Capabilities are not redundant.
6. There is one capability map for a business.
7. Capabilities map to, but are not the same as, a line of business, business unit, business process, or value stream.
8. Capabilities have relationships to IT deployments and future-state IT architecture.
9. Automated capabilities are still business capabilities — not IT capabilities.
10. Capabilities are of most value when incorporated into a larger view of an enterprise's ecosystem.

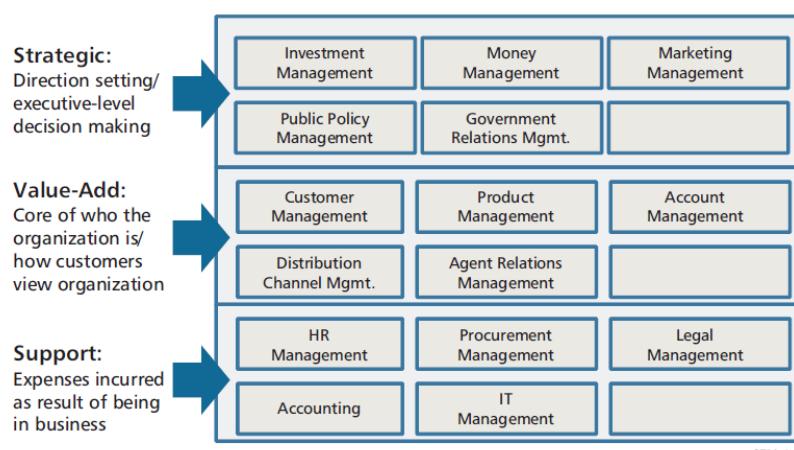
**Table 14 Capability principles**

According to Ulrich (2015) capabilities can be decomposed into different levels. Level 1-3 focuses on planning, where level 4-6 focus on detailed business/ IT mapping. The higher the number of the level, the more in depth the capability is. In Table 15 the different levels of capabilities are labeled.

Capability level	Function
<b>Level 1</b>	Foundation capabilities
<b>Level 2</b>	Capability groups
<b>Level 3</b>	Business capabilities
<b>Level 4-6</b>	Detailed business capabilities

**Table 15 division of different capabilities**

The different level 1 capabilities must be structured in different layers. Therefore, Ulrich (2015) proposes three different groups: strategic, value-add and support. The strategic layer includes capabilities that reflect executive priorities. The value-add layer includes capabilities that describe what an enterprise does to ensure viability and thrive in the marketplace. The support layer includes capabilities that represent certain abilities that a firm must have to work as a business. An example of a services organization is given in Figure 12.



**Figure 12 Service organization level 1 capability map (Ulrich, 2015)**

### Steps for building and validating a capability map

1. Draft an organization-specific Level 1 capability map.

2. Finalize Level 1 capability map.
3. Publish the Level 1 capability map.
4. Establish Level 2 capability decomposition priorities.
5. Decompose Level 2 capabilities.
6. Establish Level 3 capability decomposition priorities.
7. Decompose Level 3 capabilities.
8. Socialize and refine the capability map.
9. Publish the capability map.

Table 16 Steps for building and validating a capability map

#### **Draft level one capabilities:**

The first thing to do here, is to use the industry template gathered from step 1. This document will only be used as a guideline. To find such an industry template search the web. Use the name of your specific industry or line of business in combination with terms like 'capability map' and 'service landscape'. Also [www.apqc.org](http://www.apqc.org) possess process classification frameworks (PCF) for several industries. These frameworks consists of a list with several standard capabilities. <http://www.cabusi.com/> is a website that just started where everyone can share there capability maps from different industries. For the banking industry an industry template can be found in appendix 6. This template is derived from [www.bian.org](http://www.bian.org).

Now the capability map must be made more specific for the company. To do so, use the strategy canvas obtained in step 1. This will show the business resources, information about the IT department, HR management, knowledge sharing, relationships with external resources and more. The list can be made using Microsoft Excel, but this makes it difficult to see the total overview. Therefore, it is recommended to use the program Abacus. This will create a nice draft on the capability map. All the senior business representatives of the different LOB's of an organization must define the capabilities for their own LOB's. In order to keep a good structure, every value-add capability must be linked with a LOB. In case a certain capability is used by four LOB's, the capability must be linked with four LOB's. This can be done in Abacus.

In order to make the level 1 capabilities complete hold a meeting with all the senior business representatives of the different LOB's. Here, the draft version will be reviewed. Discuss the different capabilities and make sure that everyone holds the same definition for the capabilities. The level 1 map can be published once all the senior business representatives are sure that there are no gaps in the map.

#### **Decompose level 2 capabilities:**

Now all the level 2 capabilities must be decomposed. The focus lies on the value-add capabilities. This is the core of a given business model. In order to save time, the support and strategic capabilities can wait with the decomposition until these capabilities are required. Now, these level 1 capabilities can be filled in by searching the web for commonly found capabilities. Take for example, 'customer management'. When searching the web on 'contract management capabilities' or 'contract management functions' a list with capabilities for customer management can be found.

Like the industry template, this gives a guideline or beginning point for the level 2 capabilities. Then hold a meeting with the person involved in the specific capability. When all the capabilities are filled in, the same meeting is done as in step 1.

#### **Decompose level 3-6 capabilities:**

The decomposition of level 3 follows the same process of step 2. Here, the information of the business processes can be used to fill in the more detailed capabilities.

### **Differentiate line of business capabilities:**

The different LOB's in an organization have similarities as well as disseminations in capabilities. In order to determine the capabilities for a specific line of business, the best approach is to hold a session with the senior business representative of the LOB. Begin with the already determined capabilities. Make a list in Microsoft Excel, see Figure 13, and work the list from above. Put an X at every capability that the specific line of business uses. After this, make use of documents of the specific LOB to see if there are other capabilities. In the case study a list of scenarios is used.

Parent ID	ID	Capability Name	Capability Definition	Mobility solutions	leasing
4.1.1	4.1.1.1	Create Partner	Create new partner and capture relevant partner information	x	
4.1.1	4.1.1.2	Search Partner	Search partner profile involves searching the stored partners by specific profile parameters	x	
4.1.1	4.1.1.3	Qualify Partner	Partner due diligence and credit checks to qualify a partner to do business with	x	
4.1.1	4.1.1.4	Update Partner	Update partner profile involves modifying/updating relevant stored partner information	x	
4.1.1	4.1.1.5	Manage Partner Status	Manage partner status related to credit and due diligence checks	x	
4.1	4.1.2	Partner Relations		x	
4.1.2	4.1.2.1	Manage Partner Communications	Manage communications setup for partners, correspondence and contact information	x	

Figure 13 Capability comparison

In order to see immediately which lines of business use which capability, this thesis proposes a colour circle, see Figure 14. To do so, software program Abacus can be used. This program will automatically let you link a capability to a LOB. If this automatic link is not possible, due to software restrictions, an organization could mark LOB's with use of letters. For example, A = leasing, B = mobility solutions, etc.

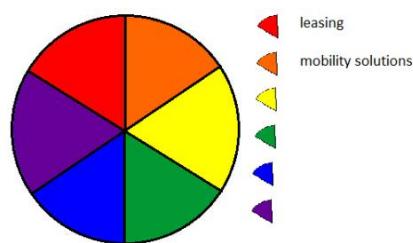


Figure 14 Coloured circle

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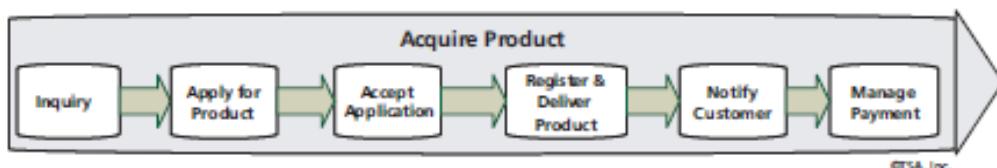
### *Step 4: map business processes*

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When a capability decomposes to a given level, it does not become a process, task, or activity. This is important to remember. Therefore, the business capability map and business processes must be

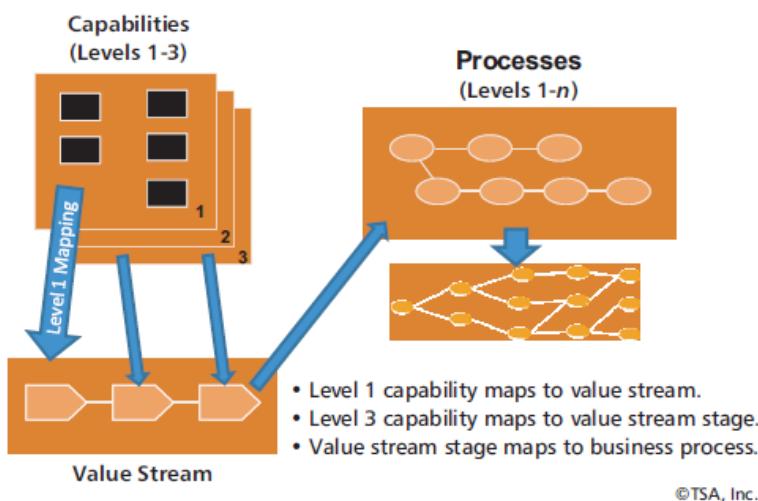
stated separate. However, for planning and analysis it is important to know which capabilities are used in the business process. Therefore, every business process must create a list with all the used business capabilities. Simply creating a list would not give a proper overview of the situation. Therefore, the use of value streams become important. The value streams become the link between the capabilities and business processes.

Value streams are decomposed into a series of stages that move from left to right with an arrow connecting each stage. Value is accrued at each stage. Stages are expressed in verb/noun format such as “process payment.” Consider a value stream where a policy is prospected, sold, recorded, paid for, and the stakeholder is notified accordingly. An example of a value steam is shown in Figure 15.



**Figure 15 Example value stream**

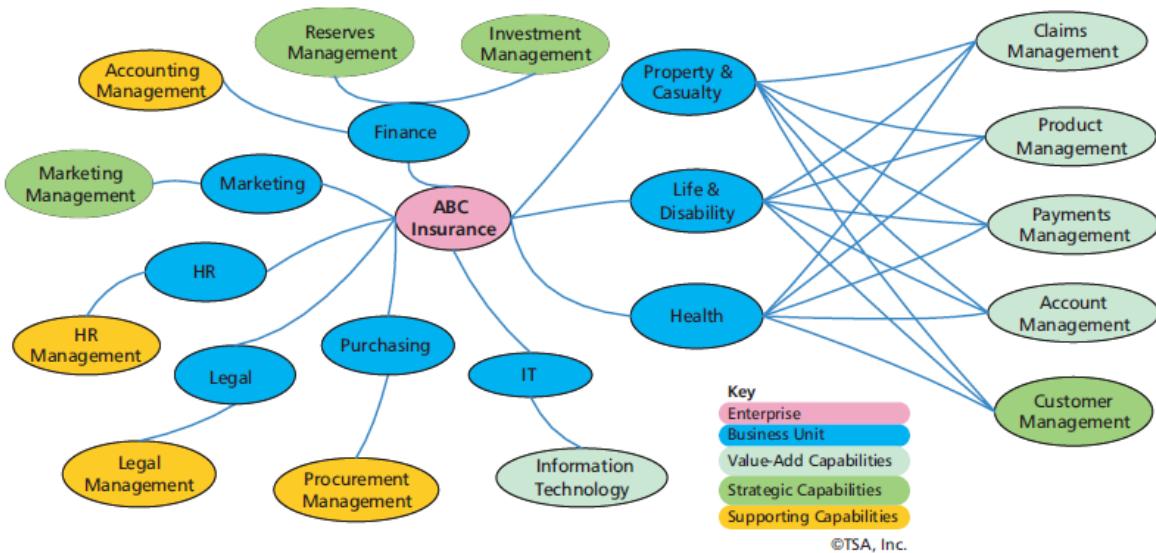
How capabilities, value streams and business processes can be mapped is shown in Figure 16. This mapping can be used for strategic planning, funding allocation, deployment priority setting and management and initiative planning.



**Figure 16 Capability, value stream, business process mapping (Ulrich, 2015)**

## *Step 5: incorporating capability into business architecture*

Business architecture can be seen as a blueprint of the enterprise and is used to align strategic objectives and tactical demands. Business-to-business and business-to-IT mappings provide the basis for much of the analysis associated with business and IT transformation. Therefore it is important to incorporate capabilities into the business architecture. This can be done by an organization-unit-to-business capability mapping, see Figure 17. Such a mapping shows how different business units share common capabilities. It is important to take into account that different business units might have misaligned definitions for terms.



**Figure 17 Organization-unit-to-business capability mapping (Ulrich, 2015)**

The business architecture knowledgebase formalizes how information about the business is stored, related and viewed. This can include capabilities, value streams, information assets, organizational structure, project initiatives, customers and partners, and related IT assets. The knowledgebase can be stored in a database or various architecture tool providers, like MEGA or Troux. The use of a knowledgebase enables business architecture teams to increase analysis efforts as they incorporate more concepts, additional business units, and required levels of granularity.

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#### *Step 6: incorporating capabilities into enterprise architecture*

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Business capabilities provide an important link between requirements and IT solutions of all the domains of an enterprise architecture. Business capabilities are a primary deliverable of the business architecture. The capabilities and value stages can be implemented by the processes. The typical architecture domains can be found at the top of the figure: business, information, application, and technology. Capabilities require information and processes. The operational resources consist of existing applications, legacy, and COTS systems like CRM and ERP. Integrated services provide the integration between existing applications. The SOA business and information services provide high-level business functionality for the enterprise or in other words a virtual implementation of related business operations. The business processes consist of a series of operations that are executed, for example initiate a new employee. The arrows in Figure 18 show the links between the capabilities. In order to incorporate capabilities into the enterprise architecture, the most important aspect is to link the capabilities to the applications and data sources, by use of the business services, see figure 20. How this step works more precisely will become clear in the execution of the framework in chapter 4.

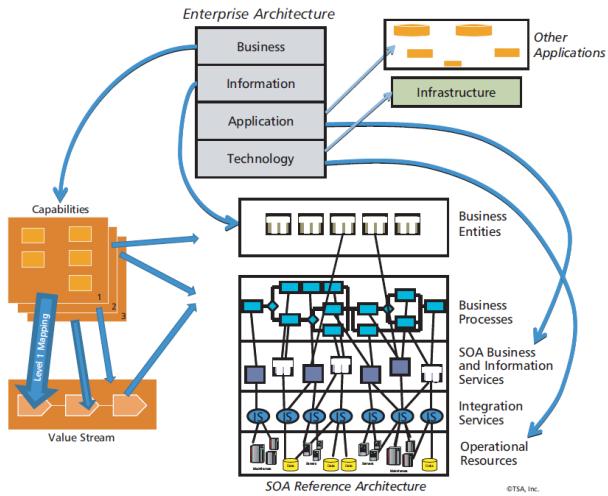


Figure 18 The role of business capabilities in EA (Ulrich, 2015)

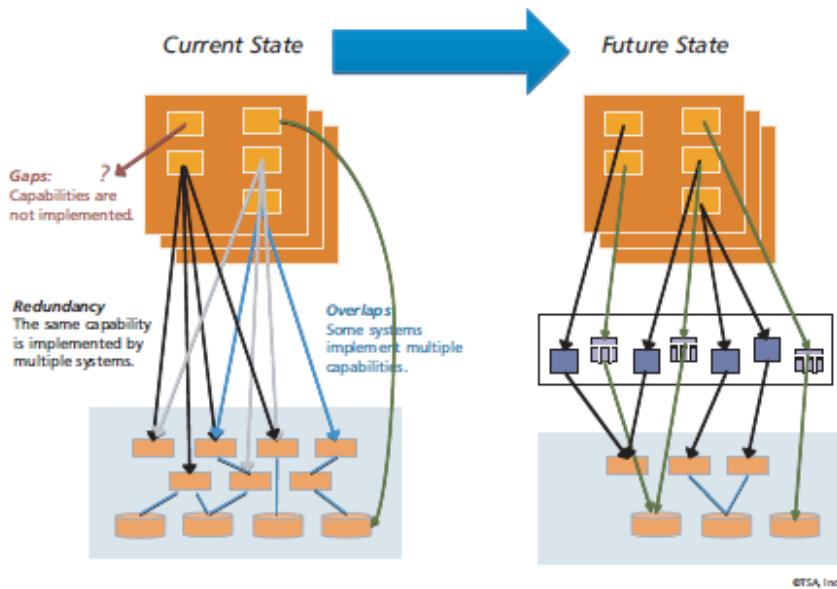


Figure 19 Capability mapping to enterprise architecture (Ulrich, 2015)

## 6. Design testing

In this chapter, the theoretical framework of chapter five is tested at DLL. It deals with the research question:

**RQ 4:** How will the conceptual approach of research question three work at DLL, followed by a gap analysis?

This includes the BASE/X framework, and the steps that need to be performed in order to come to a business capability map, including additions such as the link with business processes. DLL consists of different lines of businesses, however the execution is only performed for the business lines mobility solutions and leasing. All the steps will be analyzed in order to come to the new framework.

### 6.1. Results to-be analysis

The results of this analysis will be created by following the steps of the theoretical framework. The first thing to do here is to accept the vision of the BASE/X framework, according to the organization. Therefore, all the steps of the BASE/X framework will be executed here. Every step will be evaluated in order to form the new framework.

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#### Step 1: Apply BASE/X Framework

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##### Step 1: strategy

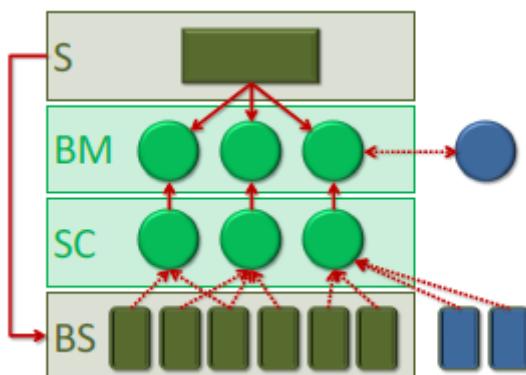


Figure 20 Layers BASE/X framework (Grefen, 2013)

In case, a company starts from scratch, the starting point is the strategy layer. This stable layer must be identified. The identity of an organization is defined by the strategy. This means that one organization has one strategy. For DLL this is the Enterprise Big Picture. This document deals with the strategy more superficial. However, since in this case every line of business deals with different customers, partners etc., it would be better to define the strategy separately. For DLL, there are also big pictures for leasing and mobility solutions. This can be seen as a higher level of abstraction. For companies that have not defined the strategy already the strategy canvas can be used, see Figure 20. For DLL the strategy is already defined. Then the criteria table for strategy can be used.

Class	Name	Enterprise	Leasing	Mobility solutions
Market relationship	Exogenous	No	Yes	Yes
		Yes	Yes	Yes

	Endogenous	No	Yes	Yes
		No	Yes	Yes
Business competences	Value	Yes	Yes	Yes
		Yes	Yes	Yes
	Collaboration	Yes	Yes	Yes
		No	Yes	Yes
Business resources	Actors	No	Yes	Yes
	infrastructure	Yes	Yes	Yes
		Yes	Yes	Yes

Table 17 criteria table strategy

The table shows that the enterprise strategy is not well defined. Therefore, The classes that are not defined or defined in a right manner, must be renewed. This will be done by use of the strategy canvas. This canvas is defined by documents from the organization, and in agreement with the domain expert and business architect. The results can be seen below.

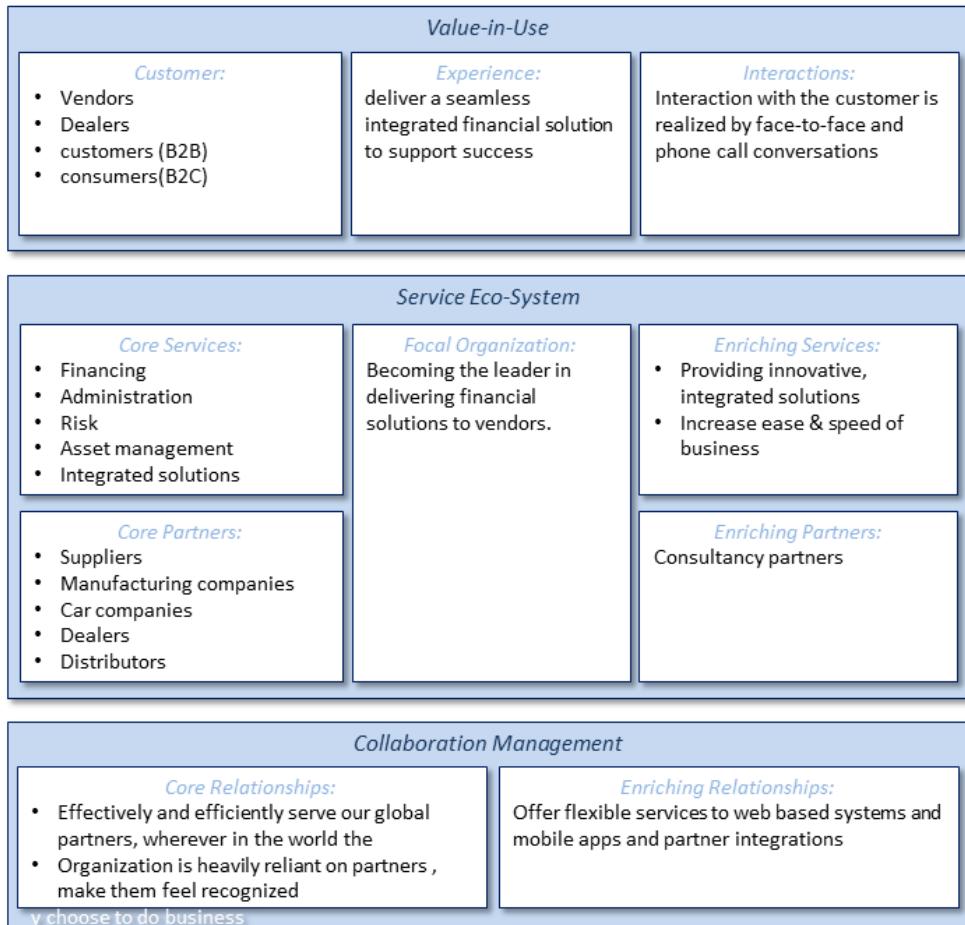


Figure 21 Strategy canvas: DLL enterprise

So, now the enterprise strategy is defined. The strategy for the separate business lines were already defined. According to the BASE/X framework, the next layer to define is the business service layer.

## Step 2: business service catalog

This step sequences on the strategy and focusses on the development of a business service catalogue. A business service catalogue is a list of all the services a company delivers clustered into different functional domains. This business service catalog can be compared to the business capability map of Ulrich (2015), however a business service encapsulates a business capability. This step will be executed so that in the final theoretical framework the best of two worlds will come together. Here, two aspects are important: the granularity of a service, and the difference between internal and external services.

This list of the business services is deduced from the strategy. In order to do so, two employees of an organization are important: a domain expert and a business architect. The domain expert to understand the content and the business architect to understand the structure. The classification of the different services is performed by using the partitioning tool, see Figure 22. Service domains that are mission critical are colored red in the service catalogue. A simplified version of the DLL business services is shown in Figure 23.



Figure 22 Partitioning tool for services (Grefen, 2013)

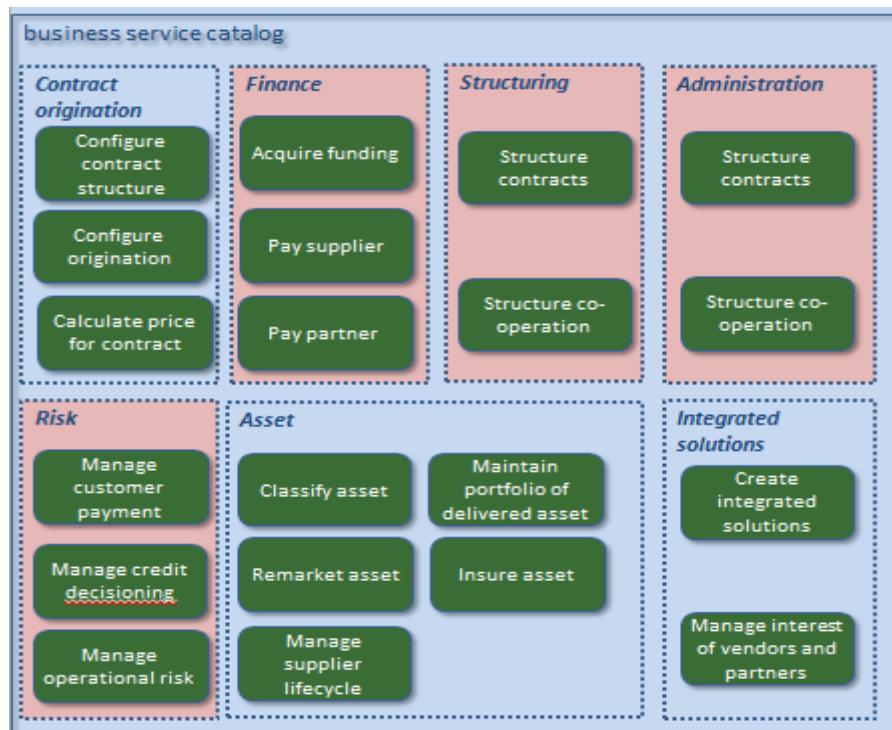


Figure 23 DLL business services catalogue

In order to facilitate such a business service catalogue, the following templates were used. Here, two examples are given.

Business Domain / Service Cluster	Asset
Domain Description	Cluster of business services that produce the asset to the customer
Person Responsible for definition of domain	??

Table 18 Catalogue template for business service domain

Service Name	Insure Asset		
<b>General Service Description</b>			
Service cluster service belongs to	Asset		
Service functionality in terms of value-in-use	Generates all the activities involved with the insurance of a certain asset. Allows customers to use an asset without worries.		
Business resources used by service	Personel		
<b>Service Classification</b>			
Mission-critical or Non-mission-critical	MC	Remarks	Important to keep customer
Commodity or Differntiation	COMM	Remarks	Most of competitors do this
Internal or External	EXT	Remarks	Change tires on asset is outsourced
<b>Service Functions</b>			
Function	Functionality	Input	Output
Create_INS	Create document for insurance	Insurance document	
Check_CST	Check customer	Customer information	
Check_status	Check status of insurance	None	

Table 19 Catalogue template for business service description

### Step 3: business models

Now the business models are explained. First of all, two different types of business models will be executed: the business model of BASE/X and the business model of Osterwalder. Service-dominant organisations often have several business models. These different business models define a concrete value-in-use and are deduced from the strategy and must be consistent with each other. Different business model start from the abstract value-in-use. From here concrete value-in-use are that are coupled to different customer groups. The abstract value-in-use for DLL is to deliver financial solutions. Although, DLL is divided into six different LOB's, this thesis deals with only two LOB's: leasing and mobility solutions.

Abstract Value-in-use	Customer group	Concrete value-in-use	Label
Complete Financial Solutions	All businesses	DFS	Direct
		DFS with relationship management	Vendor
		DFS with risk mitigation	Rabobank
	All Businesses	DFS for full operational car lease	Mobility Solutions/ Small
	'Green' businesses	DFS for total mobility services	Mobility Solutions/ Extended
	(private label)	DFS with outsourcing of business services	Mobility Solutions/ Private

Table 20 DLL cases of concrete value-in-use

The table above indicates that there are four different business models for the two LOB's, all with different customer groups and related concrete value-in-use. Two of these are elaborated: leasing/Ful and Mobility Solutions/Extended. For the other concrete value-in-use, similar radars can be made as well. The radars show the different actors for a specific business model. The radar gives a quick overview of these actors coupled to their benefits, activities and value proposition.

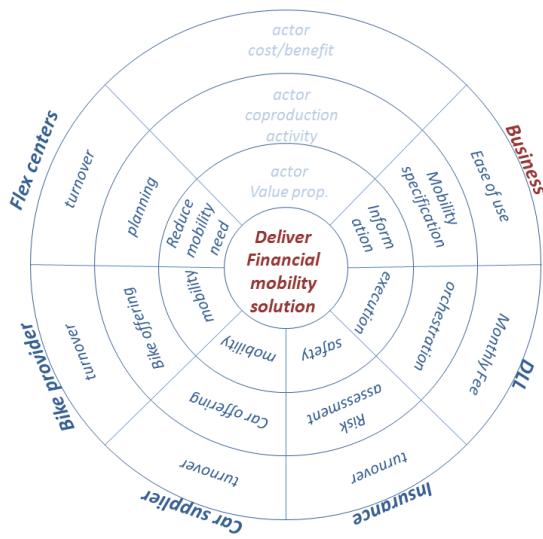


Figure 24 Business model radar for DLL mobility solutions

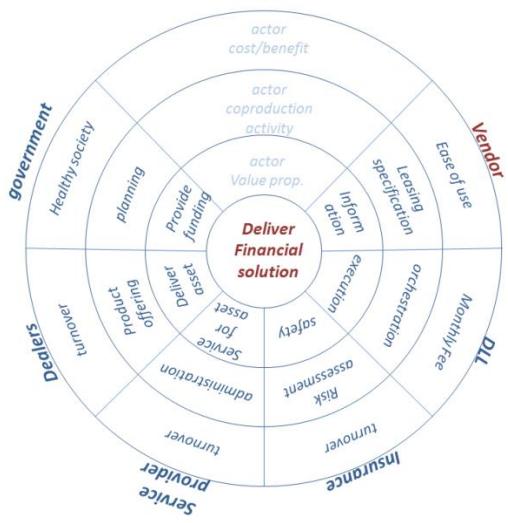


Figure 25 business model radar for leasing

<b>Key Partners</b>	<b>Key Activities</b>	<b>Value Proposition</b>	<b>Customer Relationships</b>	<b>Customer Segments</b>
	<ul style="list-style-type: none"> <li>Contract origination</li> <li>Contract management</li> </ul>	<ul style="list-style-type: none"> <li>Global partnerships</li> <li>Industry focus &amp; expertise.</li> <li>Breadth and depth of lease types like Financial Lease and Operational Lease.</li> <li>Support of finance needs for entire asset lifecycle.</li> <li>Financial stability by being part of Rabobank group.</li> <li>Speed &amp; ease of use.</li> </ul>	<ul style="list-style-type: none"> <li>Dealers               <ul style="list-style-type: none"> <li>- Vendor related</li> <li>- Retail/independent</li> </ul> </li> <li>Vendors</li> <li>Sales representatives</li> <li>Rabobank branches</li> <li>Self service</li> </ul>	<b>Customer types:</b> <ul style="list-style-type: none"> <li>Small enterprises</li> <li>Medium enterprises</li> <li>Large enterprises</li> </ul> <b>Vendors and Dealers</b> <ul style="list-style-type: none"> <li>Healthcare</li> <li>Construction, Transportation &amp; Industrial</li> <li>Food &amp; Agriculture</li> <li>Office Technology</li> </ul> <b>Rabobank</b>
<b>Cost Structure</b>	<ul style="list-style-type: none"> <li>Personnel</li> <li>Funds (for assets)</li> <li>IT infrastructure and software applications</li> </ul>	<b>Revenue Streams</b>	<ul style="list-style-type: none"> <li>Interest margin</li> <li>Non interest fees</li> <li>Asset sales (part of asset management)</li> <li>Evergreens (part of asset management)</li> </ul>	

Figure 26 Business model leasing

<i>Key Partners</i>	<i>Key activities</i>	<i>Value Propositions</i>	<i>Customer Relationship</i>	<i>Customer Segments</i>
<b>Dealer network, Vereniging ROB</b> Network responsible for RMT (Repair, Maintenance, Tyres)	Car Purchasing Car Maintenance Insurance Damage & Claims	Mobility, in terms of cars and other means of transportation	Personal contact (fleetmanagers)	B2B (companies and their employees)
<b>Damage Repair network</b> Responsible for damage repair	Fuel management Rental cars Remarketing Reporting Logistics	Hassle free Cheaper, through economies of scale Better cashflow, no investment required Professional fleet management	Online ordering Online reporting After sales (Drivers desk) Road assistance	B2C (consumers, private lease) International customers
<b>Multi Tank Card</b> Fuel		Purchase service		Large accounts, Key accounts, SME's
<b>Insurance companies</b> Insurance of vehicles, liability		Remarketing service	<i>Channels</i>	
<b>International partners</b> Athlon subsidiaries abroad and other companies		Relief vehicle, rentals Mobility advice	Face2Face Brokers Online - Private lease (new customers) Athlonline (existing customers)	
<b>NS (Dutch Railways)</b> Public transport	Athlon members (Sales, Backoffice activities)			
<b>XXIMO</b> Prepaid mobilities (debit card)	Funding (money) Vehicles (assets) Premises (parking ground, office)			
<b>Car traders</b> For remarketing purposes	IT (IT services, both Athlon / DLL)			
<b>Achmea</b> Supplier of E-driver platform				
<i>Cost Structure</i>		<i>Revenue Streams</i>		
Cost of personnel (Athlon members) Cost of funding (interest)  Invoices for Vehicles Invoices for Fuel Invoices for RMT Invoices for Insurance IT costs		Lease rates, covering: - interest and depreciation - RMT - Insurance - Relief vehicles - Management fee  Rental income Asset sales (Remarketing) Kickback bonuses on: - vehicles - tyres - glass		

Figure 27 Business model mobility solutions

#### Step 4: service composition

In this last step of the BASE/X framework, a service composition is made. A service composition offers the operationalization of a business model. According to Grefen (2013), there are two types of service compositions: the process type and the mash-up type. The mash-up type is used for a more free-form business interaction executed by a single actor. The process type follows a certain sequence of activities for multiple actors. The process service composition has similar characteristics as the value streams proposed in the theoretical framework. The two service compositions below are an example and only show the steps that are visible to the customer.

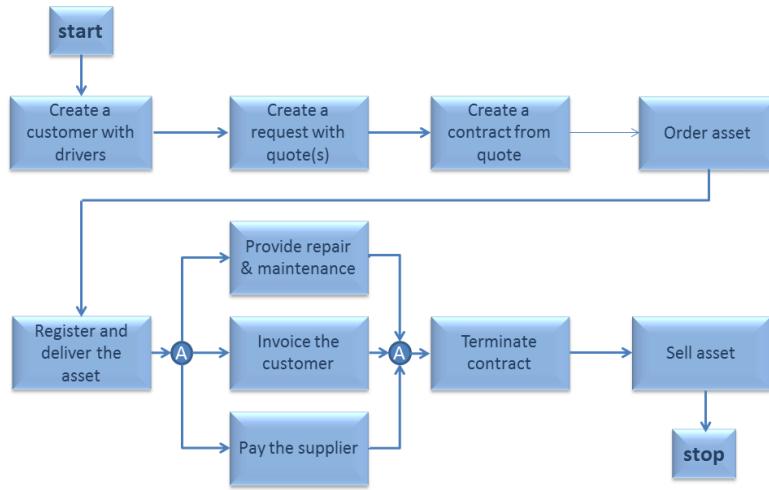


Figure 28 service composition mobility solutions

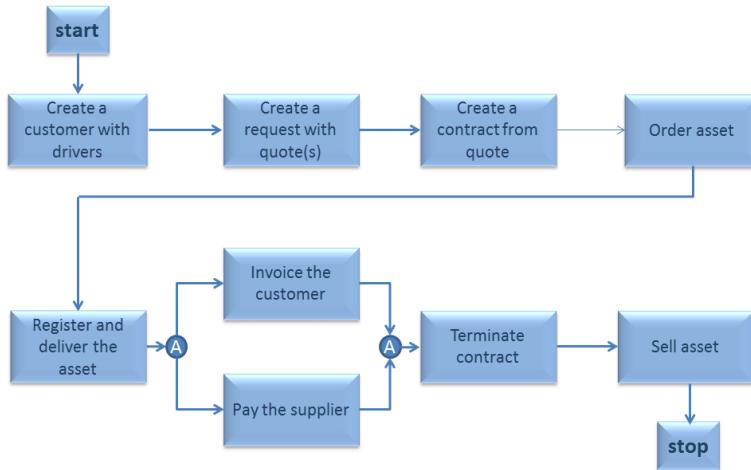


Figure 29 service composition leasing

The mash-up version of the service composition, simply sums up the different activities on a stand-alone basis. Here, the connection between the activities will be maintained by the user. Therefore, this step is not executed for DLL.

### Conclusion step 1:

#### Step 1.1.: strategy

Step 1 consists of the four steps of the BASE/X framework. It begins with defining the strategy layer. A strategy defines the identity of an organization, linked to its long-term mission. In order to build a business capability map, the identity of the organization must be clear. The resources and activities of an organization are important as well. Because this thesis focuses on a service-dominant business, the value-in-use to the customer becomes important, as well as market relationships. All these aspects must be covered by the strategy canvas. The strategy canvas of BASE/X describes all these aspects. At first, it can be concluded that the strategy of an organization must be defined before beginning with the capability map since the identity of an organization, as well as business competences and resources help define the business capabilities. Secondly, the best canvas that can be used is the BASE/X strategy canvas, because it serves all the aspects necessary for the capability map as well as the important aspects for a service dominant strategy.

### **Step 1.2.: business service layer**

The business service catalogue is a list of all the services a company delivers clustered into different functional domains. In this approach, the focus lies on the business capability map or catalogue. It would be time consuming to build both catalogs. Therefore, the business service catalog is not defined in this approach.

### **Step 1.3.: business model**

The business models in this approach are important to differentiate the lines of businesses in an organization. So before beginning with defining the business models, the different lines of businesses must be made clear. This extra step will be done in the strategy layer. In the execution of the business models two different models are elaborated. The business model of the BASE/X framework and the business model of Osterwalder (2010). The BASE/X business model sums up the value proposition, cost/benefit, and coproduction activity for every stakeholder in a service composition. Here, the focus lies on the service-dominant business. The business capability map must also deal with activities that will be outsourced. The business model radar is an ideal tool to visualize these activities. Therefore, the business model radar of the BASE/X framework is recommended. The business model of Osterwalder deals with the activities and resources, and can be used in addition.

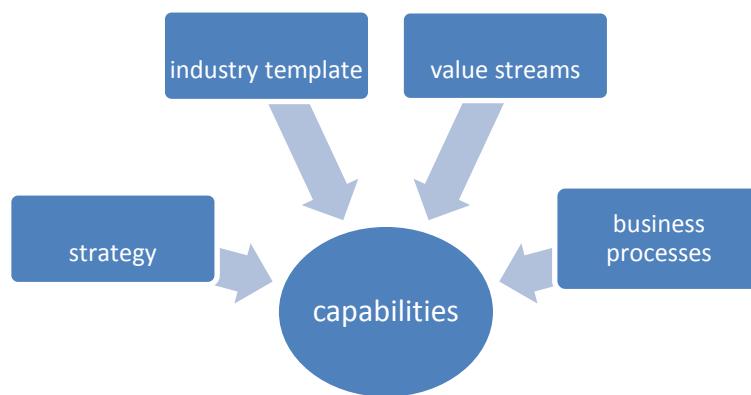
### **Step 1.4.: service compositions**

A service composition offers the operationalization of a business model. After working with the value streams in step two, and finding a way to map the business capabilities to the business processes, this thesis proposes a way to combine the service composition with the value streams in order to map the business capabilities to the business processes. This will be explained in the new framework.

---

### *Step 2: gather information*

---



in this step, the following four aspects are gathered before building the business capability map.

#### **Strategy:**

This document is defined in the previous step.

#### **Industry template:**

In order to make a beginning, industry templates are used. The industry templates that were used for this case can be found in Appendix 6.

**Value streams:**

The value streams for DLL are in a novice stadium. Therefore, the value streams will be reconsidered.

**Business processes:**

The business processes for DLL are already made. For leasing a total of 506 different business processes exist all assigned to specific classes. A representative set of business processes is selected and reviewed for both LOB's in the as-is analysis. This concludes the business processes.

**Conclusion step 2:**

All the four aspects are important for business capability mapping. However, these aspects will be assigned to other steps of the approach. The strategy defines the identity of the organization. This will become the first step of the new theoretical framework. The industry template forms a starting point for a business capability map. This aspect will be assigned to the step map the business capabilities. The value streams will be coupled to the service composition that must be made for every line of business. The value streams will then be used to link the business capabilities to the business processes.

---

*Step 3: build business capability map*

---

The building of the business capability map starts with understanding the rules and characteristics of the business capabilities, including the principles and the different levels of the capabilities. For structuring the business capabilities the template of Figure 83 is used, with the strategic, value-ad, and supporting capabilities. From here, first the level 1 capabilities were defined, followed by the level 2 and 3 capabilities. The information to define the capabilities is gathered by holding meetings with the domain experts from different business lines, looking into the business processes, product catalogues, and strategy documents. This resulted in the following business capability map.

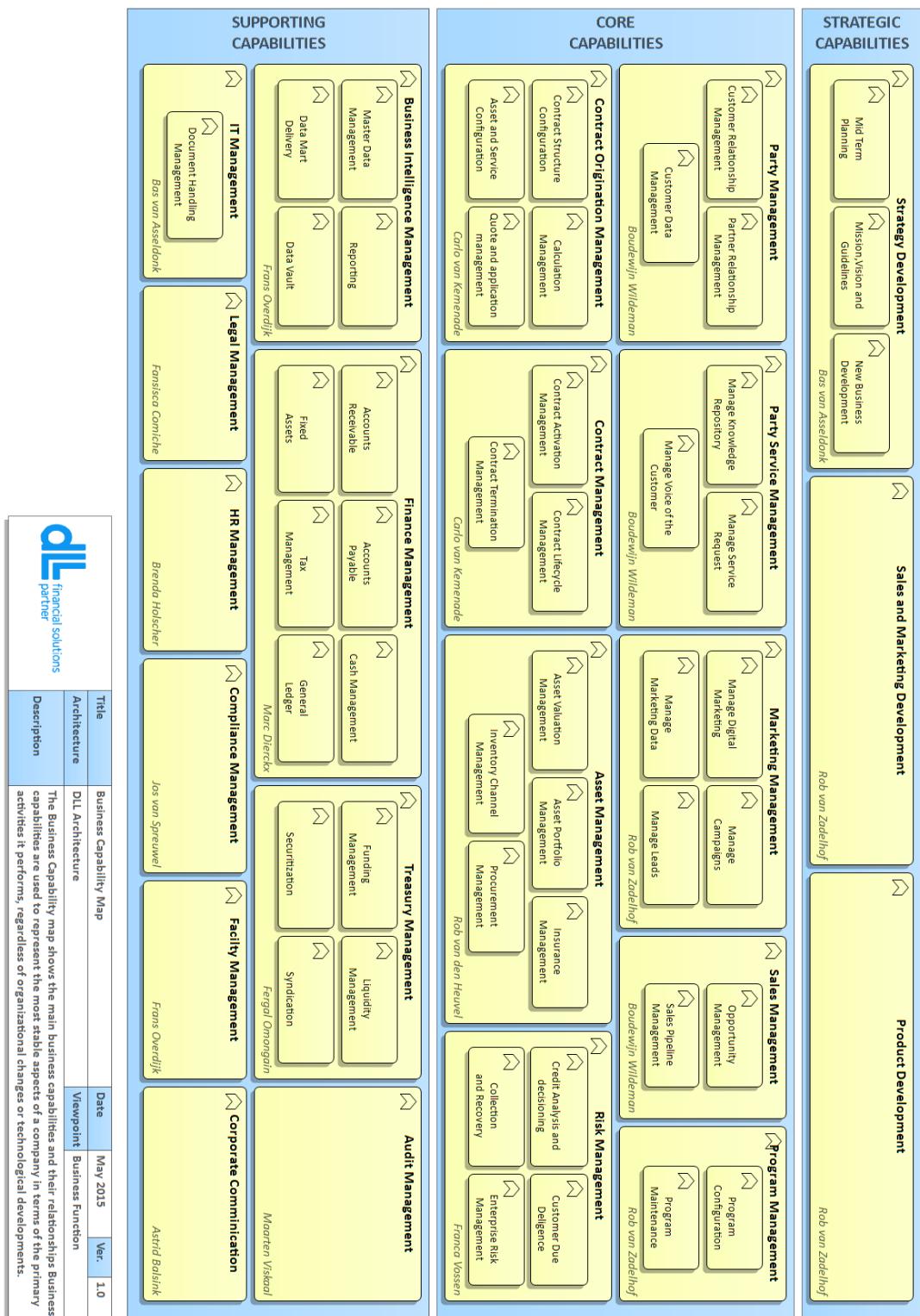


Figure 30 Old business capability map DLL

### Conclusion step 3:

The execution of this step was for a large part covered by the enterprise architects of DLL. First of all, it is important that the capability map covers the whole enterprise. Also, the strategy of the organization must be defined in order to find the key resources, key activities and more aspects that help defining the business capabilities. Furthermore, it is important to divide the capabilities into the three classes of Ulrich (2015); the supporting, value-ad, and strategic capabilities. From here,

industry templates helps as a starting point. Depending on what is already made, documents as business processes, product catalogues and other documents can help with defining the business capabilities as well. It is important to hold meetings with business architects and business domain experts as well as representatives of all the LOB's.

---

#### *Step 4: map business processes*

---

The links between the business capabilities and the business processes is done by using the value streams. Once the list of all the business processes are clear they must be mapped in a structured way. This is done by using the value streams. Below, an example is given on the value stream "create quote". The orange blocks are business capabilities linked to a single value stages. The red blocks are the business processes.

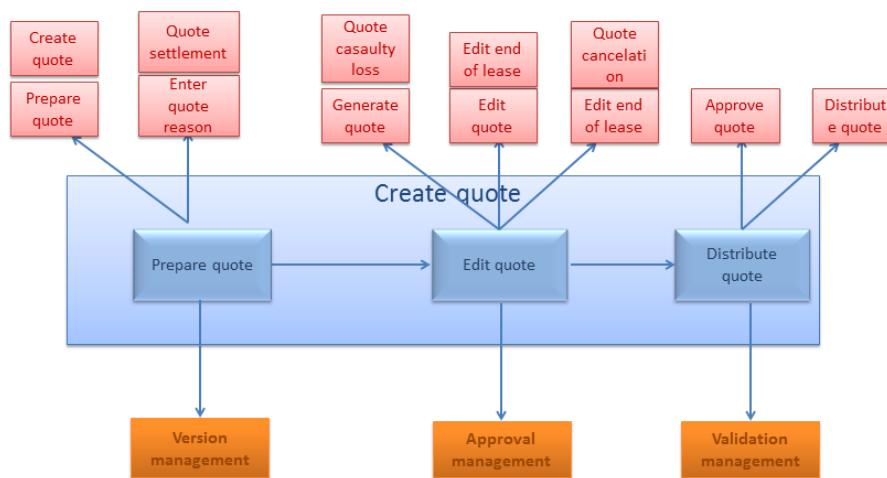


Figure 31 Value stream coupling create quote

#### **Conclusion step 4:**

By making use of the value streams the business processes can be mapped to the business capabilities. The problem here, is that the value streams are not structured. Therefore, this thesis propose a way to combine the value streams to the service composition of step 1.4. By making a service composition for every LOB and coupling the services to value streams, the whole operationalization of a single LOB becomes clear, including the business capabilities and the business processes. The service composition will consist of value streams that can be simply duplicated if other LOB's use them as well. It will also result in an efficient way to compare the capabilities and processes between LOB's. This will make step 7 unnecessary. This can be observed in the new framework.

---

#### *Step 5: incorporating capabilities into business architecture*

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The link between capabilities and business architecture is made by firstly sub dividing the different business units of the organization followed by linking these business units to level 1 capabilities. By doing so, one can see at a glance which capabilities are performed by which business unit. So, in order to understand the structure of your organization, make a visualisation, see figure 33.



Figure 32 Structure DLL

### Conclusion step 5:

For DLL the business units and lines of business are used interchangeably and in some regions certain LOB's are left out, see figure 33. Due to this fact, it is impossible to link the business capabilities in a structured way. When a business uses strictly defined business units, this step is ideal to see what business units use level 1 business capabilities in a single picture.

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### *Step 6: incorporating capabilities into enterprise architecture*

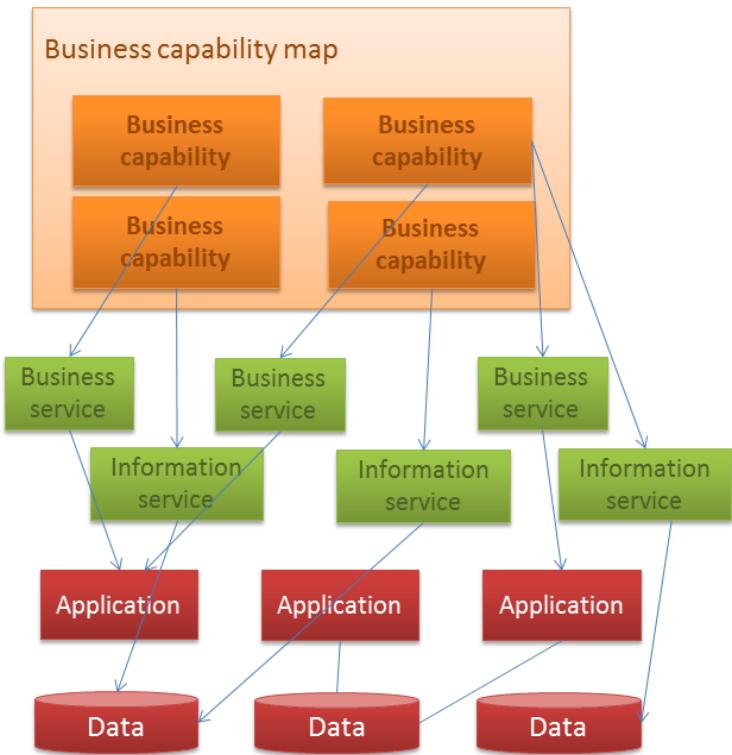
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A major challenge of IT planning is dealing with the current state of redundant and overlapping applications and information. For example, mergers and acquisitions instantly result in redundant applications and data.

IT architecture planning desires to address all three of these issues:

- To remove redundancies by eliminating and consolidating duplicate systems and information
- To reduce overlaps by breaking capabilities out into more modular systems
- To fill gaps by enhancing existing systems or acquiring new ones.

These three issues can be solved by using business and information services between the business capabilities and the applications and data, see Figure 33.



**Figure 33 Linking capabilities to applications**

#### Conclusion step 6:

Due to the focus of this research and time restrictions, this step is not executed. No conclusions could be made for this step. The following step consists of an analysis of the business capabilities and business processes.

---

#### Step 7: Gap analysis LOB's

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The different LOB's in an organization have similarities as well as disseminations in capabilities. In order to determine the capabilities for a specific line of business, a meeting is held with the representatives of each LOB. All the business capabilities were placed in Microsoft Excel. By marking each capability for a specific LOB, the differences and similarities become clear.

The list consists of a total of 203 business capabilities, differ from level 1 to level 4 capabilities. Some capabilities are not used by both LOB's, for example the strategic capabilities. However, many capabilities are used for both LOB's. There are also a few capabilities used by mobility solutions, but not used by leasing or conversely. Below, all these capabilities are summed up.

Parent ID	ID	Capability Name	Capability Definition	Mobility solutions	leasing
10	<b>10.5</b>	<b>Procurement Management</b>	Manage supplier lifecycle	x	
10,5	10.5.1	Supplier		x	

		<i>Management</i>			
10.5.1	10.5.1.1	Manage Supplier Onboarding	Manage supplier data	x	
10.5.1.1	10.5.1.1.1	Activate supplier	Manage terms and conditions to be applied for DLL and DLL customers	x	
10.5.1.1	10.5.1.1.2	Negotiate conditions	Supplier Acceptance, Compliance and Social Responsibility (Know Your Supplier)	x	
10.5.1.1	10.5.1.1.3	Qualify supplier	Register supplier data	x	
10.5.1.1	10.5.1.1.4	Register supplier	Register the supplier agreements and configure involved applications to apply these conditions	x	
10.5.1.1	10.5.1.1.5	Register supplier agreements	Enable the supplier to deliver assets and/or services	x	
10.5.1.1	10.5.1.1.6	Terminate Supplier	Inactivate the supplier	x	
10,5	10.5.2	<i>Supplier Service Management</i>	Provide services to suppliers	x	
10.5.2	10.5.2.1	Manage Supplier Contract implementation	Implement supplier agreements and conditions	x	
10.5.2	10.5.2.2	Manage Supplier contract retrieval	?? Review, evaluate, revise and re-negotiate the contract with a supplier	x	
10.5.2	10.5.2.3	Manage Supplier contract servicing	??	x	
10.5.2	10.5.2.4	Manage supplier contract termination	?? Inactivate the supplier conditions, no new contracts or services are accepted neither approved	x	
10,5	10.5.3	<i>Contract Management</i>		x	
10,5	10.5.6	<i>Purchase Order Management</i>		x	
0	<b>11</b>	<b>Risk Management</b>	Manages the credit, collection and operational risk and compliance aspects of the organization within the defined risk appetite	x	x
11	<b>11,1</b>	<b>Collection Recovery &amp;</b>	Manage customer payment for delivered services and goods in accordance with agreements made	x	
11,2	11.1.1	Manage After Care	Maximise recoveries after write offs and/or asset disposal	x	
11,2	11.1.2	Manage Dunning	Touch all overdue accounts in an effective and efficient manner	x	

11,2	11.1.3	Recover default payments	Define proper workout strategy for defaults to minimize risks	x	
11,2	11.1.4	Repossess Asset	Outsourcing of recovery related activities to external legal parties	x	
11	<b>11,2</b>	<b>Credit Analysis and Decisioning</b>	Manage credit decisioning within the defined risk appetite and client & portfolio management while safeguarding adherence to compliance standards	x	
11,2	11.2.1	Credit Decisioning Management	Managing and monitoring risk and accessioning data to continuously improve data strategy, models, decision strategies and rule sets	x	
11,2	11.2.3	Manual Credit Underwriting	Enabling the manual underwriting review of the high value, high risk credit decisioning.	x	
11,2	11.2.5	Customer Risk View	Managing aggregation risk of Customer to a legal entry to determine the exposure and accordingly control them to be with the DLL guidelines.	x	
11,2	11.2.8	Legal Entity Management	Managing the customer information at a Legal Entity level to determine the exposure and risk associated with it.	x	

Table 21 Differences capabilities

### Conclusion step 7:

The gap analysis of the business capabilities of the two business lines shows that about 80 per cent of their capabilities are similar. The differences occur in procurement management and risk management. Procurement management deals with buying additions to a car, such as tyres. The risk management deals with collection and recovery and credit analysis and decisions. Both are only applicable to mobility solutions.

With regard to this step of the approach, the differences between the capabilities of the LOB's are clear. The problem with this approach is that with Microsoft Excel it is not linked to other aspects, it does not create a proper overview and the business processes are not covered in this list. The combination of the value streams with the service composition could solve these problems.

## 7. Design of the new framework (Business Capability Mapping)

### 7.1. Introduction

In the previous chapter the theoretical framework is executed in combination with the BASE/X framework. This resulted in new insights. This chapter describes the outcome of the execution of the framework and will conclude with a validation of the new business capability mapping framework. It deals with the research question:

**RQ 5:** How should a service oriented company create a business capability map, and compare different business lines in terms of business capabilities and processes?

Below, the necessity is given of the steps of the executed concept approach. From here, the new approach is defined. The results of the conclusions of the previous chapter are summarized below, in Table 22.

Steps	Necessary?
<b>Step 1.1 strategy</b>	Yes
<b>step 1.2 business service catalogue</b>	No
<b>step 1.3 business models</b>	Yes
<b>step 1.4 service composition</b>	Yes
<b>Step 2 gather information</b>	Yes, but assigned to different steps
<b>Step 3 build business capability map</b>	Yes
<b>Step 4 map business processes</b>	Yes
<b>Step 5 incorporate capabilities into Business architecture</b>	Yes
<b>Step 6 incorporate capabilities into Business architecture</b>	Yes, but outside scope of thesis
<b>Step 7 gap analysis LOB's</b>	Yes

Table 22 Result execution concept framework

### 7.2 New theoretical framework

Below, a visualisation is given of the new theoretical framework. It consists of eight different steps. The framework of BASE/X forms the basis of the approach, however, the Business services bar is exchanged for the business capabilities bar. The red boxes indicate a more stable layer, the green boxes form a more agile structure. In purple, the different aspects of the BOAT framework are coupled. The BOAT framework provides a clear structure to analyse complex e-business scenarios, where the Business aspect describes the business goals of e-business, the organization aspect describes how organizations are structured and connected to achieve the goals defined in the B aspect, the architecture aspect covers the conceptual structure of automated information systems required to make the organizations defined in the O aspect work, and the technology aspect describes the technological realization of the systems of which the architecture is specified in the A aspect. The T aspect covers the concrete ingredients from information and communication technology, including software, languages, communication protocols, and hardware where relevant. (Grefen, 2013). The last aspect of the framework, technology is not included in the scope of the thesis. The blue arrows indicate information sharing between different steps. The knowledgebase enables the links and mappings between the different aspects. A knowledge base stores the information in a structured way.

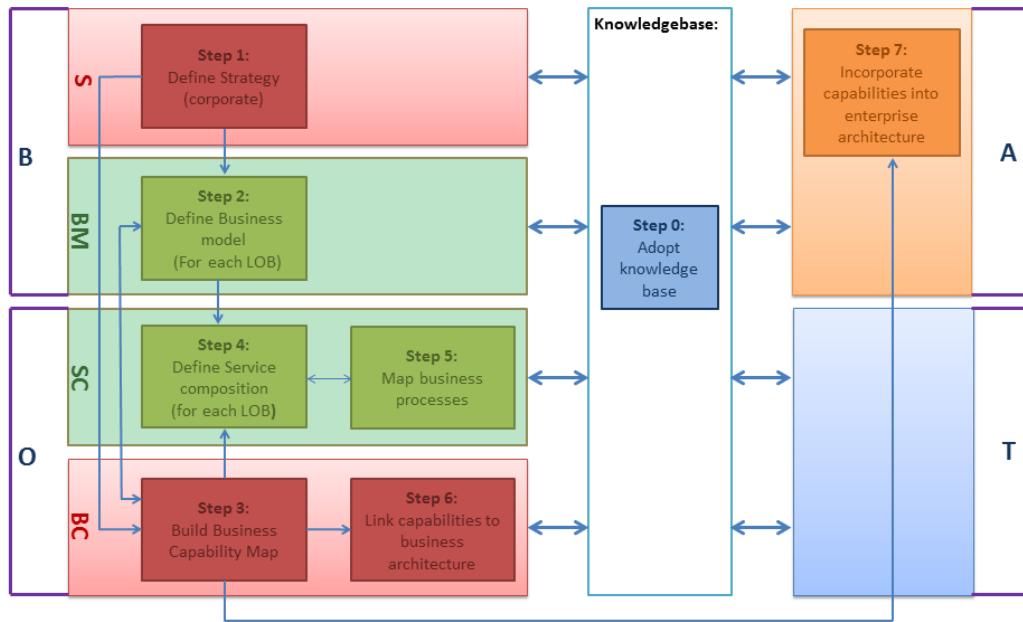


Figure 34 Theoretical Framework

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*Step 0: adopt knowledgebase*

---

Many capabilities map to multiple organization units, value streams, information assets, and other aspects. This is where best practices and standards become important. Best practice-based mappings leverage a simple data model or a meta model to map capability, value stream, and other aspects of business architecture. This enables business architecture teams to scale up analysis efforts as they incorporate more concepts, additional business units, and required levels of granularity. This formal mapping concept is implemented through the business architecture knowledgebase. The business architecture knowledgebase formalizes the way in which information about the business — including organizational structure, capabilities, value streams, information assets, project initiatives, customers and partners, and related IT assets — is stored, related, and viewed (Ulrich, 2015). At DLL, the knowledgebase of Abacus is used. Abacus helps with modelling, road mapping and digital transformation, and is capable of importing existing data from Excel, Visio and many others (Avolution, 2015).

---

*Step 1: Define enterprise strategy*

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The first step is defining the enterprise strategy. For this step the following template of the BASE/X framework can be used. This template is defined in order to capture the identity and value-in-use of

the organization. The different aspects are explained below.

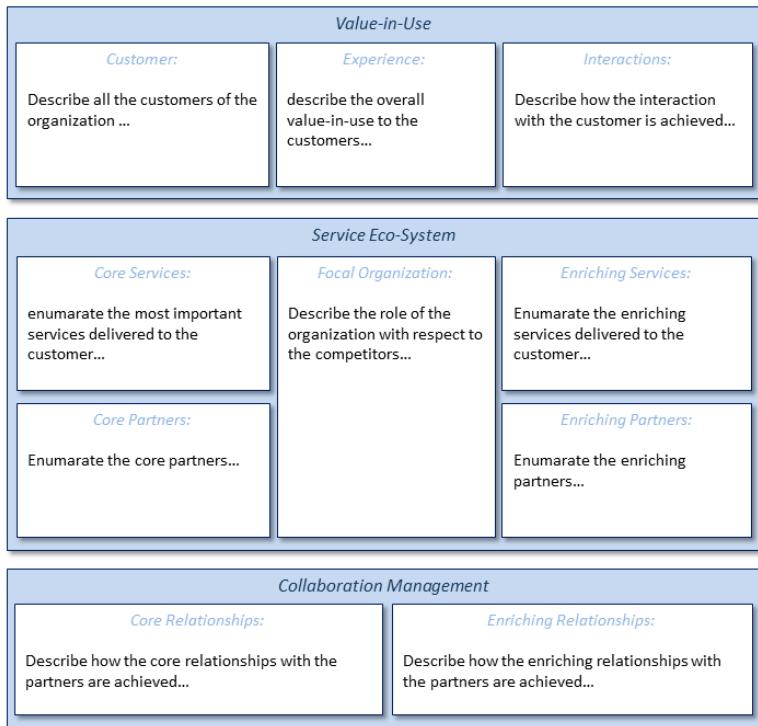


Figure 35 Template strategy canvas

In order to re-use capabilities between different service offerings, business units or line of business in an organisation, the structure of a company must become clear before building on the capability map. Therefore, it is recommended to visualize the structure of all the different subdivisions within an organisation. Figure 36 is an example of such a visualisation. The reason for making this visualisation is that it can be used in step 6 to link these divisions to the business capabilities.



Figure 36 Structure organization

## DLL

Below, the strategy of the whole enterprise (the scope of the thesis only consists of two business lines which in this case means the whole enterprise) is described. The strategy of DLL is described by using the above template. Information is gathered from already existing documents of the strategy.

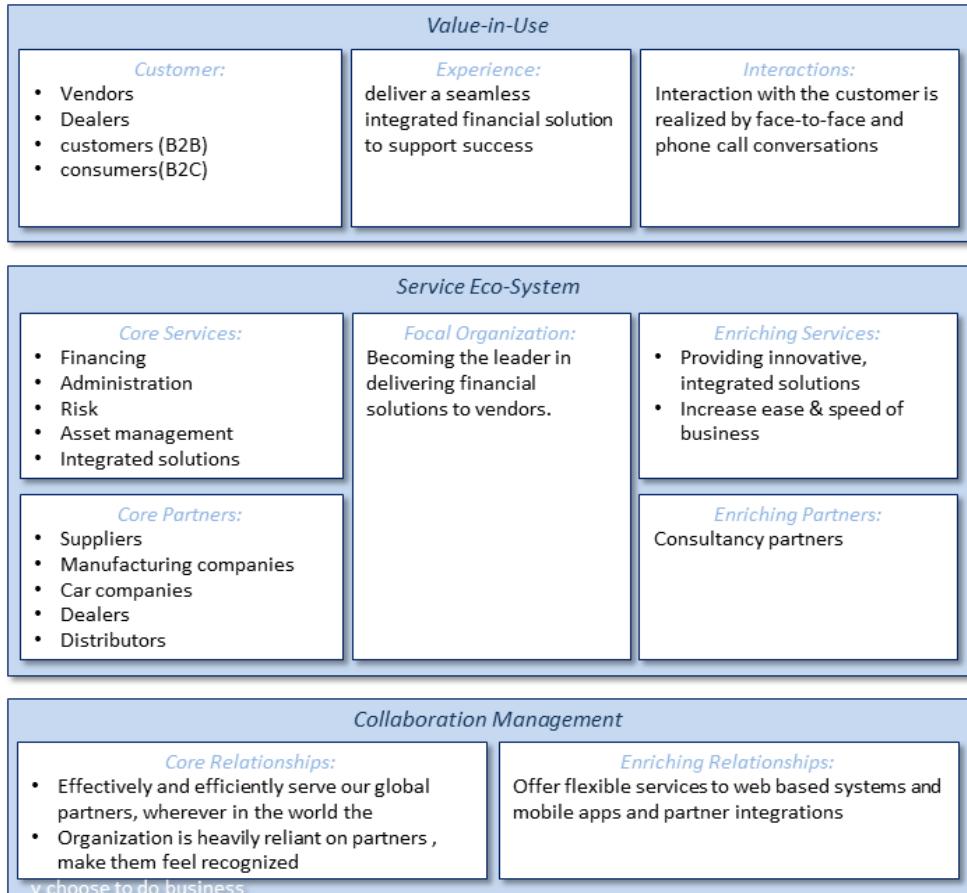


Figure 37 Strategy canvas: DLL enterprise

The previous execution showed that it is important to understand the structure of an organization, since most of the companies (especially larger companies) work with different business units, LOB's, regions and more. Simply sum up the subdivisions of the organization in a table, see Table 23. The last step here is to make a visualisation of the subdivisions, see Figure 38. This is not a time consuming step, but will help with the re-usability of different capabilities in different subdivisions of an organization. Below, the structure of the organization is visualised for DLL. DLL is divided into five different business units, four different regions and five different LOB's. It must be said that the scope of this thesis focuses only on two LOB's: mobility solutions and leasing. The lines between the different subdivisions are omitted since the business units and line of business are used interchangeably and in some regions certain LOB's are left out.

Business units	Line of Businesses	Regions
Mobility solutions	Mobility solutions	Europe
Healthcare	Commercial Finance	AsiaPac
Food & agri	Factoring	America
Office Technology	Consumer Finance	Netherlands/FS
Construction, Transport & Industrial	Leasing	

Table 23 Subdivisions DLL



Figure 38 structure DLL

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*Step 2: Define Business model*

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Now that the identity and the value-in-use of the whole organization is clear, and the structure is clear, it is time to take a closer look into the different business models coupled to their service compositions. In case an organization consists of a single business model, this step can be skipped. However, most companies do not deliver one specific business model to a specific customer, but deliver more models to different customers. A capability map must be made for the whole organization, but the differentiation between different models must be made. This will result in a more efficient IT landscape, as well as services towards customers. Therefore, the following step is to define the different service compositions for each business model. The different compositions form a different line of business, and therefore they are named line of business (LOB). Now that the structure of the organization is more clear, the business models of the different LOB's must be defined. For this step, the same template of step one is used, but it must be made specific for the LOB, see Figure 39. It is important that the capabilities distracted from the business model radar are divided into capabilities that are outsourced or not.

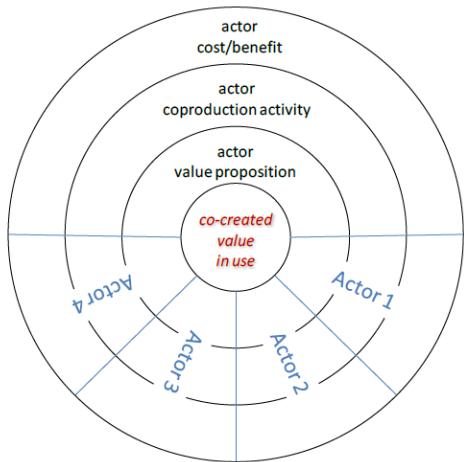


Figure 39 Business model radar

## DLL

From the previous step, the different service compositions or LOB's became clear, see Table 24. The two LOB's that are marked are the one within the scope of the thesis. Therefore, these two will be executed.

Line of Business DLL
<b>Leasing</b>
<b>Mobility Solutions</b>
Commercial Finance
Factoring
Consumer Finance

Table 24 LOB's DLL

Below, the business model radar with the different stakeholders is made for the two business lines. For every stakeholder the cost/benefit, coproduction activity and value proposition is defined, with in the middle the value-in-use of the business line.

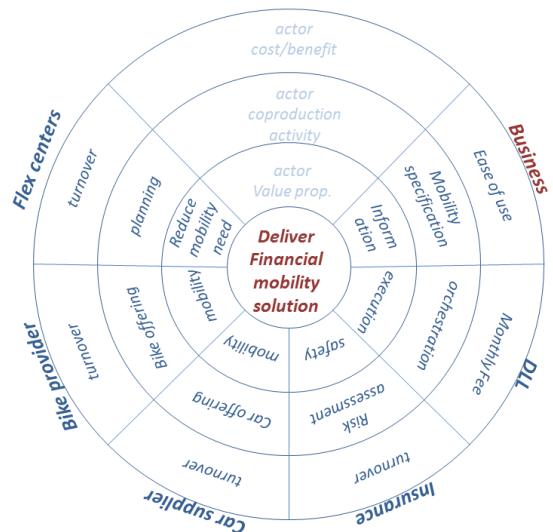


Figure 40 Business model radar for DLL mobility solutions

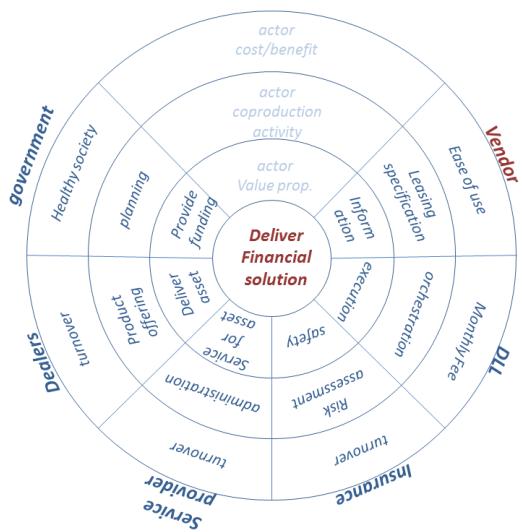


Figure 41 Business model radar for leasing

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### *Step 3: build business capability map*

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Now that the strategy of the organization is clear, the process of defining the business capabilities can start. Before mapping the capabilities, the rules and characteristics of the capabilities are explained.

#### **Rules and characteristics:**

First of all, the approach defines a capability as ‘a particular ability or capacity that a business may possess or exchange to achieve a specific purpose or outcome’. Before defining capabilities, one must keep the following principles in mind.

Capability principles
1. Capabilities define what a business does, not how a business does something.
2. Capabilities are nouns, not verbs.
3. Capabilities are defined in business terms, not technical terms.
4. Capabilities are stable, not volatile.
5. Capabilities are not redundant.
6. There is one capability map for a business.
7. Capabilities map to, but are not the same as, a line of business, business unit, business process, or value stream.
8. Capabilities have relationships to IT deployments and future-state IT architecture.
9. Automated capabilities are still business capabilities — not IT capabilities.
10. Capabilities are of most value when incorporated into a larger view of an enterprise’s ecosystem.

**Table 25 Capability principles**

According to Ulrich (2015) capabilities can be decomposed into different levels. Level 1-3 focuses on planning, where level 4-6 focus on detailed business/ IT mapping. The higher the number of the level, the more in depth the capability is. In Table 26, the different levels of capabilities are labeled.

Capability level	Function
Level 1	Foundation capabilities
Level 2	Capability groups
Level 3	Business capabilities
Level 4-6	Detailed business capabilities

**Table 26 Division of different capabilities**

The different level 1 capabilities must be structured in different layers. Therefore, Ulrich (2015) proposes three different groups: strategic, value-add and support. The strategic layer includes capabilities that reflect executive priorities. The value-add layer includes capabilities that describe what an enterprise does to ensure viability and thrive in the marketplace. The support layer includes capabilities that represent certain abilities that a firm must have to work as a business. In order to make sure a capability is correct, use the following table.

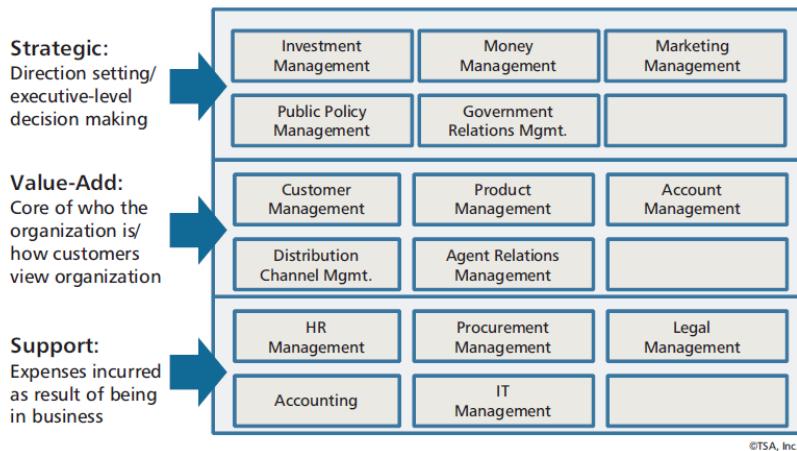
Class	Name	Criterion	If fails
How	Right grammar	Is the capability defined as a noun, instead of a verb?	Rename capability
	Right definition	Is the capability defined as a business term instead of a technical term?	Rename capability
	Right sequence	Is the sequence of the capability logical	Replace capability

		for the capability above and / or below the current capability?	
<b>why</b>	Right context	Does the capability fit in the context of the defined business strategy?	Redesign capability
	Right goal	Does the capability transform the state of the customer perception of the value-in-use?	Delete as business capability, consider as capability
<b>What</b>	Right size	Is the capability easily combinable in multiple service compositions?	Too large: split up capability Too small: combine capability
	Right scope	Isn't there any functional overlap with existing capability(s)?	Re-scope capability(s)
	Stability	Is the capability stable, instead of volatile?	Make the capability stable
	Right relationship	Does the capability have relationships to IT deployments and future-state IT architecture?	Delete capability
<b>Who</b>	Right actor	Is there a clear single actor (role) performing the capability?	Split up capability per actor
	Right beneficiary	Is there a single beneficiary (role) for whom the capability is performed?	Split up capability per beneficiary
<b>When</b>	Right start	Is there a clear starting point in time for the execution of the capability?	Scope capability down to delimited period
	Right end	Is there a clear ending point in time for the execution of the capability?	Scope capability down to delimited period

Table 27 Criteria business capability

#### **Draft level one capabilities:**

The first thing to do here, is to gather an industry template, see Figure 83. This is just an example. This document will only be used as a guideline. To find such an industry template search the web. Use the name of your specific industry or line of business in combination with terms like 'capability map' and 'service landscape'. Also [www.apqc.org](http://www.apqc.org) possess process classification frameworks (PCF) for several industries. These frameworks consists of a list with several standard capabilities. <http://www.cabusi.com/> is a website that just started where everyone can share there capability maps from different industries. For the banking industry an industry template can be found in appendix 6. This template is derived from [www.bian.org](http://www.bian.org).



**Figure 42 Service organization level 1 capability map**

Now the capability map must be made more specific for the company. To do so, use the strategy canvas obtained in step one. This will show the business resources, information about the IT department, HR management, knowledge sharing, relationships with external resources and more. Also, the business models of step three can be used. However, one must keep in mind that the capability map is for the whole organization. The list can be made using Microsoft Excel, but this makes it difficult to see the total overview. In order to see the overview, this master thesis recommends the program Abacus. This will create a nice draft on the capability map. All the senior business representatives of the different LOB's of an organization must define the capabilities for their own LOB's. In order to keep a good structure, every value-add capability must be linked with a LOB. In case a certain capability is used by four LOB's, the capability must be linked with four LOB's. This can be done in Abacus.

In order to make the level 1 capabilities complete hold a meeting with all the senior business representatives of the different LOB's. Here, the draft version will be reviewed. Discuss the different capabilities and make sure that everyone holds the same definition for the capabilities. The level 1 map can be published once all the senior business representatives are sure that there exists no gaps in the map.

#### ***Decompose level 2 capabilities:***

Now all the level 2 capabilities must be decomposed. The focus lies on the value-add capabilities. This is the core of a given business model. In order to spare time, the support and strategic capabilities can wait with the decomposition until these capabilities are required. Now, these level 1 capabilities can be filled in by searching the web for commonly found capabilities. Take for example, 'customer management'. When searching the web on 'customer management capabilities' or 'customer management functions' a list with capabilities for customer management can be found.

Like the industry template, this gives a guideline or beginning point for the level 2 capabilities. Then hold a meeting with the person involved in the specific capability. When all the capabilities are filled in, the same meeting is done as in step 1 of this phase.

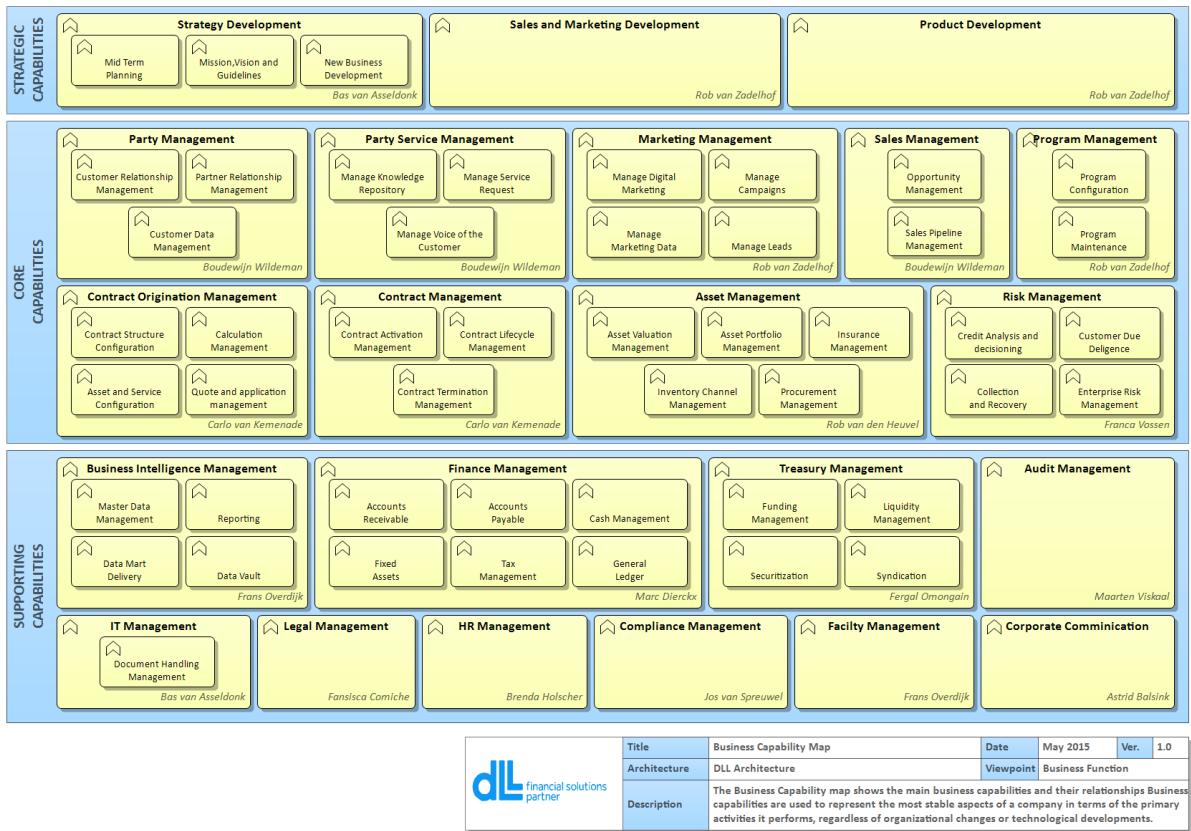
#### ***Decompose level 3-6 capabilities:***

The decomposition of level 3 follows the same process of step 2. Here, the information of the business processes can be used to fill in the more detailed capabilities.

#### **DLL**

Below, the capability map of DLL is shown for the level one and level two capabilities. The capabilities are divided into strategic, core, and, supporting capabilities. The business capability map of DLL at

this moment, also incorporates the different LOB's including their value chains. Also different business services are used to link different aspects in the map, see Figure 44.



Title		Business Capability Map	Date	May 2015	Ver.	1.0
Architecture	DLL Architecture	Viewpoint	Business Function			
Description	The Business Capability map shows the main business capabilities and their relationships. Business capabilities are used to represent the most stable aspects of a company in terms of the primary activities it performs, regardless of organizational changes or technological developments.					

Figure 43 Old business capability map DLL

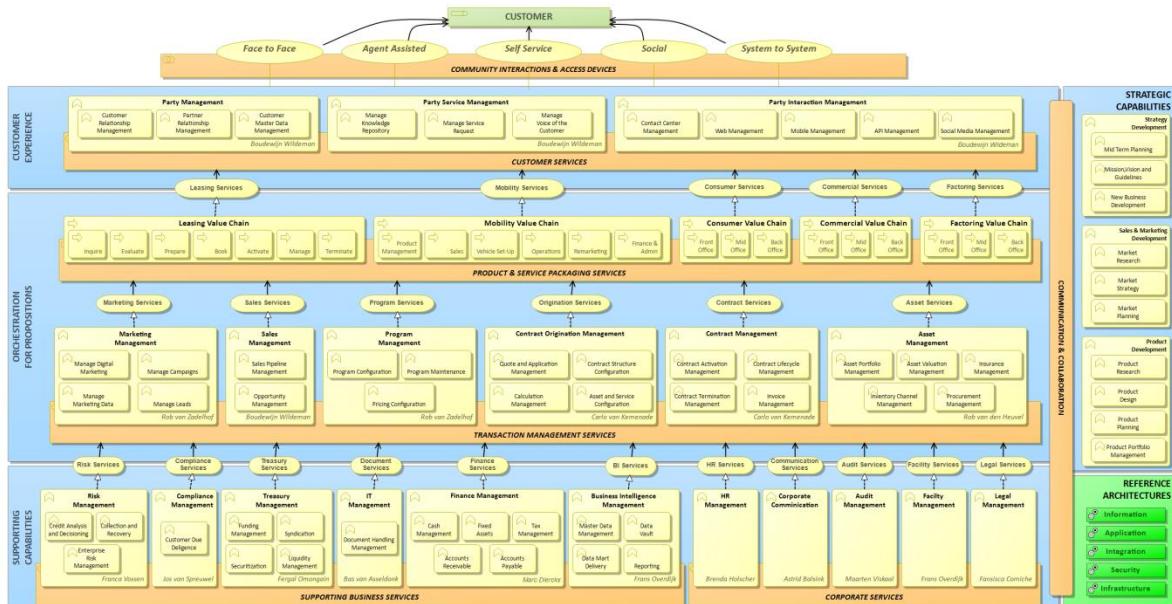


Figure 44 New business capability map DLL

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#### *Step 4: define Service composition*

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Now that the structure of the organization is clear, the operational aspect becomes important. The reason for this step is twofold: to describe the operationalization of a certain LOB, as well as linking the business processes to the business capabilities. In order to define how the operational part works, service compositions can be used. These compositions exist in two basic types: the process type and the mash-up type. It is also possible to combine these two types. The process type is typically used for strictly sequenced business interactions in which the activities of multiple actors need to be synchronized in time and information needs to be passed between these activities. The mash-up type is typically used for free-form business interactions in which a single actor invokes the functionalities of a number of other actors (Grefen, 2013). Value streams depict how a business achieves value for an internal or external stakeholder. They are defined as an end-to-end collection of activities that create a result for a customer (Whittle, 2004). The service compositions and value streams will be combined in order to structure the business processes. Such a combination must be made for every LOB. First, the business service is introduced.

this step sequences on the strategy and business capabilities and focusses on the development of a service composition. This list of the business services is deduced from the list of the business capabilities in combination with the strategy. In order to do so, two employees of an organization are important: a domain expert and a business architect. The domain expert to understand the content and the business architect to understand the structure.

#### **Service compositions:**

The service composition exists of all the activities necessary to deliver a certain service. A distinction is made between business services and supporting services. The business service transforms the state of the customer perception of the value-in-use, where the supporting service supports the total process. These activities or services can be sequential or loose. It is important that the activities form a complete picture for a single LOB, so that every activity is covered.. First, start with the services that are delivered to the customer. Mostly, these services follow a sequential process, for example create request followed by create contract. Once this process is completed, add all the services that will support the process, for example manage partner relationship. Below an example is given.

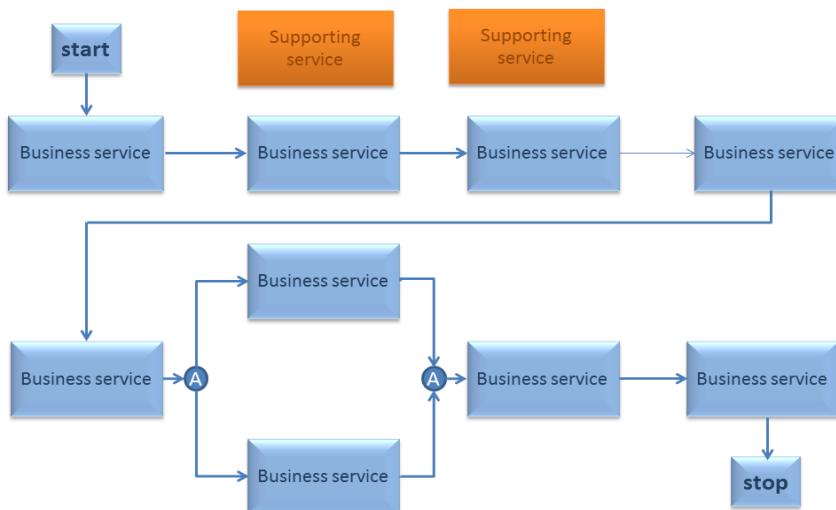
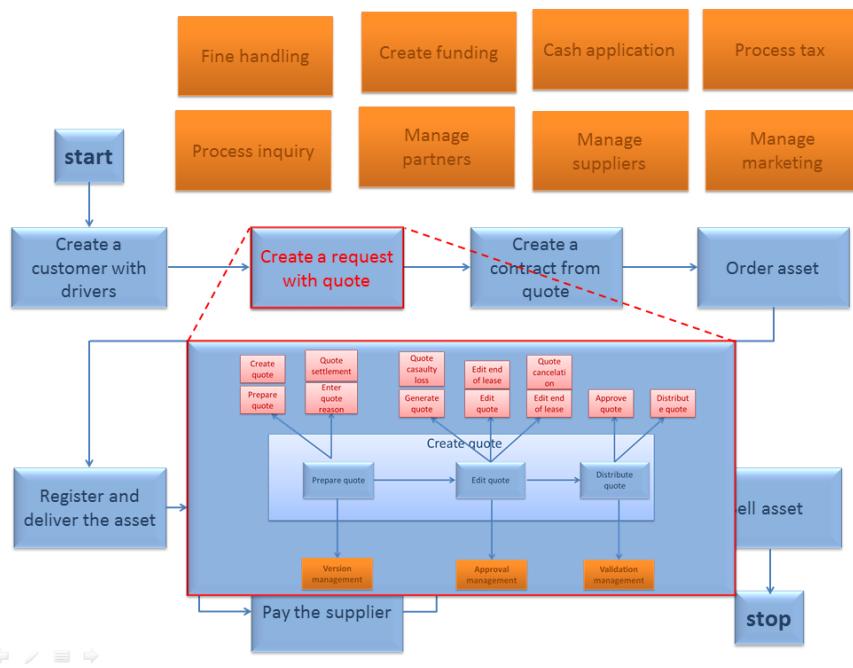


Figure 45 Service composition

## Value stream:

Each service in the composition maps to a certain value stream. The value stream becomes the high-level view on how to execute the service. For example, the business service create contract could exist of the high-level value stages receive request, create contract and, process contract. These value stages can then be mapped to the business processes.



**Figure 46 Value streams impregnated into service composition**

The result will be a complete picture of the operationalization of a single LOB, that will show all the business capabilities and business processes as well as the link between those two.

## DLL

The two LOB's of DLL: leasing and mobility solutions show similarities as well as differences in their service composition. The differences especially exist in the extra services that are involved in the repair and maintenance of the cars as well as fine handling and incident handling. The value stages can be coupled to the business capabilities, which will show the differences in capabilities of the LOB's. The aim is to provide every service with a value stream, and their coupling to the business capabilities. Here, an example is given for create request with quote. The link with the business process is elaborated in the next step.

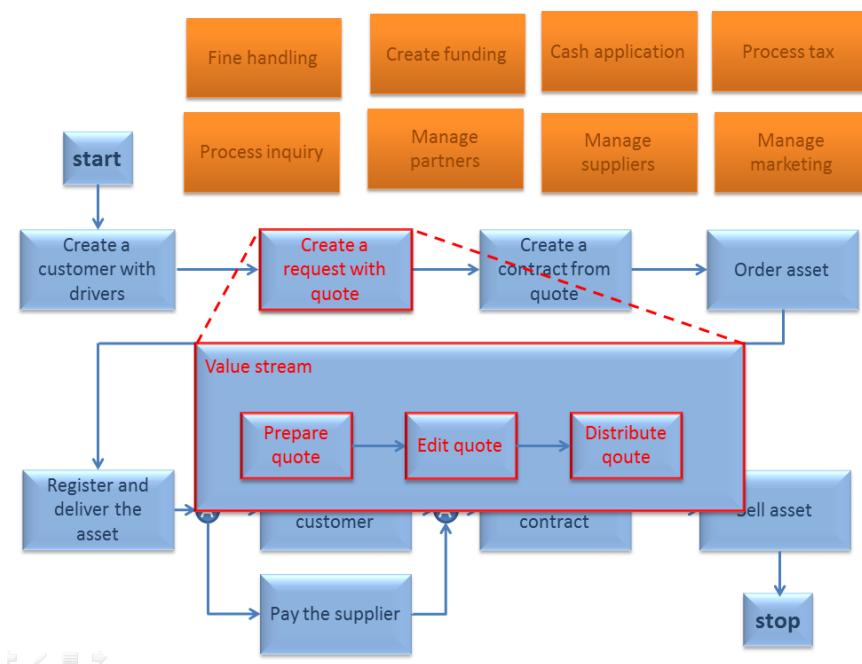


Figure 47 Service composition mobility solutions

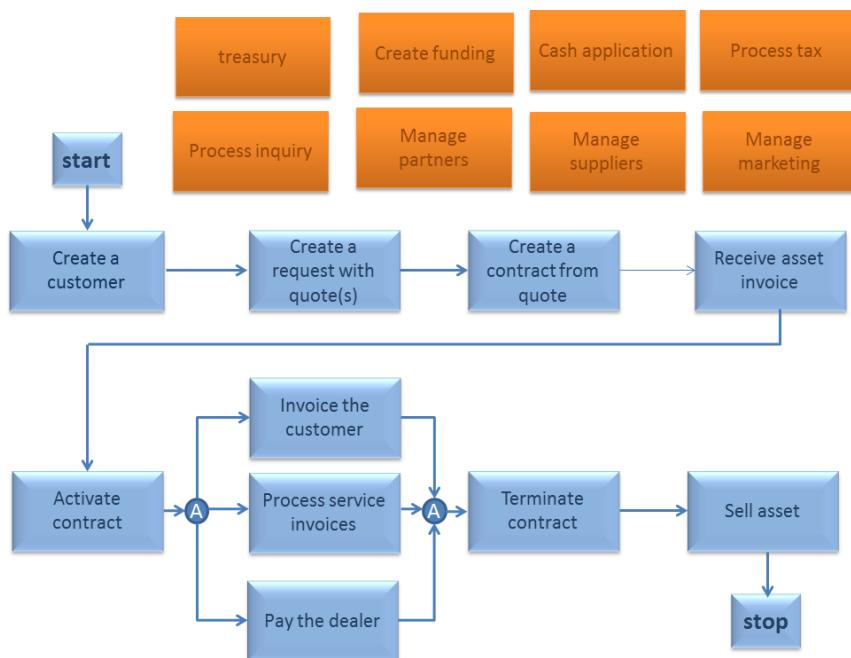


Figure 48 Service composition leasing

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### Step 5 : Map business processes

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Now that the service composition is finished, the map can be used to link business processes, and link business architecture and enterprise architecture. First, The business processes for the different LOB's must be defined. A simplified explanation can be found in appendix 1. Once, the list of all the business processes are clear they must be mapped in a structured way. This is done by using the value streams.

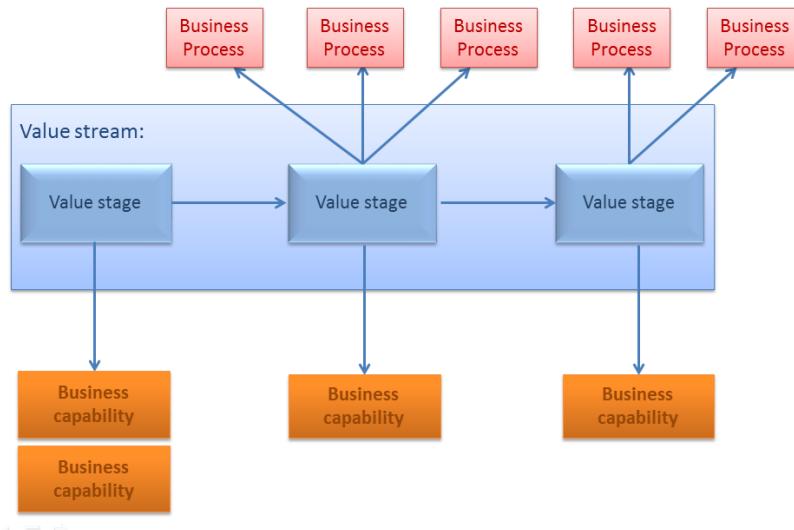


Figure 49 Value stream coupling

The gap analysis can be performed by overlaying the service compositions of the different LOB's. This high-level view of the operationalization of a line of business results in an easy comparison of the business capabilities and business processes.

### DLL

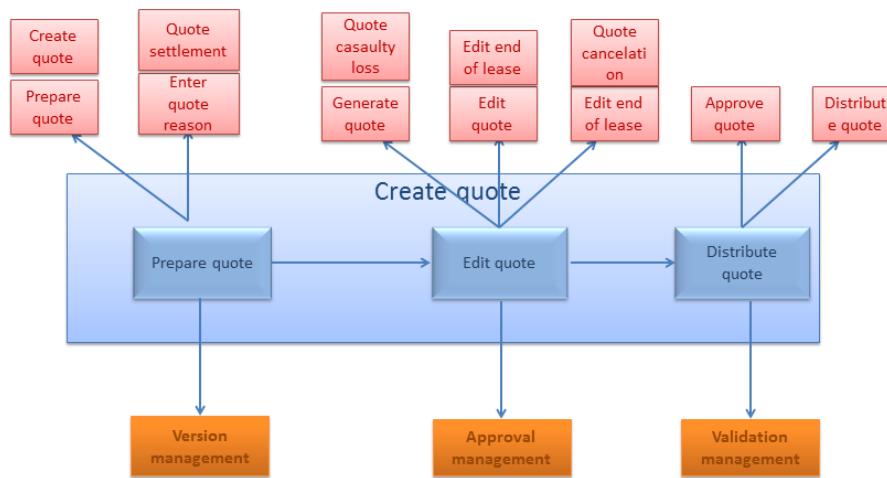


Figure 50 Value stream: create quote

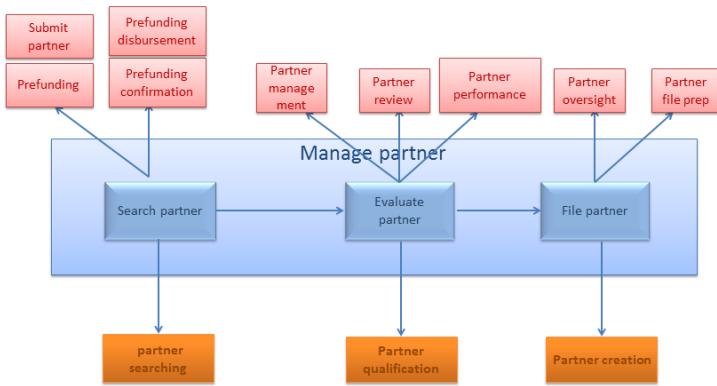


Figure 51 Value stream: manage partner

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#### *Step 6: incorporating capabilities into business architecture*

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In order to make a link between business units and more, the figure of step 2 can be used as a starting point. However, here only the business units are relevant. The business units must be linked to all the level 1 capabilities of the capability map, see Figure 52.

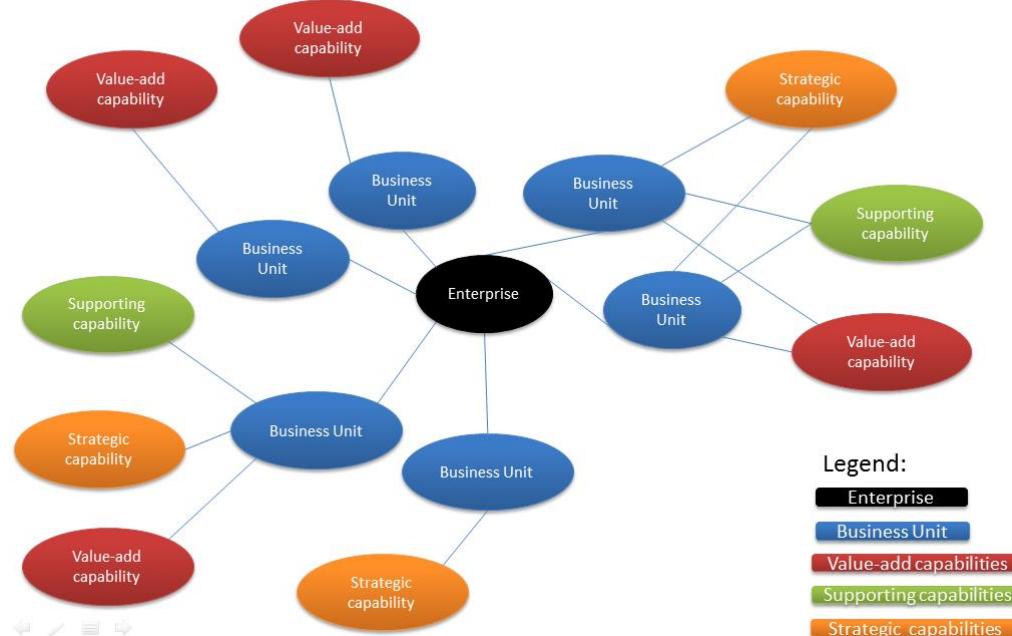


Figure 52 Linking capabilities to business units

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*Step 7: incorporating capabilities into enterprise architecture*

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A major challenge of IT planning is dealing with the current state of redundant and overlapping applications and information. For example, mergers and acquisitions instantly result in redundant applications and data.

IT architecture planning desires to address all three of the following issues:

- To remove redundancies by eliminating and consolidating duplicate systems and information;
- To reduce overlaps by breaking capabilities out into more modular systems;
- To fill gaps by enhancing existing systems or acquiring new ones.

These three issues can be solved by using business and information services between the business capabilities and the applications and data, see Figure 53.

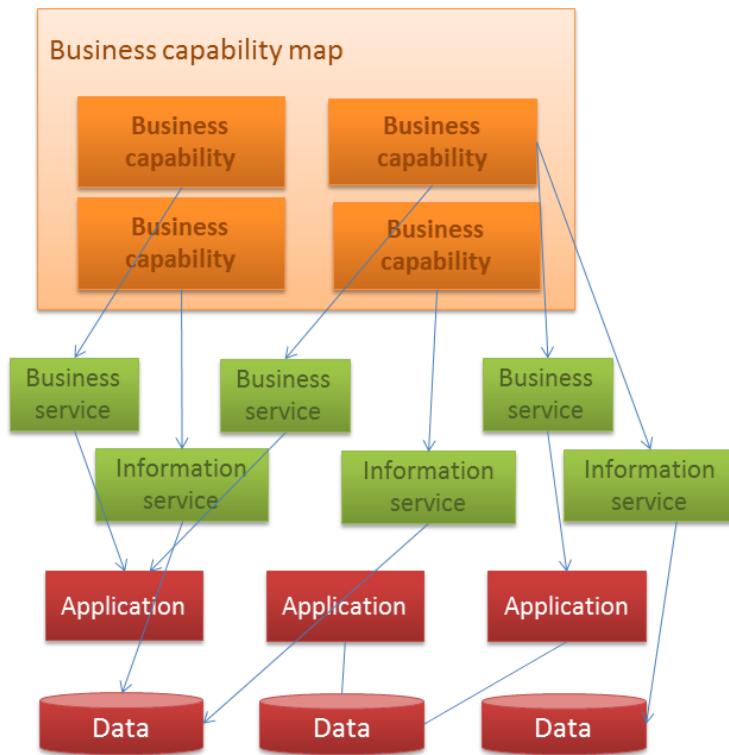


Figure 53 Linking capabilities to applications

## 8. Conclusion and reflection

In this master thesis the relatively new approach of business capabilities mapping is examined. The case study of this thesis is performed at DLL, a financial leasing company. The research started by introducing the topic, the business context and the research problem. After this introduction, the literature review was conducted in order to form a broad view of the topic. After the literature review, the as-is analysis regarding the business capability map of DLL is performed. These two aspects formed the basis of the conceptual framework. Subsequently, the conceptual framework was executed at DLL. From the conclusions of this execution, a new theoretical framework arose. This theoretical framework is applicable for all service-dominant businesses. This chapter will reflect upon the complete research. In chapter 8.1 an answer is given on the four research questions of this thesis. In chapter 8.2 the managerial contribution is explained. In chapter 8.3 the academic contribution is explained. In chapter 8.4 the limitations and recommendations for future research are described. In the last section of this chapter, the self-reflection of this master thesis is explained.

### 8.1. Answering the research questions

The different research questions, derived from the research objectives of the assignment in chapter 1.3 form the foundation of this thesis. These questions serve to help the main objective of this explorative study: to build a design for a business capability map, applicable for all service oriented companies. In this chapter the answers to these questions are given.

**RQ 1:** What are the important aspects of servitization and business capability mapping?

The answer to the first research question gives a broad understanding of two topics: servitization and business capabilities, with a focus on business capability mapping. According to Baines and Lightfoot (2009) Servitization is the innovation of an organization's capabilities and processes to shift from selling products to selling integrated products and services that deliver value in use and tend to emphasize the potential to maintain revenue streams and improve profitability. There are three factors that drive companies to a servitization strategy: financial, strategic and marketing. The challenges for companies making the servitization process are threefold: challenges in service design, organisation strategy and organisation transformation. One way to tackle these challenges is by making use of the BASE/X framework. The BASE/X framework is a structure for the development of new service-dominant business: business strategy, business models, their operationalization in service compositions, business services, and their implementation in state-of-the-art automated service management platforms (Grefen, 2013). The topic Business capability mapping starts with defining a business capability. According to Ulrich (2015), a capability defines *what* a business does. It does not communicate or expose *where*, *why*, or *how* something is done — only what is done. A capability map can be seen as a blueprint for a given business or company. It creates a common language for businesses to document and visualize capabilities within the context of various analysis or planning activities. The article of Ulrich (2015) showed that there are four aspects that are important when building a business capability map: information like industry templates, organization (which refers to clearly defined strategy documents), value streams, including business processes, and resources.

**RQ 2:** What is the current situation according to business capability mapping for the two business lines at DLL: mobility solutions and leasing?

This second question is an analysis of the current situation at DLL. The analysis is executed for two different business lines: mobility solutions and leasing. The determination of the current position according to business capability mapping is based on the analysis of the different steps already taken of the business capability map, and an analysis of the important aspects derived from research

question 1. The aspects analyzed are the business strategy, business capabilities, business processes and value streams. The first step performed in the process was the decision-making of the business capability map. DLL chose to hire an external company that deals with the architecture of information systems. After different board meetings, the final decision was made to build the business capability map. DLL choose to begin with building the map for only one business line: leasing. This should be no problem when you accept the fact that the map you are going to build is of the whole organization. Although the beginning was made for leasing, the business capability map is for the whole organization of DLL. It started with defining level 1 capabilities and used business processes, and the product catalogue including strategy documents as a starting point. According to the literature, the right information is used, however it would be better to use a matching industry template as a starting point. For the structure of the capability map, the subdivision from Ulrich (2015) is used, see Figure 83 Service organization level 1 capability mapFor defining the level two capabilities the starting point was the previous level of capabilities. To gather the internal information of the company they also used the list of business processes and the business service catalogue. They first defined the level two capabilities that were added to the draft version from the level 1 capabilities. They started defining the level 3 capabilities once all the stakeholders accepted the level 2 capabilities. At the moment, they are actively reviewing with the involved stakeholders in order for everybody to accept the level 3 capabilities before adding the more detailed business capabilities. For the aspects of the business capability map first a general analysis tool is created for these aspects. More specifically, a criteria table is defined so that every service-oriented company is able to determine the status of a certain aspect. The already defined business capabilities are well defined for both business lines. The only remark on some of the capabilities is that verbs were used in their definition. In order to differentiate between business capabilities and value streams and business processes, it is best to use only nouns for the capabilities, where verbs are used for the other two aspects. The strategy at DLL is defined in the enterprise big picture. Here, the information is kept more superficial. The strategy defined for leasing and mobility solutions, however is much more elaborated. The big picture for leasing includes aspects as vision statements, key partners, activities, and resources, customer relationships, revenue streams and more. It can be concluded that both business lines are well explained in terms of the strategy. The business processes consist of about 500 different business processes for each LOB ranging from different functional domains like contract management to vehicle disposal. From analysing a representative set of business processes it can be concluded that the business processes are well defined. The analysis of the value streams shows that DLL is busy developing the value streams. However, it is not complete. The value streams for leasing are well formed, but not all of the value streams are developed already. The value streams for mobility solutions are yet started and need some more attention. The value streams of mobility solutions are more a summary of the different functional domains. The value streams must be an end-to-end collection of activities that create a result for a customer.

**RQ 3:** How can the previous results be assembled into a framework for business capability mapping?

Answering this research question resulted in a conceptual framework that is tested in research question 4. The information of this framework is gathered from the literature review and the analysis of the current situation at DLL. This research step starts by selecting the most appropriate tool for making the servitization process and making the business capability map. For the servitization process, the BASE/X framework of Grefen (2013) is selected. For the business capability map, the article of Ulrich (2015) is selected: the business capability map: the 'Rosetta Stone' of business/IT alignment. First, the structural and functional specifications were defined. Once this was done, an approach is created for the business capability map, which uses the article of Ulrich (2015) as a starting point, extended with additional information on the topic business capabilities. This approach is enhanced with the findings of the empirical analysis at DLL, as well as the BASE/X

framework. This resulted in 6 steps: it starts with accepting the BASE/X framework. This means performing the different layers of the framework, see Appendix 3. The second step is to gather information. The four aspects here are the industry template, value streams, business processes and the business strategy. The third step consists of defining and mapping the capabilities, followed by mapping the business processes to the business capabilities. The last two steps include incorporating the business capabilities to the business- and enterprise architecture. The different steps of this framework are not enough supported by academic literature, since there are too many variables. This framework is first executed at DLL to conclude which steps are necessary to build the business capability map. This was done at research question 4.

**RQ 4:** How will the conceptual approach of research question three work at DLL, followed by a gap analysis?

In the fourth question, the approach is executed. This shows the robustness of the conceptual design. All the steps of the approach are executed for the two business lines: mobility solutions and leasing. The execution of this approach resulted in conclusions for every step. Also, the gap analysis for the different business lines is performed. From here, the new theoretical framework could be derived. For the first step, it can be concluded that the strategy of an organization must be defined before beginning with the capability map since the identity of an organization, as well as business competences and resources help define the business capabilities. Secondly, the best canvas that can be used is the BASE/X strategy canvas, because it serves all the aspects necessary for the capability map as well as the important aspects for a service dominant strategy. The business model radar is an ideal tool to visualize these activities. Therefore, the business model radar of the BASE/X framework is recommended. The business model of Osterwalder deals with the activities and resources, and can be used in addition. The service composition of the BASE/X framework offers the operationalization of the business model. This can be used to link the business processes to the business capabilities. From the second step, the industry template forms a starting point for a business capability map. This aspect will be assigned to the step map the business capabilities. The value streams will be coupled to the service composition that must be made for every line of business. The value streams will then be used to link the business capabilities to the business processes. For the third step, mapping the business capabilities, it can be concluded that the capability map must cover the whole enterprise. Also, the strategy of the organization must be defined in order to find the key resources, key activities and more aspects that help defining the business capabilities. Furthermore, it is important to divide the capabilities into the three classes of Ulrich (2015), the supporting, value-ad, and strategic capabilities. The execution at DLL showed that value streams can be used to link the business capabilities. Lastly, the gap analysis of the different LOB's at DLL showed that about 80 per cent of their capabilities are similar. The differences occur in procurement management and risk management. Procurement management deals with buying additions to a car, such as tyres. The risk management deals with collection and recovery and credit analysis and decisions. Both are only applicable to mobility solutions.

**RQ 5:** How should a service oriented company create a business capability map, and compare different business lines in terms of business capabilities and processes?

In the last question, a final design is built so that every service oriented company can first build their business capability map and analyze the similarities and differences between two or more LOB's regarding the business capabilities and processes. This approach consist of seven steps beginning with accepting a knowledgebase and defining the strategy and ending with incorporate business capabilities into enterprise architecture. This last step, is not executed due to time restrictions. The framework describes guidelines and templates on how to derive a business capability map. Adopting the knowledge base formalizes the way in which information about the business — including

organizational structure, capabilities, value streams, information assets, project initiatives, customers and partners, and related IT assets — is stored, related, and viewed. The first step in the approach is defining the enterprise strategy. Important aspects here are capture the identity and value-in-use of the organization and the resources. In order to re-use capabilities between different service offerings, business units or lines of business in an organization, the structure of a company must become clear before building on the capability map. Therefore, it is recommended to visualize the structure of all the different subdivisions within an organization. The next step deals with the different LOB's. For every LOB the business model must be defined. This is done by the business model radar. Now that the strategy and business models for the different business models are clear, the business capability map will be formed. Now that the structure of the organization is clear, the operational aspect becomes important. The reason for this step is twofold: to describe the operationalization of a certain LOB, as well as linking the business processes to the business capabilities. In order to define how the operational part works, service compositions can be used. The service composition exists of all the activities necessary to deliver a certain service. Each service in the composition maps to a certain value stream. The value stream becomes the high-level view on how to execute the service. These value streams form a structured way to compare the different LOB's in an organization. The next step is linking the business processes. Once the list of all the business processes is clear they must be mapped in a structured way. This is done by using the value streams. These steps form the basis of the business capability map, including value streams and business processes. From here, business capabilities can be used to incorporate them into business- and enterprise architecture.

## 8.2. Managerial contribution

DLL is currently transiting to a more service-oriented organisation. DLL has two business domains with currently distinct business processes and capability sets: leasing and mobility services. The business processes of these domains are inherently different, but they make use of similar capabilities. The fact that their capability sets are not yet harmonized limits possibilities for re-use of capabilities across the business processes of the two domains. This can be prevented by adopting the new theoretical framework. Adopting the framework also assists the transition into a more service-oriented organization. By creating a complete service composition combined with value streams for each line of business, the differences and similarities can be seen immediately. This high-level view creates an overview that can be compared between different LOB's. This means that the created business capability framework can be used for all the different LOB's in the organization. By first defining the global strategy, followed by defining all the different subdivisions in an organization, DLL can use the remaining steps for the development of the capabilities for the other LOB's. The remaining steps first helps to define the business model for a certain LOB, as well as the service composition coupled to the value streams. Also, at any point in time the general analysis tools at chapter four can be used to estimate the current state for business capabilities, strategy, business processes, and value streams. Moreover, by using the created framework in chapter seven, DLL is able to guide the process of the transition to a more service-oriented company. The step-by-step explanation will result in a more efficient and faster process when it comes to building business capability maps. Secondly, it is able to create a business capability map for the complete organization. There should always be one map for the whole organization in order to bring transparency. Thirdly, by creating service compositions combined with value streams that couple to the business processes and business capabilities of a certain LOB, DLL is able to create an overall picture of the operationalization of the LOB. This will also ensure that the business processes, but especially the business capabilities can be easily compared between different LOB's. In order to differentiate between business capabilities and value streams and business processes, it is best to use only nouns for the capabilities, where verbs are used for the other two aspects. This will control the fact that a capability must only define what a business does, instead of how a business does something. All these steps will result in capabilities that can be easily re-used between different LOB's. This will result in a more efficient IT landscape for DLL.

### **8.3 Academic contribution**

Business capability mapping is a relatively new concept. This means that there is not much information known about this topic. In the literature review, only one article is found on the specific approach of the business capability mapping, namely the article of Ulrich (2015). The process of building a business capability map therefore has received too little attention. Another problem is that business capability mapping is especially interesting for service-oriented companies, or companies that want to make the transition to a more service-oriented company, due to the fact that the business capability map helps to specify service-oriented architecture. Unfortunately, the academic literature related to this topic did not make this connection already. Most of the articles about business capability simply explain the business capability as an aspect, or explain which business capabilities are important for an organization. They do not explain how to structure business capabilities. This thesis provided insight into the process of business capability mapping for service-oriented organisations. The academic contribution of this thesis project is as follows: First, the created business capability framework of chapter seven provided a thorough understanding of the service-dominant business structure that provides an operationalization of the framework. The framework will help the service transition by understanding the way business is organized and changes the traditional way of thinking in terms of decision horizons where it comes to implementing agility. Second, the framework contributes to the academic literature by providing a step-by-step explanation on how to achieve a business capability map for service-oriented companies. Third, the framework includes a way to compare the capabilities between different LOB's and incorporating capabilities into business- and enterprise architecture and link the business processes. Especially the comparison between different LOB's when it comes to business capabilities and business processes was lacking in the literature. That is unfortunate, since the comparison provides a way to re-use the capabilities across the business processes of different LOB's.

### **8.4. Limitations and recommendations for future research**

The research is performed in a broad manner. The objective of this research is to develop a approach for business capability mapping for service-oriented companies. This can result in the fact that more companies are able to use the framework. However, it brings along limitations as well.

The first limitation of this study is that the business capability map is only applied at DLL, a financial leasing company. Therefore, it cannot be generalised for the entire financial leasing company, but especially for service-oriented companies. The second limitation is about the new theoretical framework that proposes a way to deal with comparing the business capabilities between different LOB's. The execution in chapter six shows that a service composition including value streams for a single LOB creates a perfect overview to link the business capabilities and business processes in order to compare different LOB's. However, this step is not executed for a complete service composition of a LOB, only for a simplified version. The last limitation is the last step of the theoretical framework. This step, incorporating business capabilities into enterprise architecture, is not executed due to time restrictions.

The limitations above show that much research remains to be done in order to complete the topic of business capability mapping. Hence, the first recommendation is to perform more case studies, in order to rectify the framework. In order to conclude if this framework is applicable for all service-oriented companies, the new theoretical framework proposed must be tested at different business contexts. The second recommendation is to execute the service composition of step 3 for a complete business line. A more thorough execution of this step could confirm the possibility of the execution of this step. The last recommendation is about the last step of the new theoretical framework. In order to complete the framework this step must be executed at new case studies. In order to optimize the business capability framework, the framework should be tested at different domains for service-oriented companies.

## 8.5 Reflection

The last section of this thesis involves the reflection on this whole research project. Now that all the work is completed, it is time to look back on the personal experience of this master thesis. The topic of this master thesis matched perfectly with my interest that I developed during the time that I followed the master Innovation Management, a combination of servitization and information systems. The objective of this thesis originated from the collaboration with DLL. From here, the project started with a literature study. Although, it was not easy to obtain all the right information (especially for the topic business capabilities), the process itself went without any significant problems. During my master, I had followed courses that included developing similar literature studies. However, getting into the project itself took me longer than I had expected it to take. Looking back now on this master thesis, I referred too much to the bachelor thesis resulting in skewed expectations from my side. The master thesis includes a research program conform accepted international research standards, in collaboration with the included company (DLL). It took me some time to understand this. Another important aspect in this master thesis was the responsibility of the student. This resulted, especially in the beginning, in poor schedules and poorly prepared meetings with supervisors. Also, master thesis as a whole was a bit overwhelming for me at the beginning. There were so many activities that needed to be performed that I sometimes lost control of the outline of the project. The use of the regulative cycle of figure 1 helped with controlling this overview.

From what I know now after completing this master thesis I would have done some things different. If I would redo this thesis, I would do at least the following three things better: at first, I will create a document with all the requirements and characteristics of the project, but especially with the expectations of all the stakeholders involved. Secondly, I should take more responsibility for the projects. This should result in designing and controlling the planning of the project, creating clear deadlines for deliverables and sticking to them. But also draw up agendas and write up reports on discussions, meetings, and agreements. Lastly, whenever I encounter a difficult or comprehensive problem or process, I will be able to start with zooming out of the problem or process, understand the overall picture, followed by guiding the process by making clear visualizations of the problem or process. Also the regulative cycle of figure 1 helped with defining the research objectives and questions. By coupling the questions to different phases of the research, the research process became much more structured. At last, the BASE/X framework and the Ulrich approach show a lot of similarities. The BASE/X framework focuses more on the business services of an organization. In this approach, the business services are less important. At hindsight, I would include the business services more into the framework.

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## Appendix 1: Gather information

### Strategy:

According to Grefen (2013), the best starting point for business services or capabilities is to deduce them from the service-dominant strategy.

Of course the strategy is focused on service dominant business. This means that the strategy will focus on delivering value-in-use instead of assets and it will be more defined in context of business networks. In order to develop a structured strategy a company could use the service dominant canvas, see Figure 54. It is subdivided into three main topics: Value-in-use, service Ecosystem and Collaboration Management. The strategy canvas define the competences and resources of the company, the partners etc. Therefore, this document tells what the possibilities are as well as the restrictions. For example, some capabilities are not possible to perform by the company, due to missing resources or employees. Keep in mind that this document must be made for all the LOB's in the organization. Also other documents that already exist can be helpful. Most organizations already possess elaborated business processes. Probably every company will already possess documents that describe the business strategy. Therefore, it will be a wise decision to take a look into those documents before filling in this canvas. For example, many companies develop an enterprise big picture of the company. Most of the domains shown in such an enterprise picture can be transformed into business capabilities. This could be used as a template in combination with the business strategy.

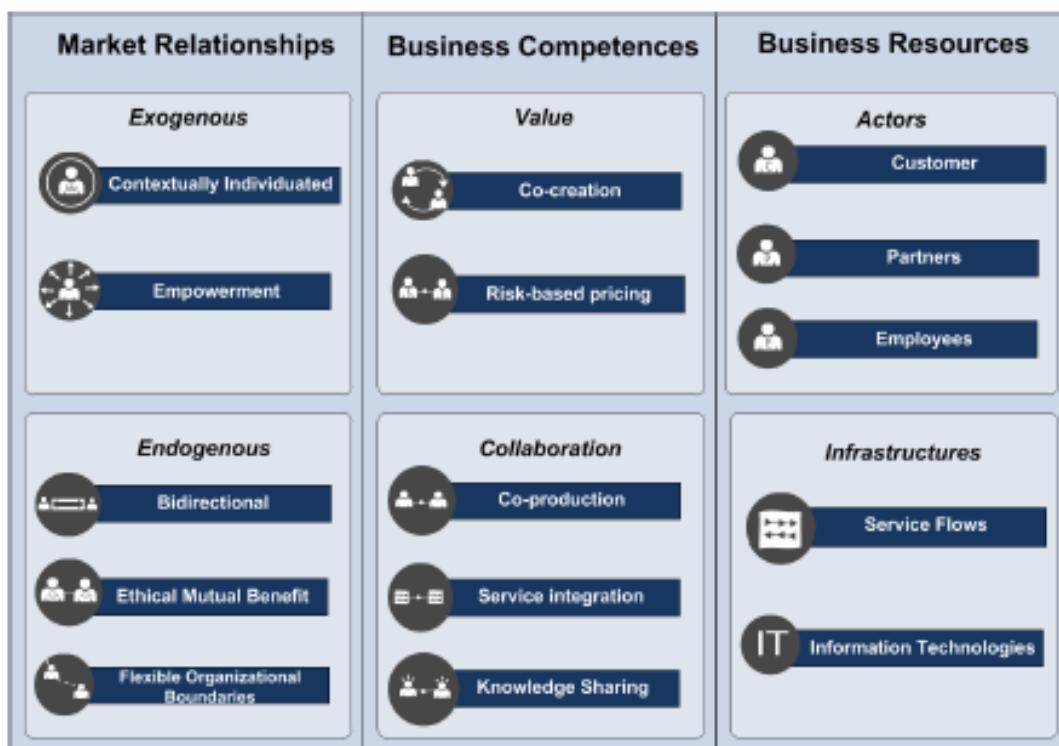


Figure 54 SD business strategy canvas

### Industry template:

The process of developing a business capability map is difficult to do when beginning from scratch. An industry specific template can therefore be a good opportunity to avoid this. For a lot of industries capability maps and capability lists already exists. In appendix 6, a reference capability map can be found for the banking industry. Keep in mind that this is not the same for every organization.

Such documents can be used to adopt it to make it more specific for the organization. Also [www.apqc.org](http://www.apqc.org) possess process classification frameworks (PCF) for several industries. These frameworks consists of a list with several standard capabilities. <http://www.cabusi.com/> is a website that just started where everyone can share there capability maps from different industries. For the banking industry an industry template can be found in appendix 6. This template is derived from [www.bian.org](http://www.bian.org).

### **Value streams:**

Value streams depict how a business achieves value for an internal or external stakeholder and are defined as an end-to-end collection of activities that focus on the result for a customer. A value-stream begins with a stakeholder that triggers the first stage and ends when the product or service is delivered back to the stakeholder. They decompose into business processes, see Figure 55.

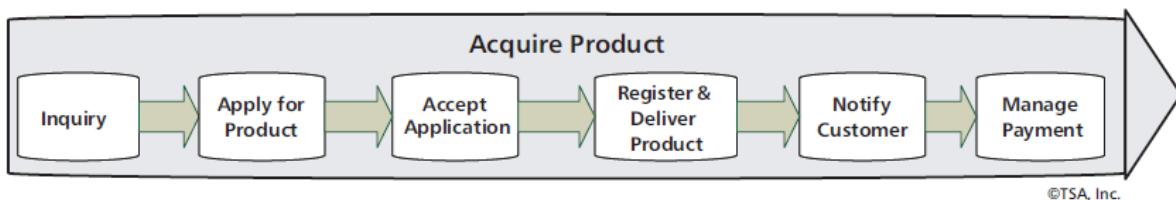


Figure 55 example value stream

Most of the companies already have a list of value streams. If this is not the case, follow the steps below to come to a value stream map:

### **Step 1: collect products/services**

The first step consists of gathering all the products or services that a company offers to the customer to generate revenue. It is recommended to use Microsoft Excel to build this list. This involves holding a meeting with senior business representatives from each LOB. Once the list of products or services are complete, complement the products or services with the sales volume and sales revenue. This makes it easy to determine the priorities of the different products and services. In case a company consist of different LOB's it would be a wise decision to mark the different LOB's with the value streams.

### **Step 2: add processes**

Now that the delivered products or services are clear, the functions, activities, departments or processes through which these products or services travel through becomes important. Use the same list developed in step 1 and horizontally write down the aspects that the product or service travels through, see Figure 56.

Products	Sales Volume	Sales Volume %	Process 1	Process 2	Process 3	Process 4	Process 5	Process 6	Process 7
Product 1	10	5%	x	x		x	x		x
Product 2	50	23%							
Product 3	15	7%	x	x	x	x	x	x	x
Product 4	5	2%	x	x		x	x		x
Product 5	10	5%		x	x			x	
Product 6	70	32%	x		x	x	x	x	
Product 7	20	9%	x	x	x			x	x
Product 8	10	5%		x	x			x	
Product 9	25	11%	x		x		x		x
Product 10	5	2%	x		x	x	x		x
	220	100%							

Figure 56 products vs processes

The last thing to do is to mark the processes with X in case the product or service uses that process. In case different services or products use exactly the same processes, these can be brought together in a group.

### ***Step 3: develop value stream map***

From the list of step 2, you can select the product or service with top priority to begin with the value stream map (this could be highest sales volume or revenue). The first thing to do is to identify the needs of the customer for the product or service. This becomes the title of the value stream, for example 'acquire product'. From here, the last process from the map of step 2 must be placed at the end. Keep working backwards to identify all the necessary processes that are needed to fulfill the value stream. Keep the value stream simple, and only use processes that are really necessary to fulfill the value stream.

Although this would complete the value streams as information source for the capability map, it is also possible to add extra information to the different processes, such as cycle time, error rate, employees needed, etc. this could be handy to identify delays between different processes. It is also possible to work with different arrows between processes to help identify how the product or information between different departments will flow. However, these aspects are less relevant when building a capability map.

### **Business processes:**

A business process or business method is a collection of related, structured activities or tasks that produce a specific service or product (serve a particular goal) for a particular customer or customers. The objective of the Business Process Model is to identify and detail all the business processes supported by the Product to the extent necessary to detail the roles of the Product (and its components, i.e. Application Components, Business Service Components and Tool Components).

The Business Process defines:

- the business processes of the domain which are relevant to the product or service, and which will enable the goals to be met, and:
- the roles of the resources that perform those processes.

Most of the companies already have a list of business processes. If this is not the case, follow the steps below to come to a business process map. The approach of the development for business processes is derived from the literature in the Comet component and model-based handbook:

### ***Step 1: derive goal model***

A goal model describes the business goals that will be met by implementing and then using the Product. Goals must be achievable, preferably measurable, and not self-evident, and should have clear and detailed implications. It should be reasonable (but not necessarily appropriate, and almost certainly not correct) to assert an alternative. The implications should be expressible in terms of a set of sub-goals or enabling processes. Thus "to have total customer satisfaction" is probably not a useful goal, as it is neither achievable nor measurable, and the alternative (no customer satisfaction) could hardly be argued. A more useful goal in this case might be of the form "95% of all customer complaints are resolved to the customer's satisfaction within 2 hours".

One of the key aims of Goal modeling is to identify the things that have to happen in the business for the goals to be met. These are the enabling processes which form the starting point of the Business Process model.

### ***Step 2: derive resource model***

The Business Process model is generally prepared at the same time as the associated Business Resource model. Each business process is defined in terms of its steps, and each step performed by a

resource at a higher level of detail may then be treated as a process performed by a community (of The Business Process Model is derived through a set of activities that encompass brainstorming sessions, structured workshops, interviews and feed-back sessions, and detailed modeling using a UML tool. The business resources are already defined in the strategy canvas. This list can then be used to develop the business processes.

### ***Step 3: build business process model***

The Business Process Model is derived directly from the Goal Model. Goals may be thought of as high level statements of the things that have to happen in a business, each expressed as an outcome, but in a way that leaves unspecified how that outcome is to be made to occur.

Thus, the first step in creating the Business Process Model will be the identification of the enabling behaviors that have to happen for each goal to be achieved. Initially this is done through a brainstorming process and production of an unstructured list of enabling behaviors for each goal. This list is then consolidated into a single set of enabling behaviors that, together, support all goals. This is the starting point for the Business Process Model which may then be entered into the tool using the Business Process Modeling Profile. Each Enabling Behavior is entered into the package containing the business processes in the top level Community model (see modeling framework) as a Class stereotyped either as <>Business Process<>, where it can clearly be seen that this behavior can be represented as a set of steps with a defined beginning and end, or, where no such approach is apparent, as a <>Behavioral Policy<>.

## Appendix 2: DLL business processes

### Leasing

Below, the three selected business processes of the leasing business line of DLL is showed.

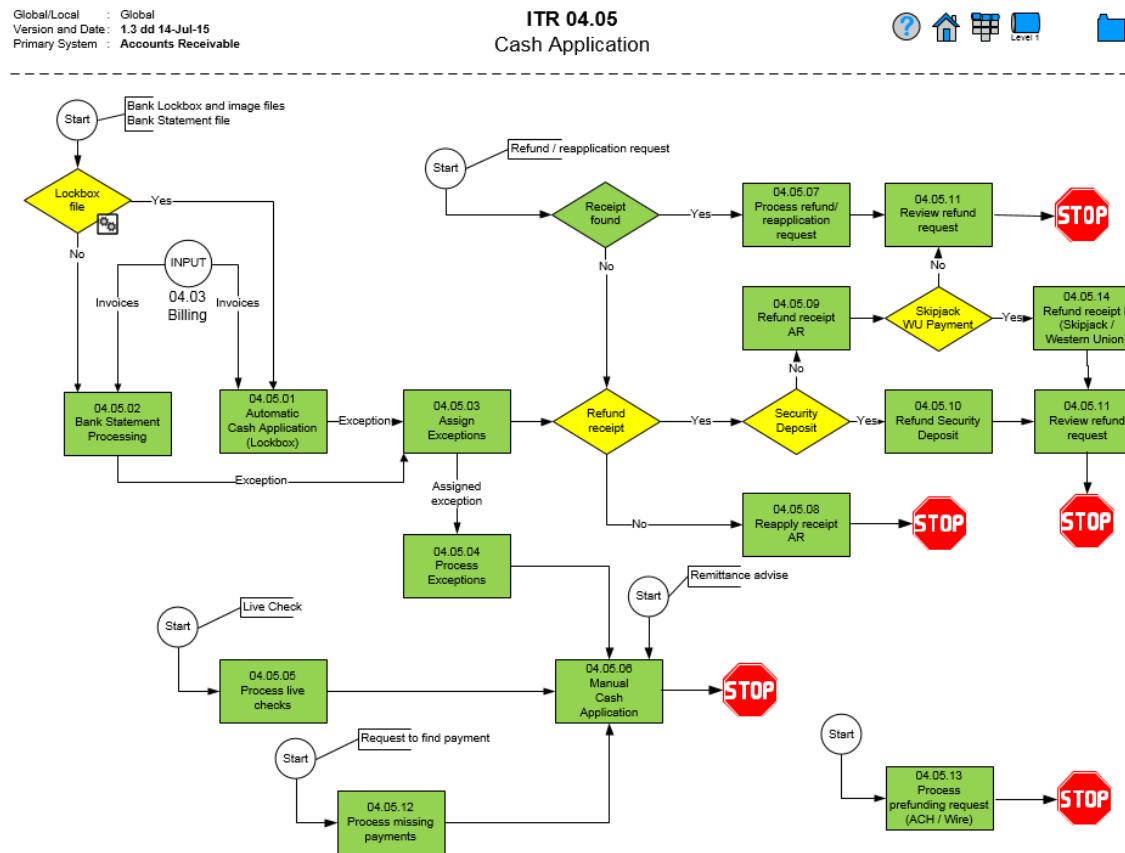


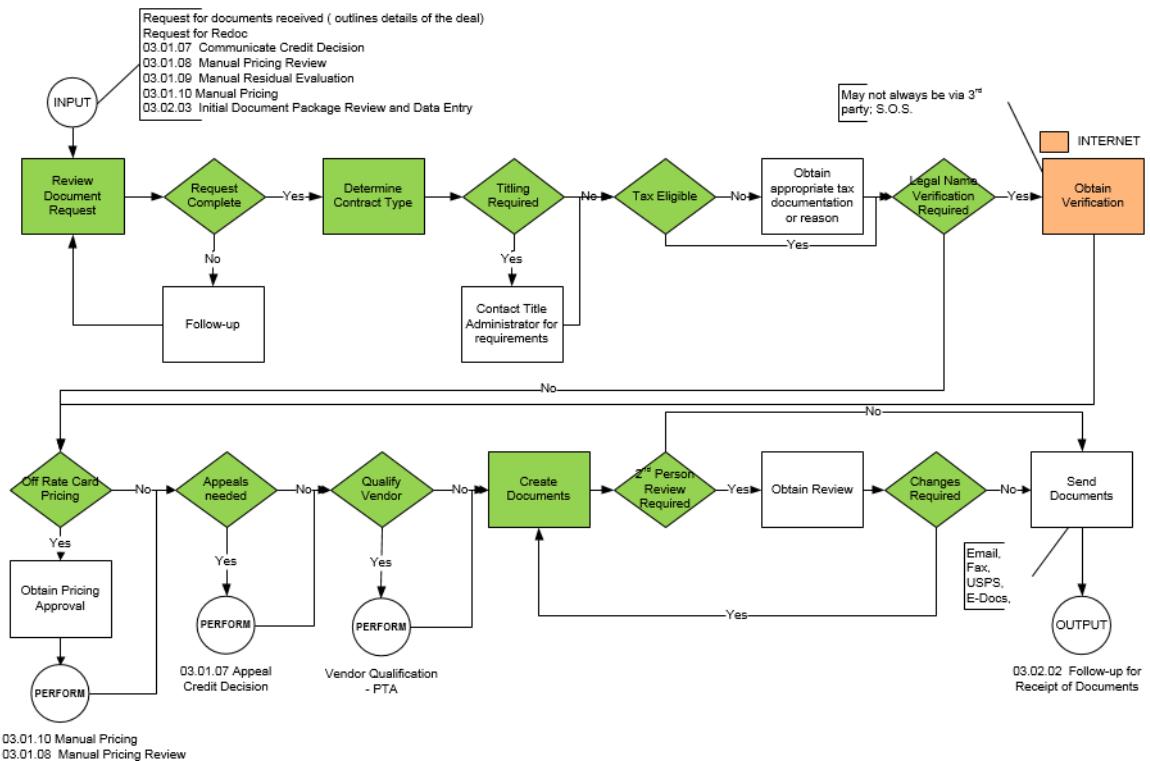
Figure 57 Business process leasing: cash application

Global/Local : Local  
Version and Date: 0.1 dd 14-Jul-15  
Primary System : New@Once

CTB 03.02.01  
Document Contract



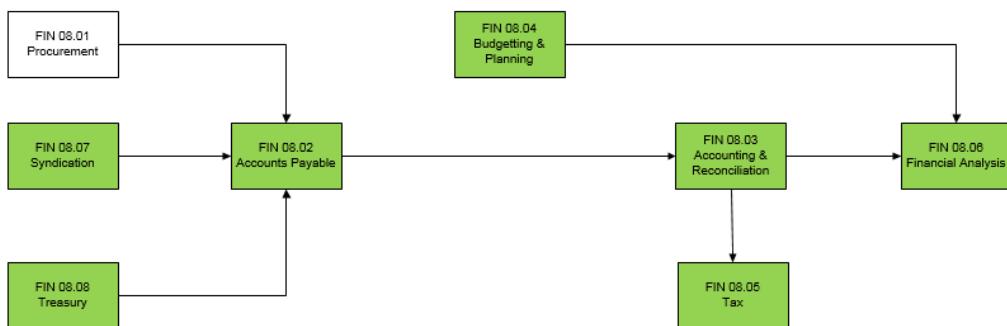
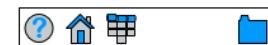
\*This process flow will also be used as the basis for re-documenting a contract.



**Figure 58 Business process leasing: document contract**

Global/Local : GlobalGlobal  
Version and Date : 1.2 dd 14-Jul-15  
Primary System : Multiple

**FIN 08.00**  
Finance (FIN) - High Level Flow



**Figure 59 Business process leasing: high level flow**

## Mobility solutions

Below, the three selected business processes of the mobility solutions business line of DLL is showed.

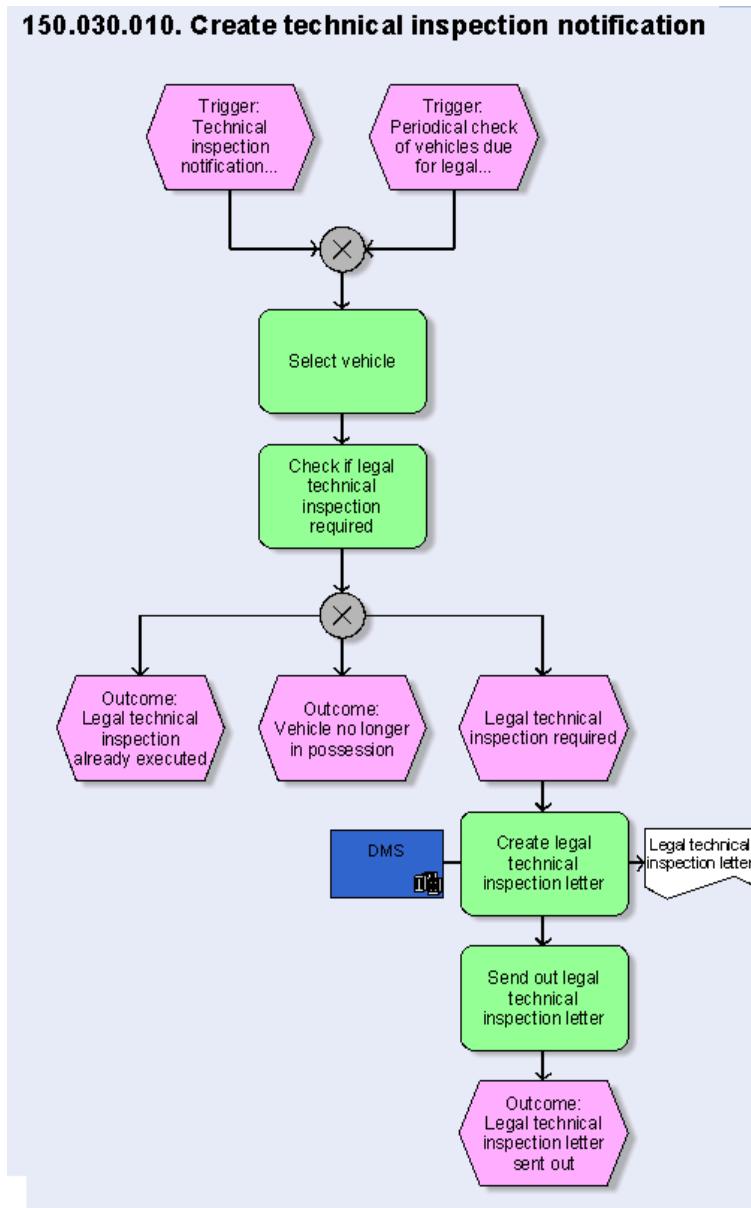


Figure 60 Business process mobility solutions: create technical inspection notification

## 120.020.020. Create fuel report

20/06/2012/ Fuel mgt workshop  
This scenario is part of the reporting done by Athlon  
Scenario not treated in the workshop

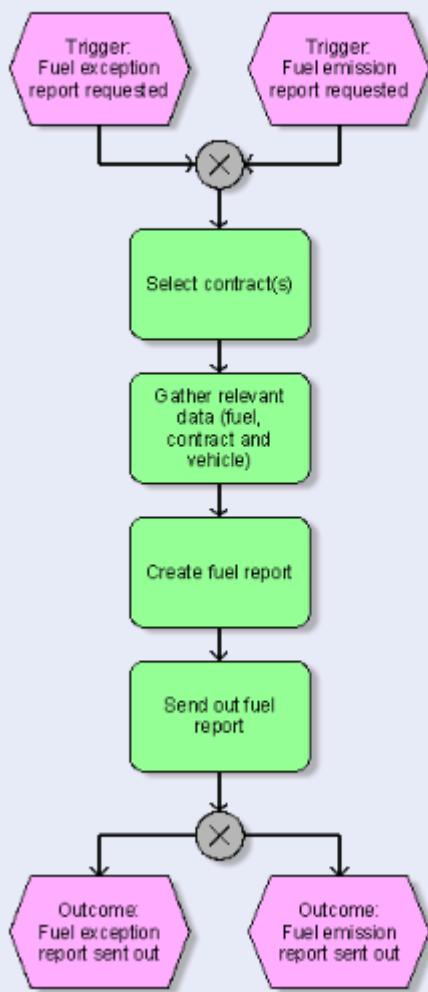


Figure 61 Business process mobility solutions: create fuel report

### 030.020.010. Set up of clauses

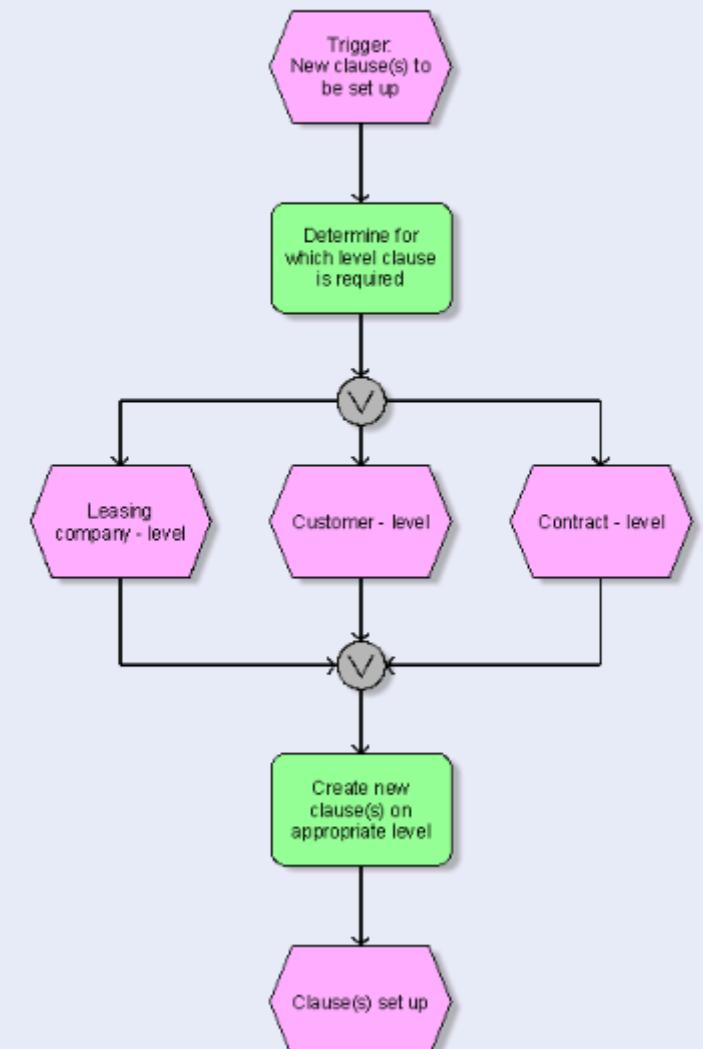


Figure 62 Business process mobility solutions: set up clauses

## Appendix 3: the BASE/X framework

The service blueprint only helps the process of building a service composition. However, there are more aspects in business decision making. The BASE/X framework, proposed by Paul Grefen deals with all the aspects of business decision making. The BASE/X framework starts with the renewal of an old pyramid that helps with the decision making of a company. This will be the basis for the approach. The new pyramid will be more suitable for a network-based, service-dominant approach (Grefen, 2013).

### 1. From the old pyramid to a new pyramid



Figure 63 The old pyramid

The old pyramid , Figure 63, faces three problems: firstly, the pyramid has troubles processing the increase of the frequency of strategic and tactic decision making process in the modern-day economy. Secondly, strategic and tactic decisions have to become more and more flexible in their content nature to reflect swiftly changing market environments. Thirdly, the old pyramid is not set to the service-dominant business paradigm, which is the basis of modern business thinking. Therefore, the new pyramid is developed, see Figure 64.

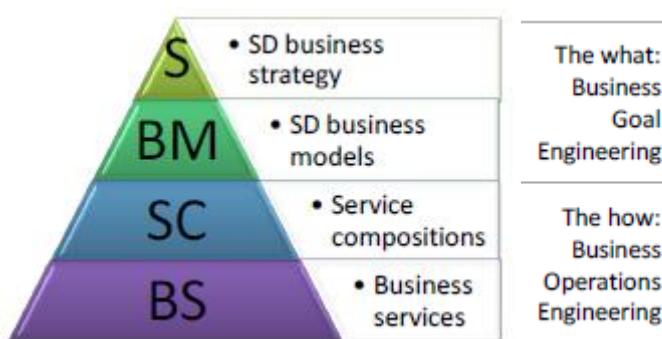


Figure 64 new pyramid

The service-dominant business strategy layer defines the identity of a business organization in terms of the high-level services the organization will deliver to its context. The business models layer makes medium-term decisions. This layer translates itself in business models defined in services. The layer below, the service compositions layer makes decisions by use of the implementation of these business models. This implementation is done by composing a number of services from the business services layer. This layer simply contains a list of services a company can perform. This means that the upper two layers contain what the company wants, where the lower two layers contain how this will be achieved. Or in other words goal engineering vs operations engineering.

This strategic design and the tactic design. The strategic design starts at the top of the pyramid and follows a more long-term strategy, where the elementary services evolve over the identity defined by the strategy. The tactic design follows the dynamism of the market context. It is a mix of top-down

decision making and bottom-up decision making: new business models are designed by matching business interest and relevance, which is called desirability and on the other hand there is the feasibility of the services. In this design it will be important to find an optimum between these two variables. An illustration of these designs can be found in Figure 65.

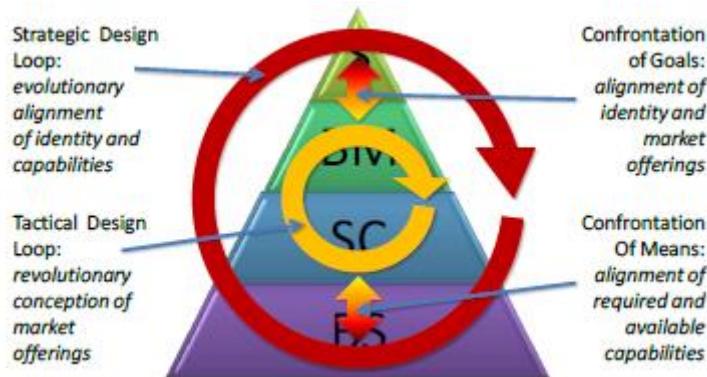


Figure 65 Strategic & tactical design cycles

The BASE/X framework uses the tactic design approach. This tactic design have their roots in the two stable layers: the strategy and the services layer. From here four different designs can be made, see Figure 66.

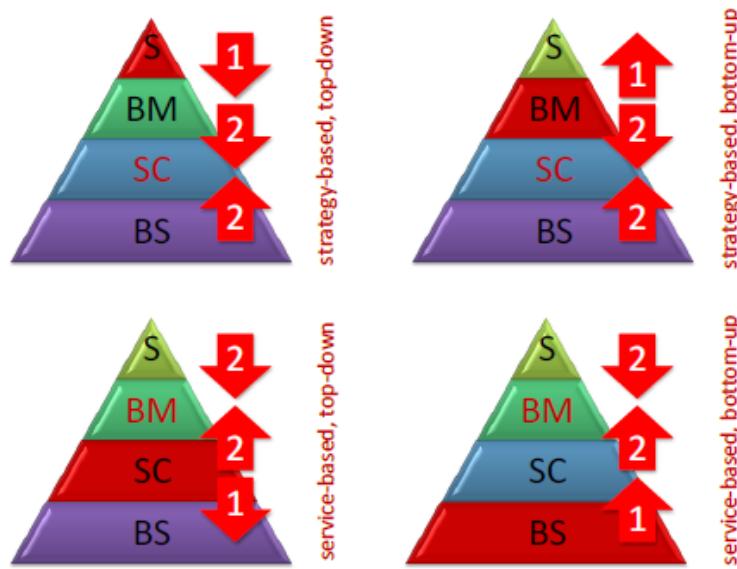


Figure 66 Four practical sequences for business design

The strategy-based, top-down approach starts from the identity of a business organization in a market and derives new business models from a strategy. These models are then translated by deriving the service compositions. The strategy-based, bottom-up approach tries to find new business models or goals and solidifies the model in the strategy layer. After this the model is translated into the service compositions.

The service-based, top down approach starts from the service composition layer and is operations-oriented: it focusses on how to sequence business capabilities. First compositions are mapped to the business service layer. Then the compositions are mapped to business models. The service-based, bottom up approach starts from the business service layer. First business services are combined into possibly interesting service compositions. The service compositions are mapped to business models,

which will be checked by the strategy layer. Below, you will find a table with the specification of the different sequence designs.

Sequence (root, direction)	Orientation	Goal	Start	Confrontation	Activity
Strategy-based, top-down	Identity	Alignment of business with strategy	Strategy layer	Service composition layer	Structural deduction
Strategy-based, bottom-up	Goal	Exploration of new business opportunities	Business model layer	Service composition layer	Organized idea creation
Service-based, top-down	Operations	Exploration of new business configurations	Service composition layer	Business model layer	Organized idea creation
Service-based, bottom-up	Capabilities	Alignment of business with capabilities	Business service layer	Business model layer	Structural composition

Table 28 overview of business design

In order to use this pyramid it will be transformed into a service-dominant business sandwich model. The above design sequences show that there are two stable layers: the business strategy layer or identity of an organization and the business services layer or the core capabilities of an organization. This means that the other two layers implement the external business offerings: the business models layer and the service composition layer, see Figure 67. The service-dominant business sandwich model can be used to build a new more service-oriented design.

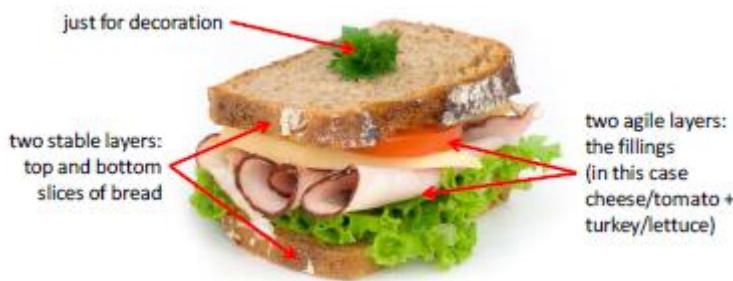


Figure 67 illustration of service-dominant business sandwich

The build-time view of the sandwich concentrates on designing the contents of the four layers. The overall starting point here is the definition of the business strategy, the identity of the organization. One must keep in mind that organizations with an explicit hierarchical structure will probably have more strategies. So, when beginning with the service transition, according to the sandwich, first the sandwich itself must be built. After that many alternatives can be made via the agile layers. The strategy that is determined in the first step is the basis for the core capabilities in the business services layer. The core capabilities are seen as business services. They must have a clear business-level interface, the elements they possess can be combined with several configurations, and they must represent the competences of a business organization that define its essence. By addressing these two layers the basis of the sandwich is built. After this, it is time to work on the changeable part of the sandwich: business models and the service compositions. The business models layer contains several service-dominant business models, which will be context-dependent and specialized

operationalizations of the strategy. The service compositions layer contains service compositions, which are aggregations of a set of elementary services from the services layer and a set of external elementary services. Important here is that each service composition is linked to a specific business model. So it forms the operationalization of that specific business model. These four layers form the basis for the BASE/X framework. One important aspect in this model is business networks. In the business model layer, this means that a single internal business model can rely on many other external business models. Value constellations can be created by using a network of companies and their relationships to jointly create an offering. Also service compositions uses external business services. To become more detailed the concept model, see Figure 68 gives a brief overview.

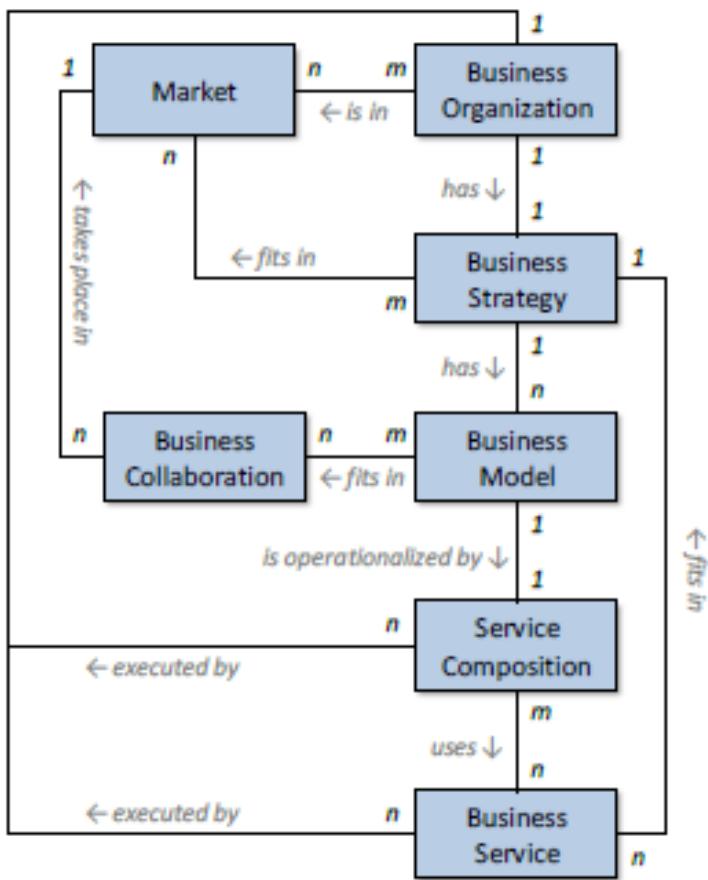


Figure 68 Concept model

## 2. A pyramid for business support

Now that the basis for the framework is formed, adding other layers to the pyramid is not the right thing to do. The reason here is twofold: firstly, going from high-level business concepts to low-level business concepts is different than going from business concepts to information system concepts. Secondly, information systems can support more than only the business services layer. It would be a better solution to extend the framework with an additional pyramid that covers the business support in the form of information system elements.

Therefore, Grefen states that it would be better to add an extra dimension to the pyramid model, the realization dimension or Information System pyramid, see Figure 69.

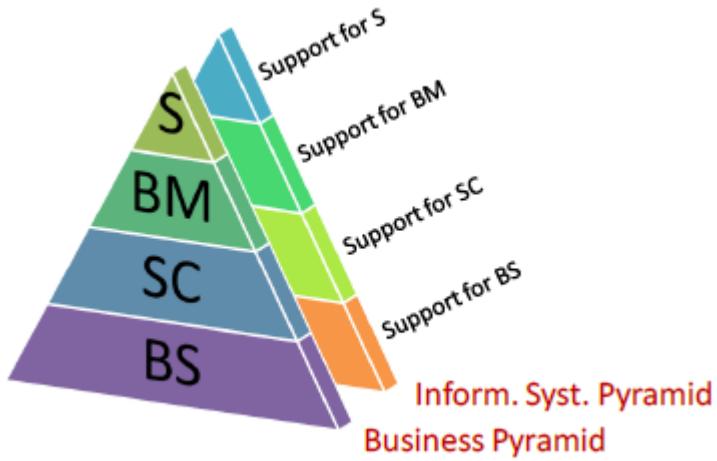


Figure 69 Business & information system pyramid

This pyramid describes the support for the Business pyramid by information systems. This could be automated applications as well as manual information processing. Each layer will contain support for the business functionality in the corresponding layer of the business pyramid. More specific this will mean that the business strategy layer of the IS pyramid will contain IS applications that support design and evolution of a business strategy. This could be a strategic decision support application that could be used for long-term what-if analysis or a tool for qualitative analysis to support the identification of new long-term trends in specific business domains. For the business model layer this could be a decision support application that provides information that will be used in the design and analysis of business models or tools for identifying and analyzing potential business partners. Other things in this layer could be tools that help managing a set of business models, especially in maintaining the consistency of different business models. For the service composition layer this could be implementations of service compositions. It could also contain tools to create and deploy these implementations or tools to quickly create prototypes or mock-ups of new service compositions. For the business service layer this could be implementations of business services. It could also contain tools to create and deploy business service implementations. In these layers, agility plays an important factor: changes in the business pyramid should cause changes in the IS pyramid. The other way around is not allowed.

## 3. The platform pyramid

In order to complete the framework, a third pyramid is added: the platform pyramid. This pyramid extends the realization dimension.

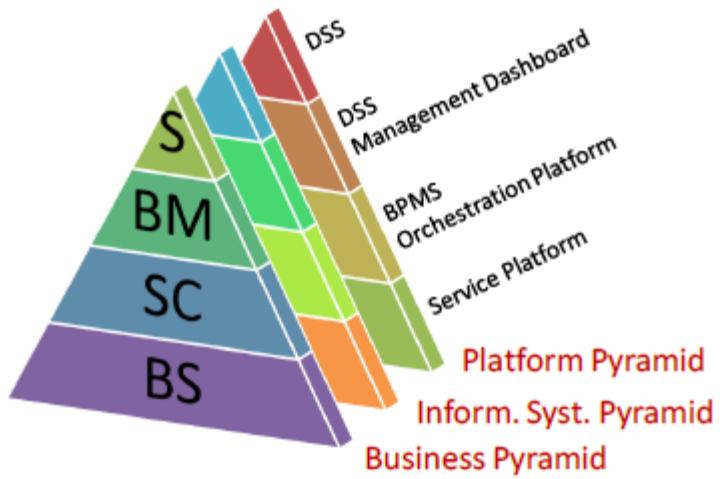


Figure 70 Adding platform pyramid

Now that the overall framework is clear, the individual layers will be explained more in detail.

### 3.1. Business strategy layer

The business strategy layer is used to define the identity of an organization. The strategy will evolve over time and is coupled to the long-term position of the company. Of course the strategy is focused on service dominant business. This means that the strategy will focus on delivering value-in-use instead of assets and it will be more defined in context of business networks. According to the BASE/X framework, there are two design tools that can be followed to design the strategy:

- the complete strategy
- the pragmatic strategy

The complete strategy involves filling in the following canvas:

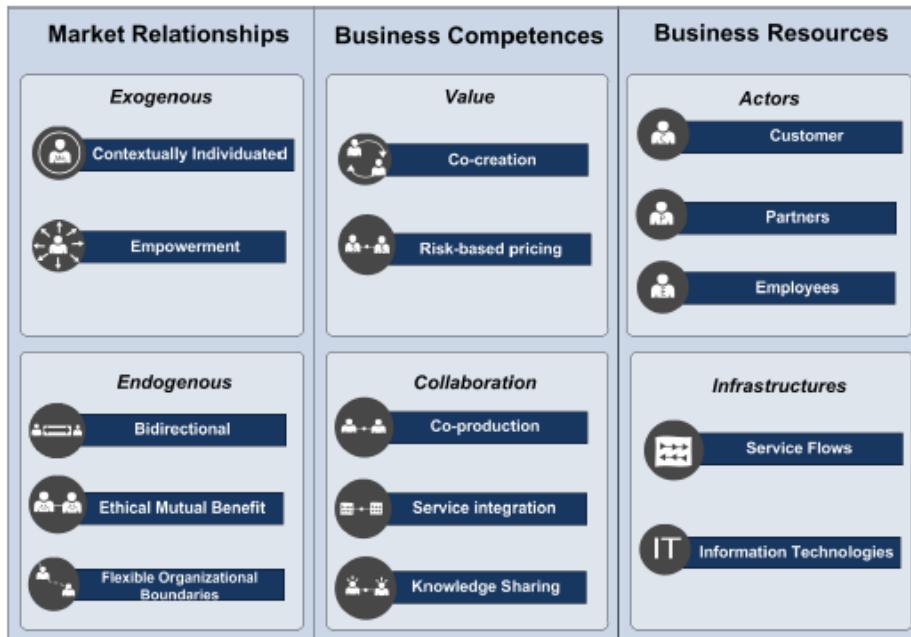


Figure 71 Complete SD business strategy canvas

The first thing a company must do is organizing the essential elements of an SD strategy by using the three main components: Business Resources, Business Competence and Market Relationships. The complete canvas consists of fifteen different elements, see Figure 71.

The complete strategy canvas can be too complicated for use in practice. Therefore, a company could use the pragmatic canvas, see Figure 72. It is subdivided into three main topics: Value-in-use, service Ecosystem and Collaboration Management. This canvas consists of only ten elements.

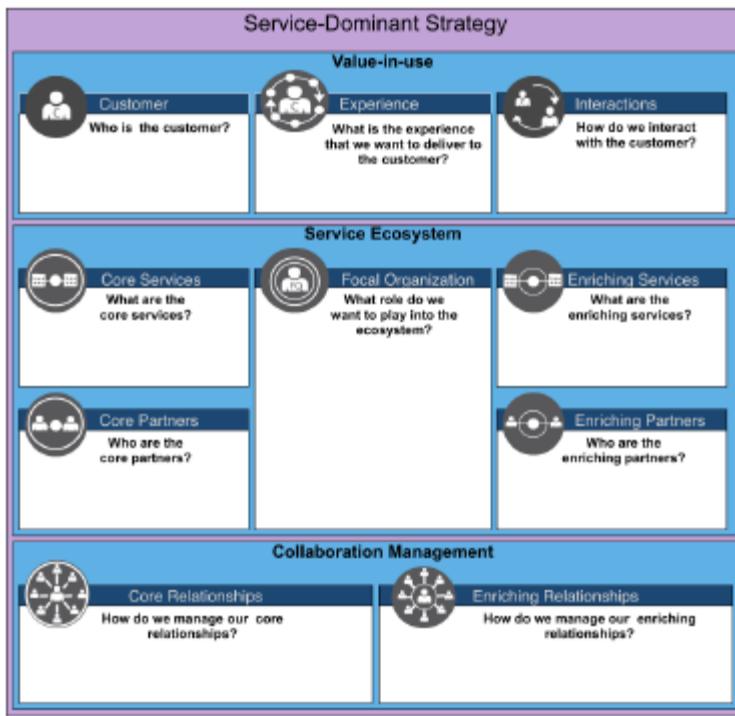


Figure 72 pragmatic SD business strategy canvas

### 3.2. Business service layer

According to the BASE/X framework, the business service layer will be the next layer to define. The bottom slice of the SD business sandwich contains the elementary business services. Here, the business capabilities of an organization are formed. The business capabilities can be seen as the core functionalities a business organization offers to its (commercial) context. A business capability has an internal realization process and defines the steps that have to be performed. The anatomy of a business service can be seen in Figure 73.

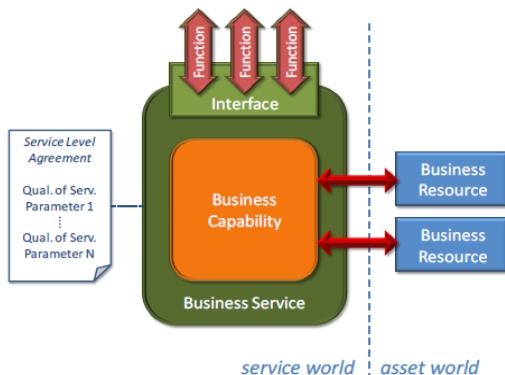


Figure 73 Business service anatomy

Each business service consists of an elementary business capability of the organization and makes it accessible through a business-level interface. The interface provides business-level access to a specific aspect of the service. The business resources are subdivided into material resources and human resources.

The service itself must be coupled to a service level agreement (SLA). An SLA specifies non-functional behaviour of different functions of the service in terms of quality of service (QoS) parameters. An important aspect of business services is the distinction of external and internal business services, or in other words what an organization will do on its own and what needs to be outsourced. This distinction can be made using the canvas in Figure 74.



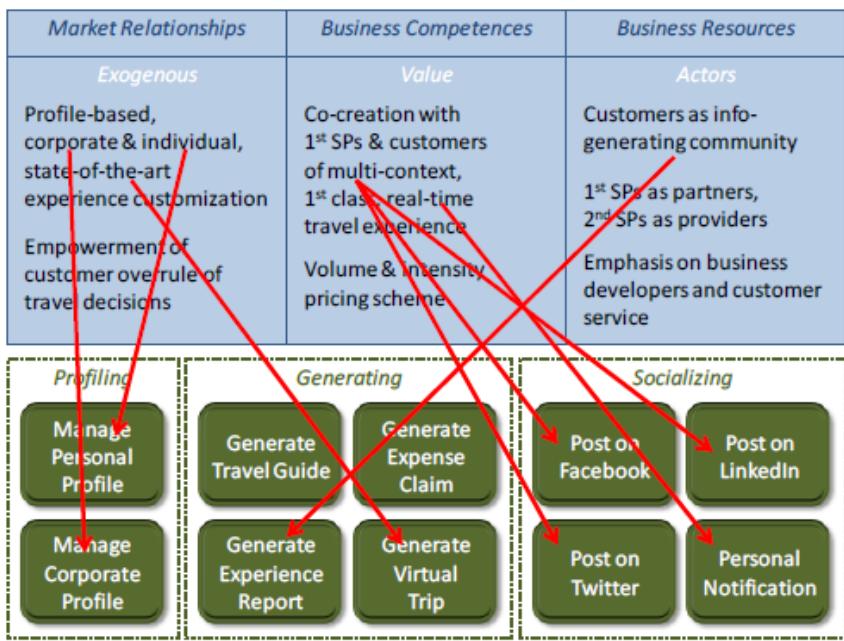
Figure 74 Strategic partitioning tool for business service classification

In order for a company to determine the right service the criteria from Table 29 Criteria for service determination can be used.

Class	Name	Criterion	If fails
Why	Right context	Does the service fit in the context of the defined business strategy?	Redesign service
	Right goal	Does the service transform the state of the customer perception of the value-in-use?	Delete as business service, consider as building block service <sup>15</sup>
What	Right size	Is the service easily combinable in multiple service compositions?	Too large: split up service Too small: combine services
	Right scope	Isn't there any functional overlap with existing service(s)?	Re-scope service(s)
Who	Right actor	Is there a clear single actor (role) performing the service?	Split up service per actor
	Right beneficiary	Is there a single beneficiary (role) for whom the service is performed?	Split up service per beneficiary
When	Right start	Is there a clear starting point in time for the execution of the service?	Scope service down to delimited period
	Right end	Is there a clear ending point in time for the execution of the service?	Scope service down to delimited period

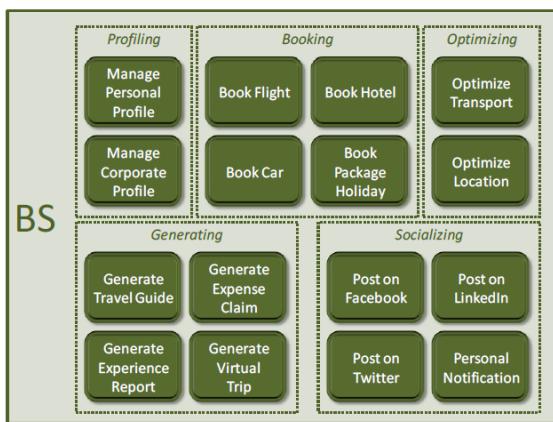
Table 29 Criteria for service determination

In order to design a set of essential services, a company can use their strategy as a starting point.



**Figure 75 Example of Partial mapping of strategy to services**

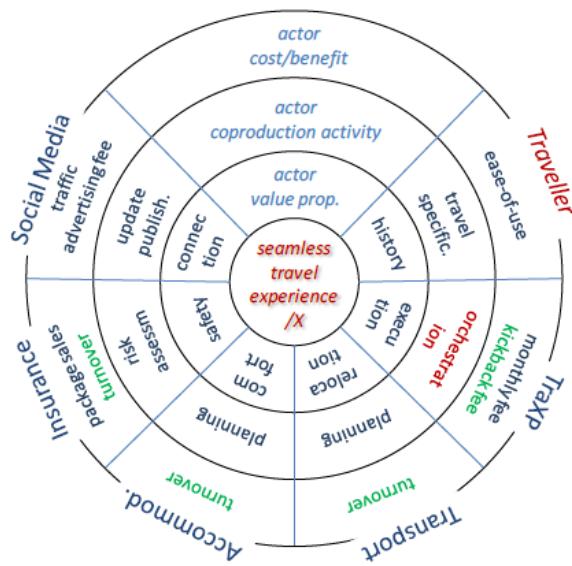
In order to make the services manageable, the BASE/X framework proposes an service catalogue. The services must be grouped to their business service domains. An example of the service catalogue is given in Figure 76.



## Figure 76 example business service catalogue

### 3.3. Business model layer

Beginning with the business model layer means that the stable layer are already defined. Now, the business models will be defined, which will be context-dependent, specialized operationalization's of the strategy. A lot of approaches exist for modeling these models, however these do not focus on the service-dominant business. Therefore the BASE/X framework proposes a radar. In Figure 77, an example of this radar is given. This tool specifies an operationalized value constellation.



**Figure 77 Service-dominant business model radar**

A typical sequence of this design process is going from business strategy to business model using the strategy-based, top-down sequence from table 26. In this radar the service is central, presented as the core notion of a co-created value-in-use. Surrounding this service are two rings which consist of service management (actor coproduction activity) and cost/benefit (actor cost/benefit).

An important aspect in this layer is the consistency between different business models and between the business model and the business strategy. The first consistency can be checked by combining business radar diagrams of different business models. The consistency exists if overlapping business models or business models with conflicting business networks are detected. The second consistency can be checked by relating the concrete value-in-use of the business model to the abstract value-in-use of the business strategy. The consistency exists if: the concrete value-in-use is not covered by the abstract value-in-use or if the concrete value-in-use is covered by the abstract value-in-use, but only fills a minimal space in this.

### 3.4. Services compositions layer

This last layer of the BASE/X framework provides the agile operationalization for business models. Service compositions make complex functionality available to a market by combining a set of simpler functionalities realized as services. In order to build service compositions, one must keep in mind that there are two basic types: the process type and the mash-up type. The process type is typically used for strictly sequenced business interactions in which the activities of multiple actors need to be synchronized in time and information needs to be passed between these activities. In the process type, there is an explicitly managed (and possibly complex) state of a service delivery, where the management of the state is the responsibility (or even the added value) of the service orchestrator. The mash-up type is typically used for free-form business interactions in which a single actor invokes the functionalities of a number of other actors. In the mash-up type, there is an implicitly managed (and usually simple) state of a service delivery, where the management of the state is the responsibility of the service consumer (Grefen, 2013).

The basis of a service composition can be created by mapping key activities from the business model radar to business services in a business service catalog. Once the list is complete, a company must choose between the mash-up or process type composition.

#### 4. Sandwich in a BOAT

The last aspect that is described according to the BASE/X framework is the BOAT framework. The BOAT framework is an framework for structured analysis and design of e-business scenarios, where e-business is formulated as " IT-enabled business, conducting core business activities in a way that is enabled by the integrated use of information technology for processing and communication of information (Grefen, 2010). The BOAT framework consists of four aspects: Business, Organization, Architecture and Technology.

The business aspect describes the business goals of e-business and explains why a certain e-business scenario exists and what should be reached. An example of a topic is access to new markets. The organization continues on the business aspect and describes how organizations are structured and connected to achieve the goals. Here the business processes, business functions and more are described. The architecture aspect describes how automated systems support the involved organizations in a conceptual way. The technology aspect describes the concrete ingredients from information and communication technology, including software, languages, communication protocols, and hardware where relevant that fulfils the description of the architecture.

These aspects show many similarities to the sandwich of the BASE/X framework and could therefore be easily mapped into the pyramid, see Figure 78.

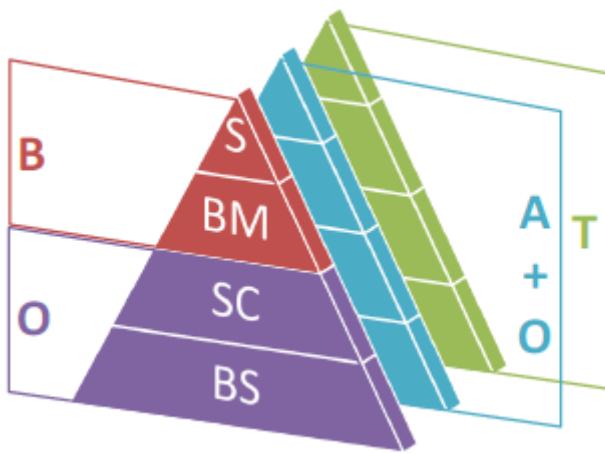


Figure 78 BOAT framework mapped to sandwich tri-pyramid

Although the business aspect does not distinguish a strategy aspect, it includes elements related to the business strategy. Therefore this aspect can be mapped to the top two layers of the business pyramid. The organization aspect describes how business models are implemented without referencing technology and are therefore mapped to the bottom two layers of the business pyramid, as well as the information system pyramid. The architecture aspect can easily be mapped to the complete architecture pyramid of the sandwich approach. The technology aspect describes the ingredients for information and communication and can therefore be mapped to the complete platform pyramid of the sandwich approach.

## Appendix 4: Framework for Business capability modelling

The business capability provides a link between business architecture and IT architecture. Capabilities can provide business with a common language. They can ensure that a firm will spend money to ensure that a given capability is supporting the business. They serve as a starting point for strategic planning, impact analysis, and change management. Capabilities also serve as a representation of the business requirements that provide information for IT systems. Below the approach of Ulrich (2015) for business capabilities into planning and executing a business/IT transformation program is described. This approach is chosen because it is the only article in the business capabilities topic that handles the business capability map.

### Step 1: defining capabilities

First of all, the approach defines a capability as 'a particular ability or capacity that a business may possess or exchange to achieve a specific purpose or outcome'. According to Ulrich (2015) capabilities can be decomposed into different levels. Level 1-3 focuses on planning, where level 4-6 focus on detailed business/ IT mapping. A capability is dependent on different factors of an organization, see Figure 80. Resources include technology, funding and other assets of the firm. Value streams depict how a business achieves value for an internal or external stakeholder and are defined as an end-to-end collection of activities that focus on the result for a customer. A value-stream begins with a stakeholder that triggers the first stage and ends when the product or service is delivered back to the stakeholder. They decompose into business processes, see Figure 79.

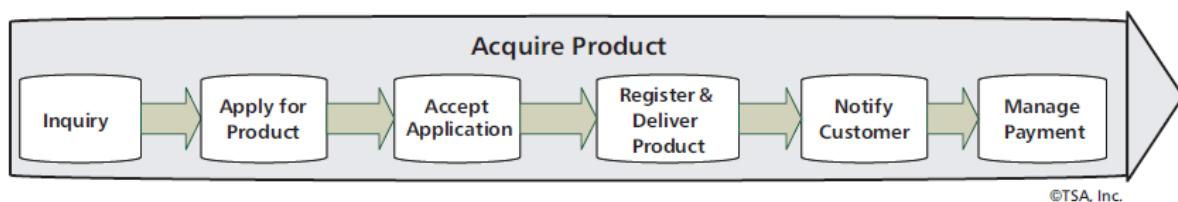


Figure 79 Example value stream

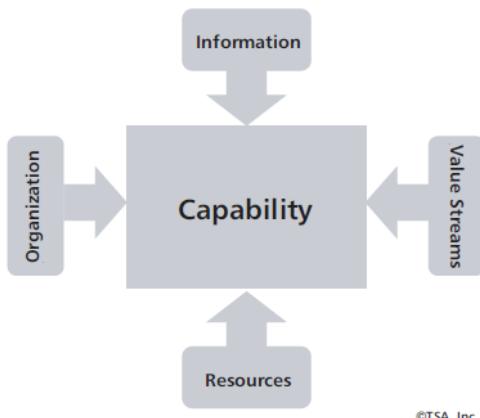


Figure 80 Capabilities related to other aspects of a business

The use of business capabilities is a challenging process for management team. Therefore, Ulrich (2015) established ten principles, see Table 30.

Capability principles
1. Capabilities define what a business does, not how a business does something.
2. Capabilities are nouns, not verbs.
3. Capabilities are defined in business terms, not technical terms.
4. Capabilities are stable, not volatile.

- |  |
|--|
| 5. Capabilities are not redundant.   |
| 6. There is one capability map for a business.   |
| 7. Capabilities map to, but are not the same as, a line of business, business unit, business process, or value stream. |
| 8. Capabilities have relationships to IT deployments and future-state IT architecture.                                 |
| 9. Automated capabilities are still business capabilities — not IT capabilities.                                       |
| 10. Capabilities are of most value when incorporated into a larger view of an enterprise's ecosystem.                  |

**Table 30 Capability principles**

### **Step 2: mapping business capabilities**

Business capabilities create an overall picture by mapping them in a capability map. Introspective analysis and decomposition are important aspects when building a capability map. Capabilities must be decomposed in order to understand how a capability is defined and viewed. In Figure 81, you see a three-level decomposition, where the level is used to describe the depth of the capability decomposition.



**Figure 81 Three-level capability decomposition**

The decomposition can go as far as six levels, where level 4 and 5 focus on SOA business services. These levels are important when a business wants to align specific abilities between different lines of businesses. An example of a capability decomposition is given in Figure 82.

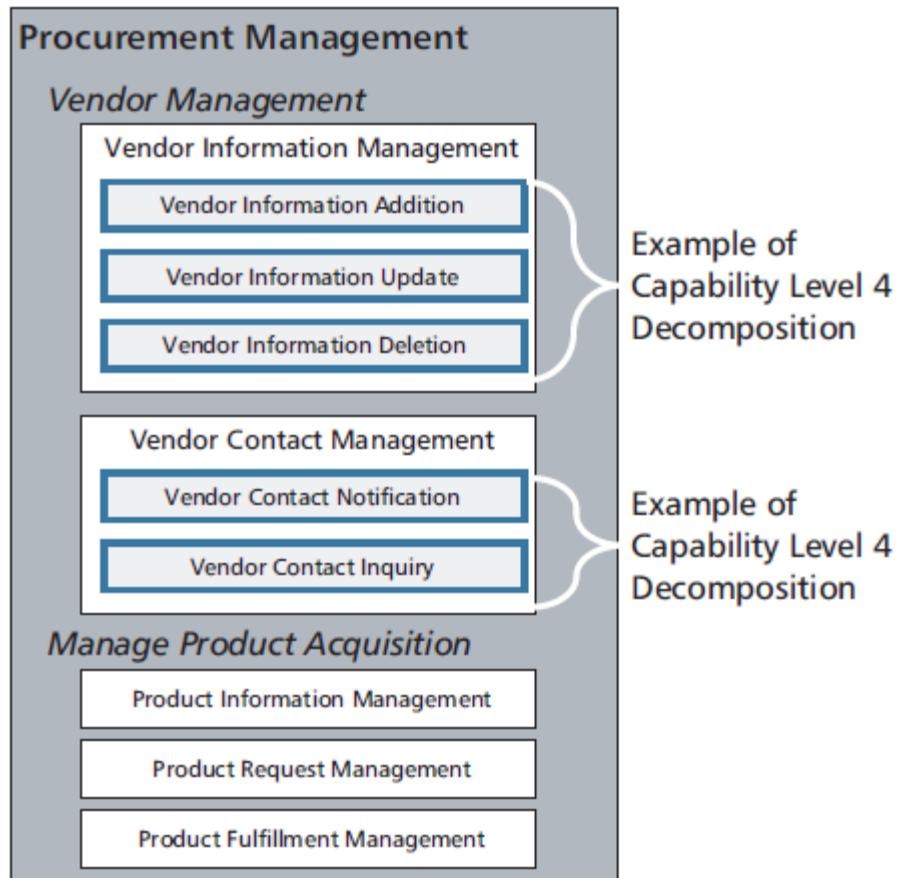


Figure 82 capability decomposition example (level 4)

### Step 3: breaking down the capability map

The different level 1 capabilities must be structured in different layers. Therefore, Ulrich (2015) proposes three different groups: strategic, value-add and support. The strategic layer includes capabilities that reflect executive priorities. The value-add layer includes capabilities that describe what an enterprise does to ensure viability and thrive in the marketplace. The support layer includes capabilities that represent certain abilities that a firm must have to work as a business. Ulrich (2015) outlines ten rules that must be followed to build and validate a capability map, see Table 16. An example of a services organization is given in Figure 83.

Rules for building and validating a capability map
1. Obtain an industry template if possible.
2. Draft an organization-specific Level 1 capability map.
3. Finalize Level 1 capability map.
4. Publish the Level 1 capability map.
5. Establish Level 2 capability decomposition priorities.
6. Decompose Level 2 capabilities.
7. Establish Level 3 capability decomposition priorities.
8. Decompose Level 3 capabilities.
9. Socialize and refine the capability map.
10. Publish the capability map.

Table 31 Rules for building and validating a capability map

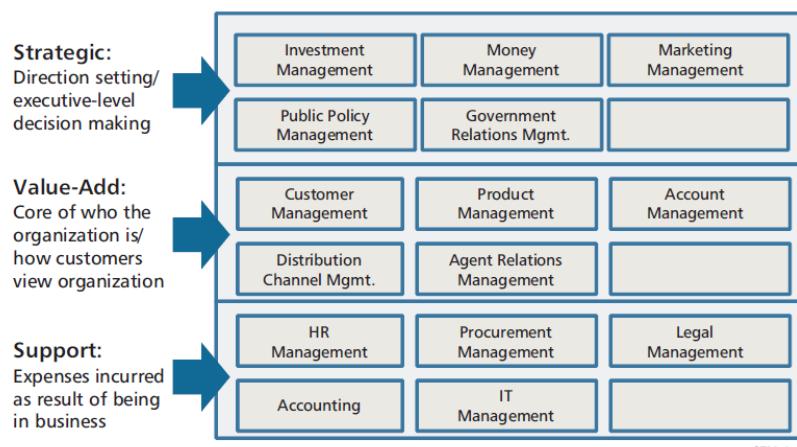


Figure 83 Service organization level 1 capability map

Different patterns could be used when breaking down a capability map. For example, Grefen (2013) uses the value chain of Porter to distinguish different functions or capabilities, see Figure 84. For example the function marketing & sales compose of the e-business functions advertising, negotiating, contracting, selling, and billing.

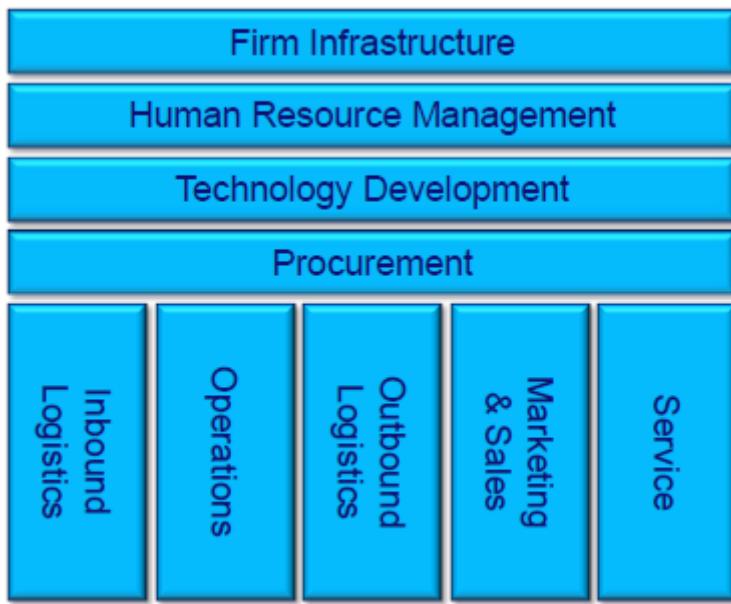


Figure 84 Value chain model Porter

#### Step 4: incorporating capability into business architecture

Business architecture can be seen as a blueprint of the enterprise and is used to align strategic objectives and tactical demands. Business-to-business and business-to-IT mappings provide the basis for much of the analysis associated with business and IT transformation. Therefore it is important to incorporate capabilities into the business architecture. This can be done by an organization-unit-to-business capability mapping, see Figure 85. Such a mapping shows how different business units share common capabilities. It is important to take into account that different business units might have misaligned definitions for terms.

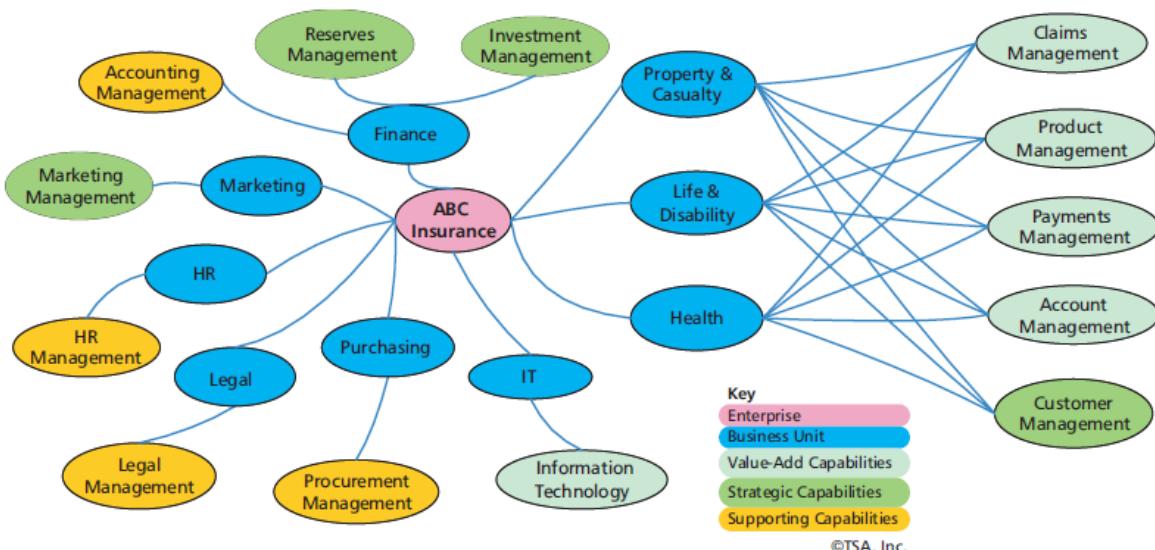


Figure 85 Organization-unit-to-business capability mapping

Another aspect off the business architecture that is important is the value stream. The different stages in a value-stream are expressed in verbs or nouns. Value streams enable capabilities that can

be mapped to each stage of the value stream. How capabilities, value streams and business processes can be mapped is shown in Figure 86. This mapping can be used for strategic planning, funding allocation, deployment priority setting and management and initiative planning.

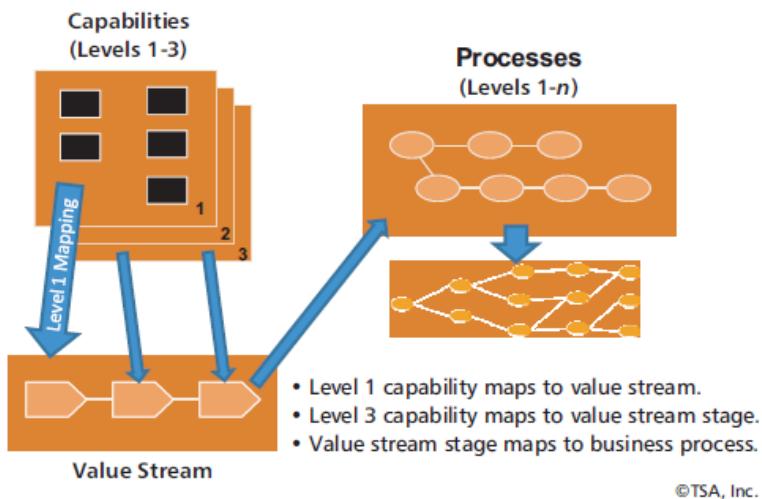


Figure 86 Capability, value stream, business process mapping

### Step 5: business architecture knowledgebase

The business architecture knowledgebase formalizes how information about the business is stored, related and viewed. This can include capabilities, value streams, information assets, organizational structure, project initiatives, customers and partners, and related IT assets. The knowledgebase can be stored in a database or various architecture tool providers, like MEGA or Troux. The use of knowledgebase enables business architecture teams to increase analysis efforts as they incorporate more concepts, additional business units, and required levels of granularity.

### Step 6: incorporating capabilities into enterprise architecture

Business capabilities provide an important link between requirements and IT solutions of all the domains of an enterprise architecture. Business capabilities are a primary deliverable of the business architecture, see figure 26. The capabilities and value stages can be implemented by the processes. The typical architecture domains can be found at the top of the figure: business, information, application, and technology. Capabilities require information and processes. The operational resources consist of exist applications, legacy, and COTS systems, like CRM and ERP. Integrated services provide the integration between existing applications. The SOA business and information services provide high-level business functionality for the enterprise or in other words a virtual implementation of related business operations. The business processes consists of series of operations that are executed, for example initiate a new employee. The arrows in Figure 87 show the links between the capabilities. The link between capabilities and enterprise architecture need to be done by linking the capabilities with applications and data sources via business services.

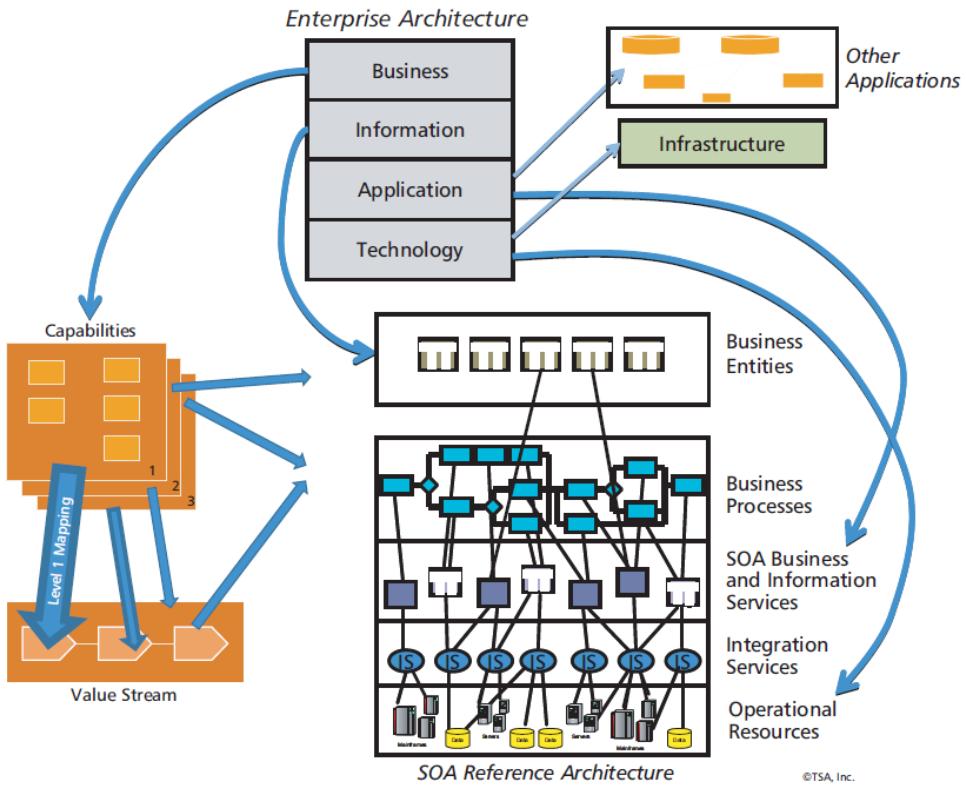


Figure 87 The role of business capabilities in EA

Step 6 concludes the approach of Ulrich (2015). A combination of the BASE/X framework and the approach of Ulrich will form the theoretical framework, combined by the findings of the as-is analysis of chapter two. This framework will be tested at DLL.

## Appendix 5: Questionnaires

### Questionnaire “Business Capability Map”

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This questionnaire is part of a research on the process of business capability mapping at DLL, Eindhoven. The aim of this research is to identify the process towards a business capability map for two business lines at DLL: leasing and mobility solutions. The research is conducted in the context of a graduation program in the department of Industrial Engineering and Innovation Sciences at Eindhoven University of Technology.

The questionnaire contains questions regarding the actions and documents used in order to develop the business capability map:

### Project details Business Capability Map

---

The questions in this section concern the details of the business capability mapping process.

<b>Person details:</b>	
What is your name?	Hans Tonneijk
What is your highest education qualification?	Havo
What is your functional background?	Several roles within IT, started as junior Cobol developer
What is your function at DLL?	Enterprise Architect
How long do you fulfill this function at DLL?	About 4 years as EA, before that 10 year as solution architect
What is the name of the business line you are working for?	I'm working as EA for DLL Corporate IT with a focus on Mobility Solutions
<b>Overall process:</b>	
When did you started with the business capability mapping?	Within EA we started to create a Business Capability map early 2015. However this map is based on the Enterprise Big Picture that is dominant integrated in the IT Strategy, as established in 2013.
When do you expect to finish this process?	Level 1 and 2 capabilities are finished, for Mobility Solutions we are now working on the detailing of the next levels. I expect this activity to be finished early September.
How far do you think you are right now at the process expressed in percentages?	Processes at lower level are available, I expect them to be complete and valid for 85%.
Can you give an estimation on the total hours that are needed to complete the process?	That would be more a guestimation, but based on available process descriptions and following a bottom-up approach I expect about 40-80 hours to complete the archimate diagrams.
According to you, what would be the goal for building such a business capability map?	Get a clear overview of capabilities and the overlap of them between LoB's.

According to you, what would be the benefits for building such a business capability map?	Enabling flexibility, agility and re-usability in the current rigid landscape.
How many persons are working on the business capability map?	At this time all EA's are expected to document their domain, that's 9 people in total.
Where will this business capability map be used for?	Optimization, Servitization and Rationalization of the current IT landscape.
Did you use any documents to guide the process?	Yes, available documents as available from other activities. For example the process diagrams.
Could you tell in a few sentences how the process towards a business capability map proceeds?	Quite difficult due to other project and operational activities and priorities.
<b>Business capabilities:</b>	
What documents did you use to help define the business capabilities?	Available documents from other initiatives (2BE), the documents as already available from the LoB Leasing (big picture).
What software programs do you use to map the business capabilities?	Abacus
What kind of structure or framework is used to map the business capabilities	Archimate, in the future combined with TOGAF, especially the ADM cycle of TAGAF.
Did you use strategy documents of the company to define the business capabilities, if yes how?	Yes, IT Strategy, DLL strategic framework and the MTP of MS.
How will the business capabilities help with the information system architecture?	It will enable activities for Optimization, Servitization and Rationalization of the current IT landscape. It will also help to identify impact of specific projects.
What is the most difficult aspect of defining the business capabilities?	To keep them general and keep the detailing to the lower levels.
Do you have any additional suggestions for defining business capabilities?	
Do you have any additional suggestions for mapping business capabilities?	It will be interesting to see the similarities and differences between LoB's.
<b>Business processes:</b>	
What documents did you use to help define the business processes?	Available documents from other initiatives (2BE), the documents as already available from the LoB Leasing (big picture).
What software programs do you use to map the business processes?	Abacus, in the past ARIS and BWise.
How are the business processes and business capabilities related to each other?	Business Processes are using Business Capabilities (or Business Functions according Archimate).
Are the business processes defined before or after the business capabilities?	Depends, for Mobility the processes are already available before the capabilities/functions.
How will the business processes help with the information system architecture?	On a similar way as Business Capabilities will help.

Do you have any additional suggestions for defining business processes?	
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### Questionnaire “Business Capability Map”

---

This questionnaire is part of a research on the process of business capability mapping at DLL, Eindhoven. The aim of this research is to identify the process towards a business capability map for two business lines at DLL: leasing and mobility solutions. The research is conducted in the context of a graduation program in the department of Industrial Engineering and Innovation Sciences at Eindhoven University of Technology.

The questionnaire contains questions regarding the actions and documents used in order to develop the business capability map:

### Project details Business Capability Map

The questions in this section concern the details of the business capability mapping process.

<b>Person details:</b>	
What is your name?	John van de Voorde
What is your highest education qualification?	TUE Mechanical Engineering
What is your functional background?	IT, Enterprise Architecture
What is your function at DLL?	Enterprise Architect
How long do you fulfill this function at DLL?	9 years
What is the name of the business line you are working for?	My focus area is Leasing
<b>Overall process:</b>	
When did you started with the business capability mapping?	January 2015
When do you expect to finish this process?	Don't know yet, depends on priorities.
How far do you think you are right now at the process expressed in percentages?	50%
Can you give an estimation on the total hours that are needed to complete the process?	800 hours
According to you, what would be the goal for building such a business capability map?	Common understanding of what capability belongs where.
According to you, what would be the benefits for building such a business capability map?	Common language instead of jumping into IT application landscape.
How many persons are working on the business capability map?	Most of the EA team, 8 people.
Where will this business capability map be used for?	Ownership, framework for design of processes and applications.
Did you use any documents to guide the process?	Our current Enterprise BIG Picture, organization structure, process designs.
Could you tell in a few sentences how the process towards a business capability map	Top down design, first level 1, then 2, then 3. Prioritization, so not all at the same time.

proceeds?	Collaborative sessions with the team, sessions with business stakeholders to review.
<b>Business capabilities:</b>	
What documents did you use to help define the business capabilities?	Enterprise BIG Picture, process designs, experiences with defining BIG Pictures and setting standards for building blocks.
What software programs do you use to map the business capabilities?	Started with Powerpoint and homegrown system, now Abacus.
What kind of structure or framework is used to map the business capabilities	Archimate as language, no external reference framework used.
Did you use strategy documents of the company to define the business capabilities, if yes how?	Not explicit, but Mid Term Plan and assessment of IT approach in the past led to a “back in the box” principle in the new IT strategy.
How will the business capabilities help with the information system architecture?	It makes it explicit “what” the IT architecture needs to provide.
What is the most difficult aspect of defining the business capabilities?	The logical partitioning and level of details. How does capability relate vs. process. Non functional capabilities.
How will the business capabilities help with the information system architecture?	
Do you have any additional suggestions for defining business capabilities?	Start small
Do you have any additional suggestions for mapping business capabilities?	
<b>Business processes:</b>	
What documents did you use to help define the business processes?	Process design/flows/functional designs/meetings
What software programs do you use to map the business processes?	The organization uses BWise, Visio, Work, Powerpoint. We use Abacus to capture the value chain.
How are the business processes and business capabilities related to each other?	Value chains use services of other capabilities via business services.
Are the business processes defined before or after the business capabilities?	We started with business capabilities but we did have business processes as well.
How will the business processes help with the information system architecture?	They provide insight in the nature of the capability and possible IT architectures that may support the process.
Do you have any additional suggestions for defining business processes?	

## Appendix 6: Industry templates

### Contract management:

- Authoring and negotiation
- Baseline management
- Commitment management
- Communication management.
- Contract visibility and awareness
- Document management
- Growth (for Sales-side contracts)



Figure 88 Industry template asset management

### Program management:

is the process of managing several related projects, often with the intention of improving an organization's performance. In practice and in its aims it is often closely related to systems engineering and industrial engineering.

- financial management;
- risk management;
- contract management;
- change management;
- relationship management;
- strategic management;
- project management; and
- influencing skills.

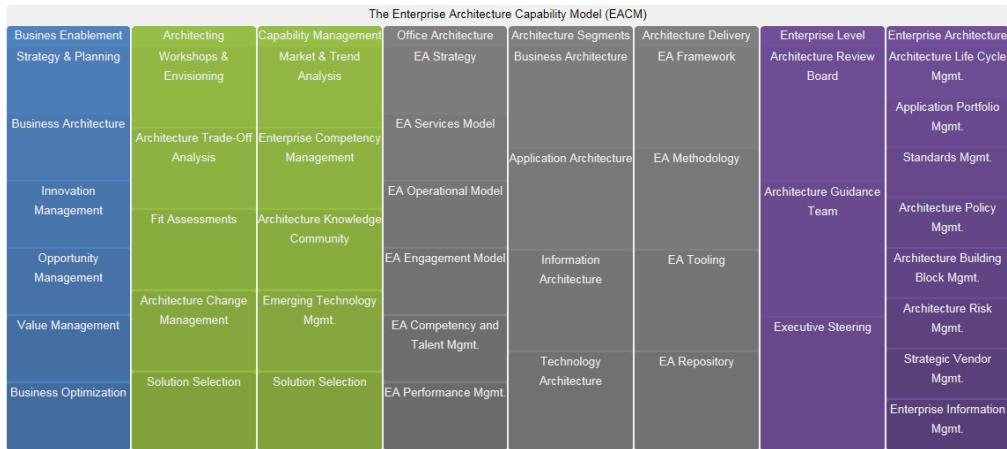


Figure 89 Industry template enterprise architecture

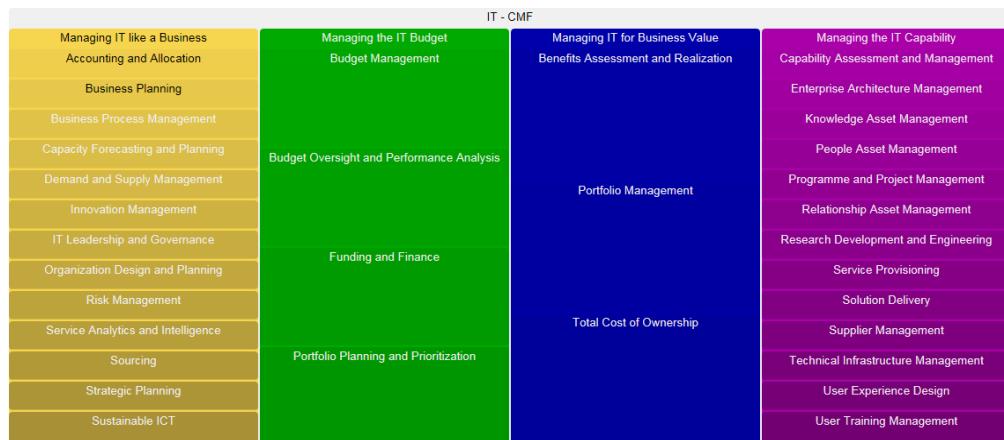


Figure 90 Industry template CMF

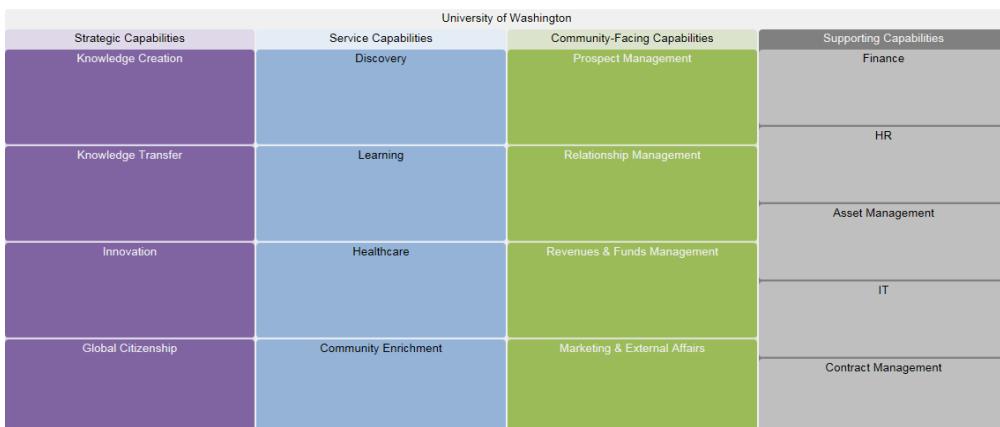


Figure 91 Industry template University of Washington

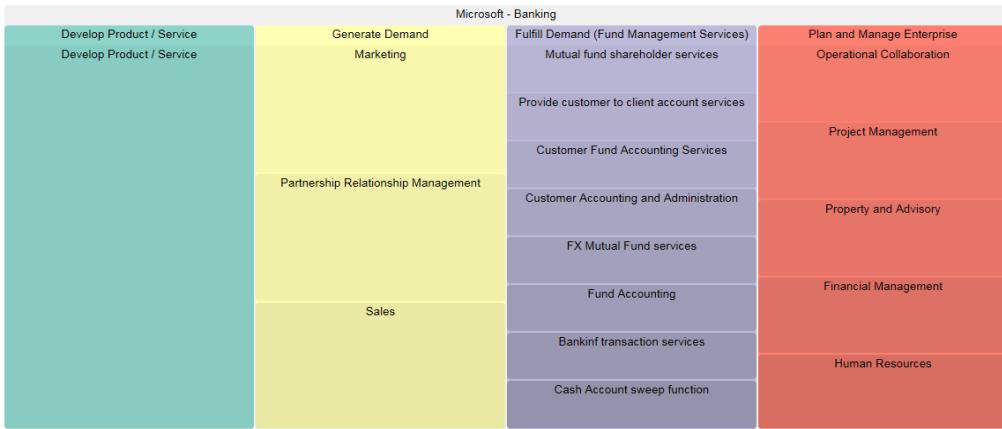


Figure 92 Industry template banking



Figure 93 Industry template financial institution

## Business Capability Map of a Financial Institution

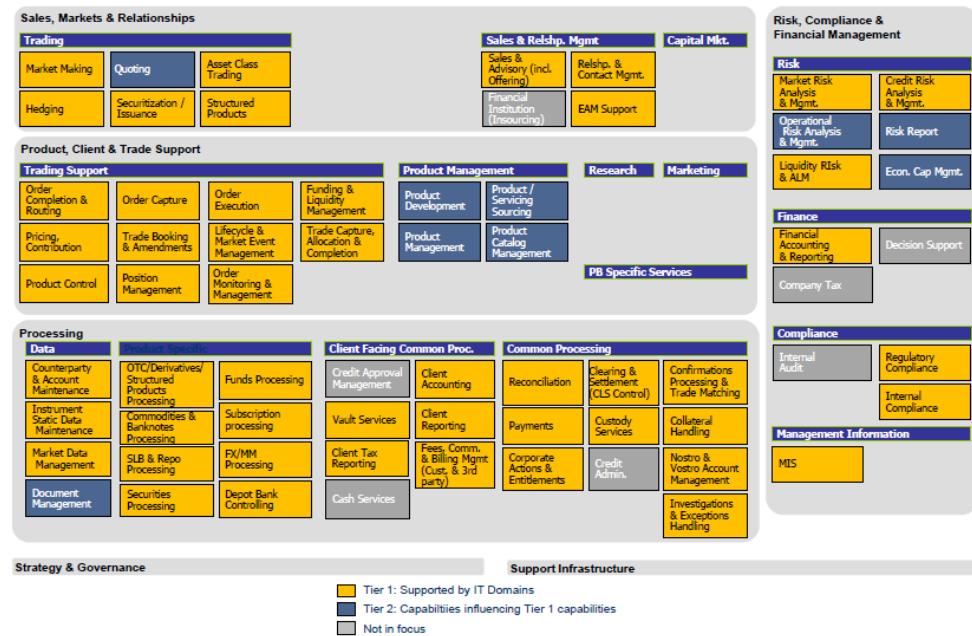


Figure 94 Industry template financial institution

## Appendix 7: summary BISA

### Introduction

This summary is based on the information of the course business information systems architecture (1BM41). This course handles the structure of computerized systems that underlie the operation of any complex modern organization. It focuses on the structuring perspective; how to analyze and design complex architectures. The main theme of the course is to map business requirements to corporate information systems (CIS) structures.

Corporate information systems can be seen as a high-level blueprint of that system that helps understand its internal structure and it consists of hundreds of individual systems. The architecture of such a system defines that system in terms of functional components and relations between those components, from the viewpoints of specific aspects of that system, possibly organized into multiple levels, and based on specific structuring principles. It brings structure into the design of the structure. This can be product or process oriented, see Figure 95.

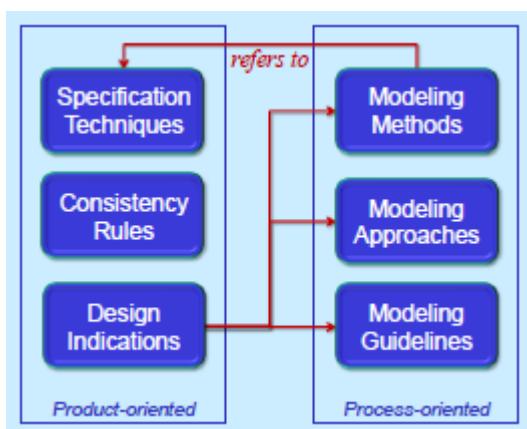


Figure 95 The two faces of architecture

The role of an IS architect is to understand end user requirements (functional and non-functional), to design abstract structures of complex software and hardware systems, to instruct software and hardware engineers for realizing systems, and to oversee the entire realization process and to communicate between stakeholders. The architecture can be used in five different sub disciplines:

**VLSI architecture:** VLSI (Very Large Scale Integration) is the term for complex computer chips, such as processor chips or memory chips.

**Computer architecture:** describes the abstract structure of computer systems, such as PCs, or file servers. Chips and basic devices are the elements and it is mainly about hardware.

**Software architecture:** is concerned with the structure of complex computer programs (software), such as operating systems or application systems.

**IS architecture:** is about the structure of complete information systems. Elements are mainly software modules, but elements from the software context may be taken into account too, like elements from the (business) organization the software is embedded in.

**CIS architecture:** describe the structure of complete corporate information systems or inter-organizational information systems that are used in e-business. Here the elements are information systems.

### 1. Aspects of architectures

An aspect can be seen as a specific way to look at an architecture. An architecture can be seen from different aspects or views. According to Grefen (2015), there are two views: the 5-aspect model of Truyens and the 4+1 aspect model of Kruchten.

### The 5-aspect model of Truyens:

This model describes an IS in five different aspects, see Figure 96.

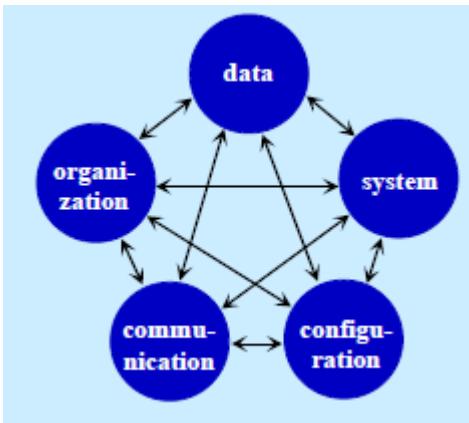


Figure 96 The 5-aspect model of Truyens

The data aspect describes the organization of the data in an information system, typically in terms of data structure diagrams or specifications.

The system aspect specifies the structure of the software of the information system under consideration, i.e. being designed or analyzed. This can also be referred to as the application logic structure.

The configuration aspect described the structure of the platform used by the information system under consideration, i.e., the software (and possibly hardware) that the application logic relies on. Examples here are operating systems and database systems.

The communication aspect specifies how the information system communicates with other information systems by defining the communication topologies, the messages passed and possibly the protocols used for message passing.

The organization aspect finally describes how the information system under consideration is embedded into an organization for its design, implementation and maintenance.

### The kruchten 4+1 aspect framework:

in this framework, the IS is shown in 5 different views, see Figure 97.

The logical view specifies the object/module models of the design, i.e., the structure of the application logic in abstract terms.

The process view specifies the concurrency and synchronization aspects of the software design, i.e., the way objects or modules in the logical view dynamically collaborate in parallel.

The physical view describes the mapping of software onto hardware, thereby reflecting the distribution aspect (what runs where?).

The development view specifies the organization of the software in development environment, i.e., the way the software development is supported.

Each view has its own stakeholder and main concerns.

**The scenarios** describe a few selected use cases that illustrate the four basic views. The scenarios make things concrete and provide a basis for discussions between the various groups of stakeholders in the architecture design or analysis.

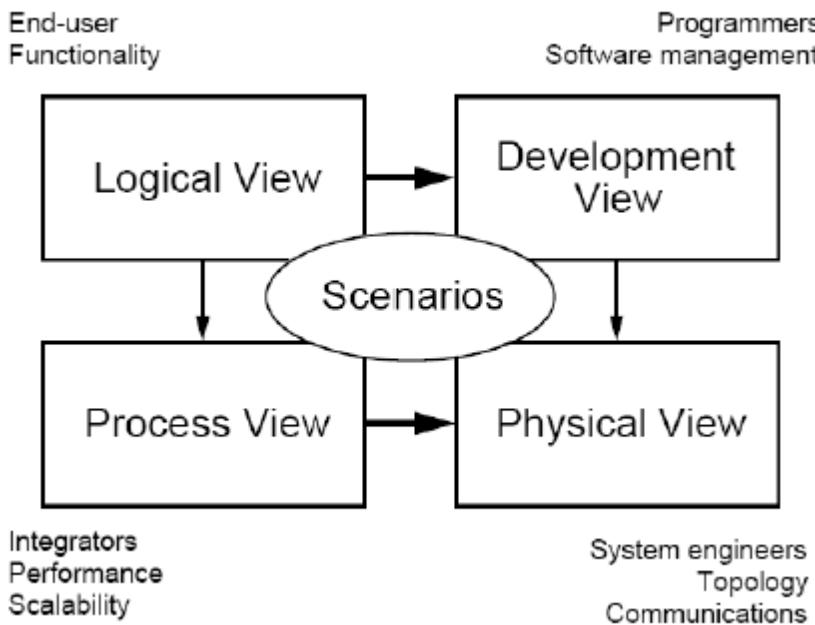


Figure 97 4+1 aspect framework from Kruchten

In this course, the 5-aspect model of Truyens is recommended.

## 2. Levels of architecture

An architecture can have various dimensions and levels. Grefen (2015), defines three different subdivisions:

- Aggregation dimension: this determines the number of components in a IS. The number of aggregation is determined by the type of architecture, see Figure 98.

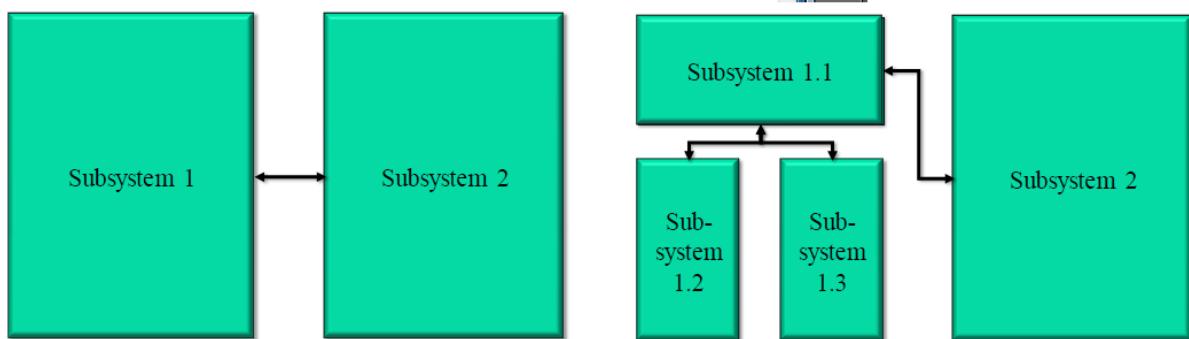


Figure 98 Level 1 & level 2 aggregation

- Abstraction dimension: this determines how abstract (without specific choices) or concrete (everything specifically chosen) the description of the architecture must be, see Figure 99.

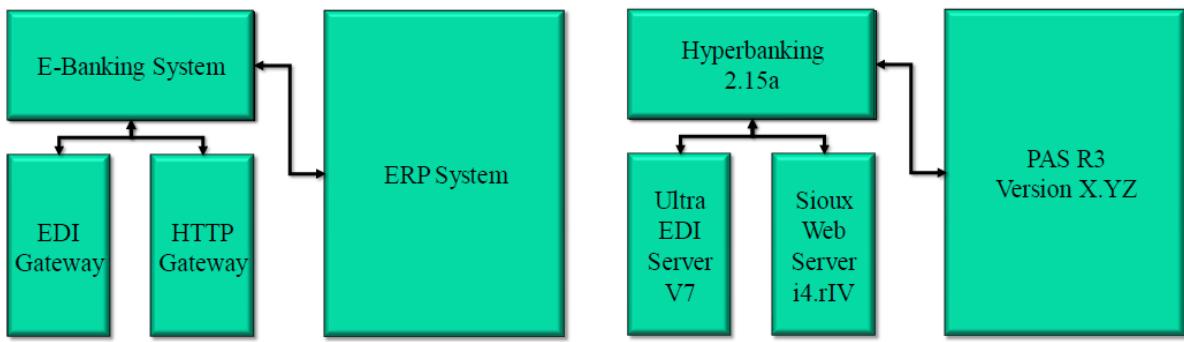


Figure 99 Abstraction level 3 & level 4

- Realization dimension determines what the system means. The distinction is made using the BOAT framework:

**Business (B):** the business level describes the business goals of an information system. As such it answers the question why a specific information system exists or should exist or what should be reached. Topics can be leverage of efficiency levels, support new business functions, etcetera. How things are done is not of interest at this level.

**Organization (O):** the organization level describes how organizations are structured to achieve the goals defined at the B level. Organization structures and business processes are main ingredients here – automated systems are not yet in scope in this level. The O level is closely linked to the concept of enterprise architecture

**Architecture (A):** the architecture level covers the conceptual software structure (software architecture) of automated information systems required to make the organizations defined at the O level work. As such, it describes how automated systems support the involved organizations.

**Technology (T):** the technology level describes the technological realization of the systems of which the architecture is specified at the A level. The T level covers the concrete ingredients from information and communication technology, possibly including hardware, software, languages and protocols.

These four dimensions can be combined and create a four dimensional design space, see Figure 100. By choosing different design steps, the specification of a concrete, detailed, IT-oriented architecture is formed. The four dimensions can be transformed into a design cube. By following the path in the cube, a modelling path is created. In this example, first two realization steps are made, then three refinement steps along the aggregation dimension, followed by a third realization step, and finally two concretization steps are made in the abstraction dimension. Instead of using the realization dimension, the aspects of Kruchten can be used as well.

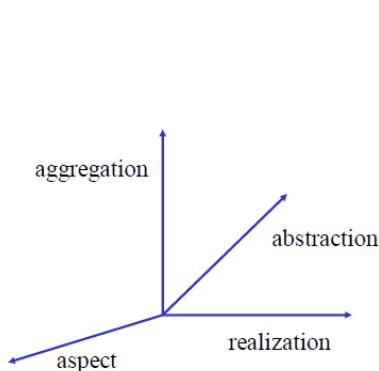


Figure 100 The four dimension combined

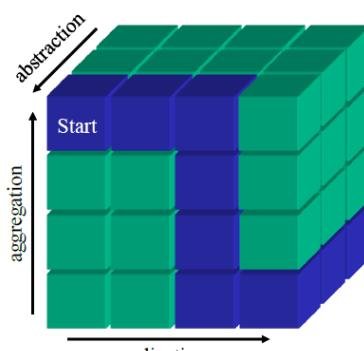


Figure 101 Example path of the design cube

### 3. Styles for architectures

An architecture style is a generally recognized overall approach describing the overall structure of an architecture (and the process of architecting). According to Grefen (2015), there are four different structure styles: monolithic, layered, columned, and component-oriented, see Figure 102.

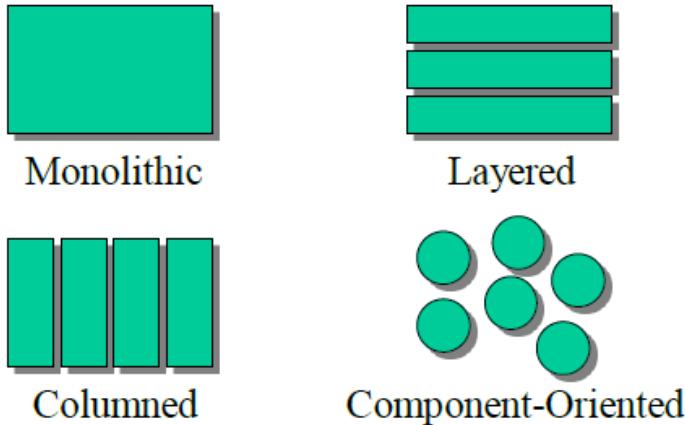


Figure 102 Four structure styles

**Monolithic:** the monolithic style uses a black-box approach: all functionality is included in one monolith and hence there is a complete absence of explicit structure.

**Layered:** the layered style defines structure by organizing functionality into several layers of functional abstraction.

**Columned:** the columned style defines structure by organizing functionality into several functional 'sub-areas' (the columns) at the same level of functional abstraction.

**Component-Oriented:** the component-oriented style defines structure by grouping coherent application functionality into components with explicit interfaces.

### 4. Patterns for architectures

An architecture pattern is a generally recognized recurring (sub)structure that is used to describe part of the overall structure of an architecture. This substructure can be seen as building blocks and can be reused. It is commonly used in the software aspect. An overview of all the patterns is given in Figure 103. It contains 12 patterns, divided in five pattern classes.

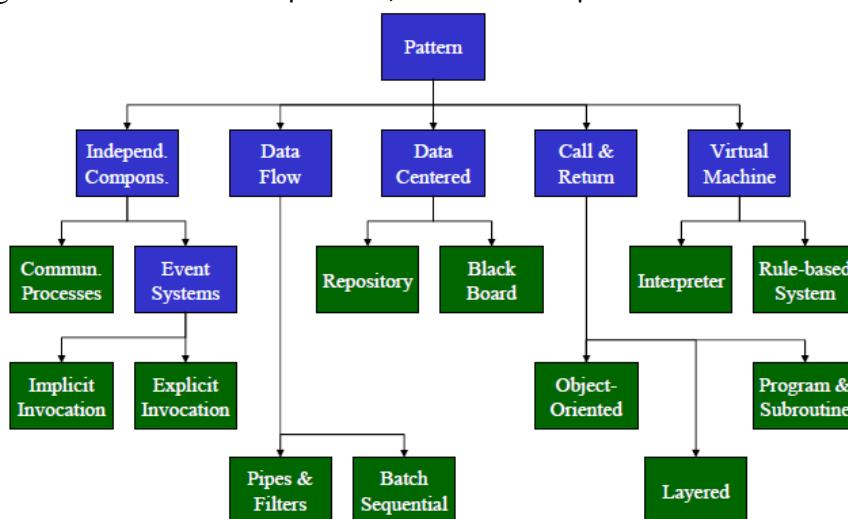


Figure 103 Overview patterns

Only the four patterns to connect architecture components are explained: direct invocation, file transfer, shared database and shared bus, see Figure 104.

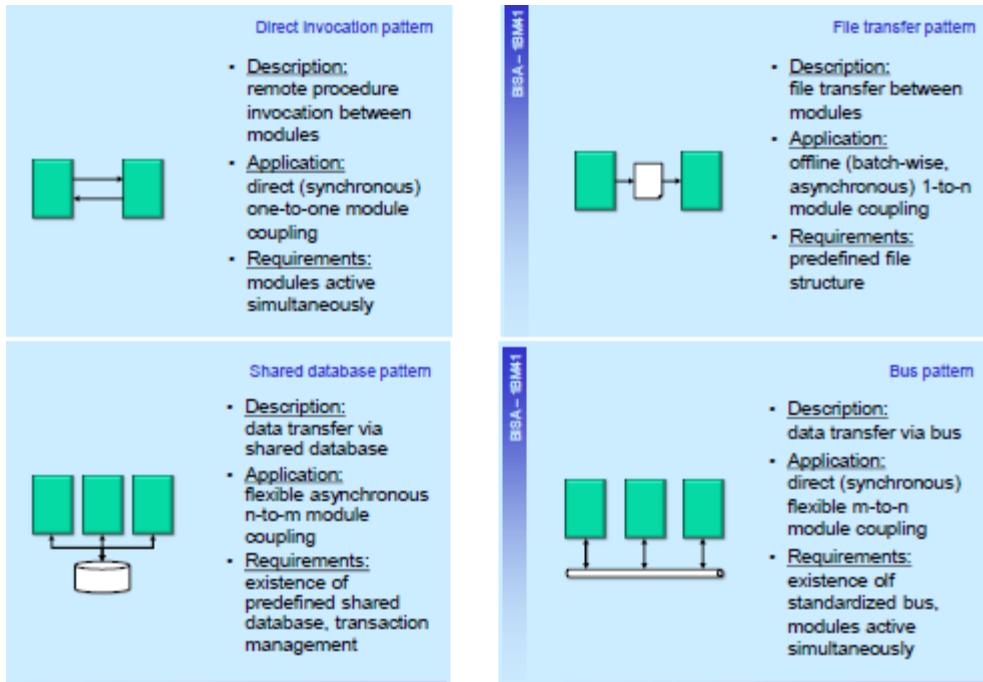


Figure 104 Four patterns

## 5. Reference architectures

A reference architecture is a general design (abstract blueprint) of (system) structure for a specific class of information systems and is elaborated (detailed, extended, parameterized) for a specific situation to obtain a concrete architecture. They describe certain aspects of CIS, for example data management, and process management. There are two different reference architectures: one for individual systems and one for enterprise integration:

Reference architectures for individual systems describe the structure of a single information system. An example is the WfMC reference architecture for workflow management, see Figure 105. This reference architecture provides an elaboration along the aggregation dimension and it elaborates the internal structure of the main components of the top level model.

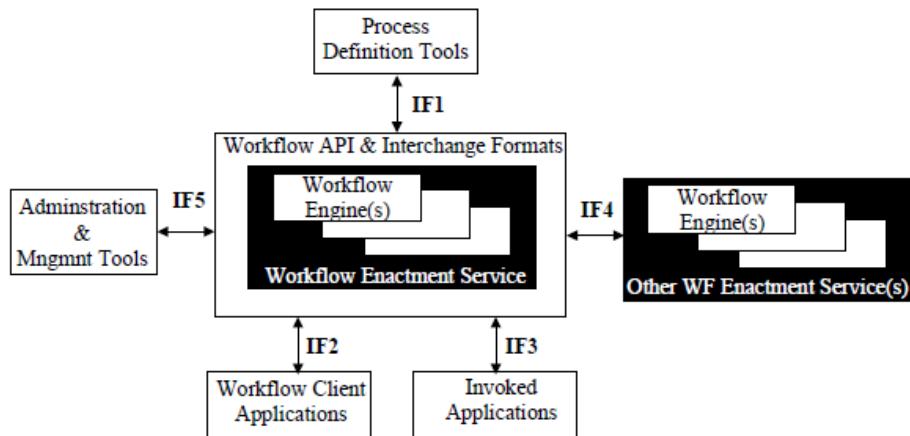


Figure 105 WfMC reference architecture

Reference architectures for enterprise integration focuses on interoperability issues between systems that provide specific functionality. They describe structures related to the use of software technology designed for accommodating interoperability. An example is the object management architecture (OMA), defined by the object management group (OMG), see Figure 106. The OMA reference architecture describes that in a complex, object-oriented software environment, software

modules (objects) are to be divided into three main classes. The Object Services class provides modules with low-level, general functionality. The Common Facilities class provides modules with high-level, general functionality. The Application Objects class contains the modules with application-specific functionality. All modules interact using a software infrastructure called the Object Request Broker (ORB).

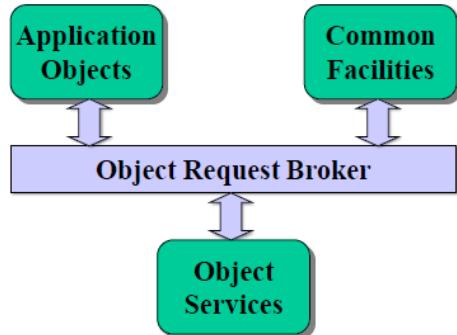


Figure 106 Basic object management architecture

## 6. Architecture specification techniques

In order to specify architecture models, modelling techniques can help. Two modelling techniques will be discussed: UML and Archimate.

Unified modelling language (UML) is designed to provide a standard way to visualize the design of a system and can be used in various aggregation levels. It uses many types of diagrams, divided into two categories: structure diagrams and behaviour diagrams. Structure diagrams describe static structures of systems. Examples of structure diagrams are class diagrams, component diagrams, object diagrams, and package diagrams. Behaviour diagrams describe how systems dynamically behave. This category includes diagrams like use case diagrams, activity diagrams, and sequence diagrams.

Archimate is an enterprise architecture specification technique and offers a common language for describing the construction and operation of business processes, organizational structures, information flows, IT systems, and technical infrastructure. Services play a central role in the relationships between aspects. Services are organized in three main layers: business layer, application layer, and technology layer. The business layer contains products and services offered to external parties, realized by business processes. The application layer contains the application services that support the business layer. These application services are realized by software components. The technology layer contains infrastructural services required to run the application services.

## 7. Architecture design methods

Design methods give standardized descriptions of architecture design processes and specify the steps to take, the documents to produce in each step and the stakeholder to involve in each step. Below, two methods are explained: TOGAF and COMET.

The open group architecture forum (TOGAF) is a high-level approach to architecture design and uses four levels of models: business, application, data, and technology. It relies heavily on modularization, standardization, and already existing, proven technologies and products.

Component and model-based development methodology (COMET) is a use case-driven, model-focused approach for developing and maintaining software products product families. It uses UML-based specification techniques. It also uses four types of models: business, requirements, architecture and platform specific models.

## 8. Layers and Platforms

Applications are IS that support specific business functions and make use of functions of infrastructures. Infrastructures are IS that provide general-purpose functionality that can be used across business functions, usually to support applications. The infrastructure layer uses functionality of operating system software, which again uses hardware functions. In layered architectures like the one shown in Figure 53, we often use the concept of platform. A platform for a specific layer is the functionality offered by the layers beneath that specific layer. For example, the platform for the infrastructure software in Figure 107 is the combination of operating system and underlying hardware.

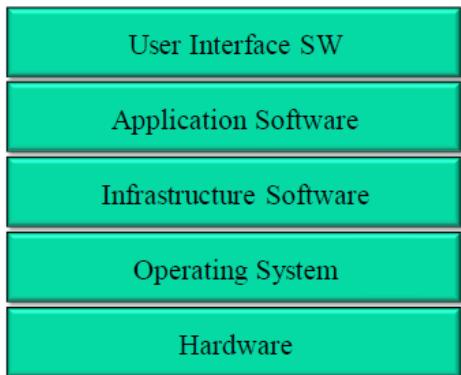


Figure 107 Application and infrastructure layers in context

In order to identify the elements of an application layer, a business model framework can be used, for example Porter's framework, see Figure 108. The vertical columns are primary functions, where the horizontal columns are secondary functions.

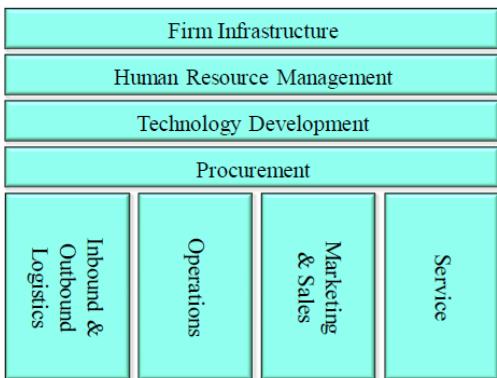


Figure 108 Adapted version of Porter's value chain model

the infrastructure layer contains the main supportive elements of a business information system and the connections between these. Here, the elements are defined by a general support functionality classification. There is no framework to help determine the elements. However, there are three classification of support functions: business data management, business process management, and system interoperability support. An example of a simple infrastructure layer structure is shown in Figure 109.

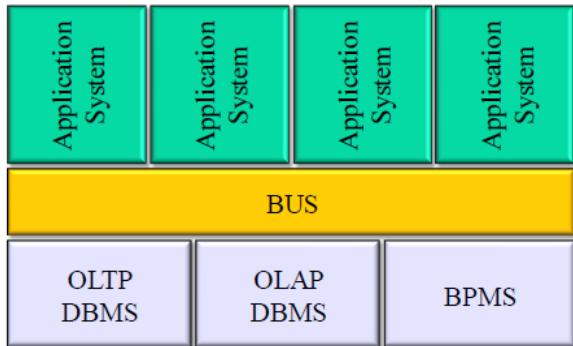


Figure 109 Infrastructure layer structure

## 9. Data-oriented systems

Database management technology is infrastructure system technology used to manage large sets of (business data). The technology is available as a COTS solution in the form of a database management system (DBMS). The internal architecture of such a system can be seen in Figure 110. The application interface modules provides the interface to application modules, i.e., software modules in the application layer of an IS or CIS architecture. Through the application interface, application modules can pass their commands to the DBMS – for example to store or to retrieve specified data. The query translation module translates commands from the external, application-oriented format to the internal, processing-oriented format. The query optimization module transforms a command such that it can be efficiently processed by the underlying layers – this relieves the applications from the burden to be aware of the internal processing mechanisms of the DBMS. The query processing module oversees the execution of commands. The actual execution of commands (or parts thereof), i.e. the low-level operations against the databases managed by the DBMS, is performed by the data management module. The transaction management module orchestrates the concurrent execution of multiple commands from various applications (Grefen, 2015).

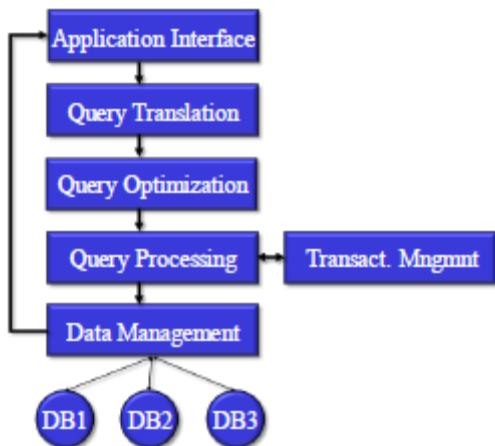


Figure 110 Architecture of a DBMS

The data processing occurs in two different fashions: transaction processing (OLTP) and data warehouse processing (OLAP). In table 8, the difference between the two are given.

	transaction processing (OLTP)	warehouse processing (OLAP)
Information	Operational information	Management information

Usage	Used by administrative staff	Used by decision makers
<b>database</b>	Standalone database	Integrated view
<b>Frequency of transactions</b>	Very high	low
<b>Amount of data queried</b>	small	Very large
<b>Amount of data updated</b>	small	None / large
<b>Duration of transactions</b>	Small	Long
<b>Quality requirements</b>	Perfect	good

Table 32 Differences OLTP vs OLAP

## 10. Process-oriented systems

Business process management technology or workflow management technology is information technology to manage the design and execution of complex, well-specified business processes that are typically performed by many actors in large organizations. Comparable to DBMSs for data management, the technology is available in COTS form as business process management systems (BPMSs) or workflow management systems (WFMSs). BPMS or WFMS can both be used as reference architecture, see figure 57.

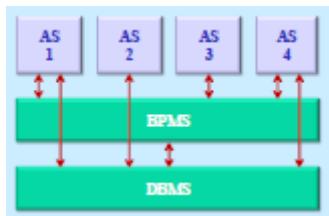


Figure 111 BPMS as architecture

## 11. Middleware

In a CIS, different programs do not always work together properly. Middleware is defined as General-purpose software, defined by an API, that facilitates application elements to interoperate at a logical level, be distributed across multiple systems, or ported to another platform, despite differences in underlying communication protocols, operating systems, or other basic services. Middleware is designed to facilitate interoperability between different programs or software modules. There are four different types: function-oriented middleware, message-oriented middleware, object-oriented middleware, service-oriented middleware.

### Function-oriented middleware:

Function-oriented middleware interoperable by supporting program-to-program function invocation, for example by remote procedure call (RPC) mechanisms. Using an RPC mechanism, one program can synchronously invoke a function that is implemented in another program that may be running on a different platform, see Figure 112.

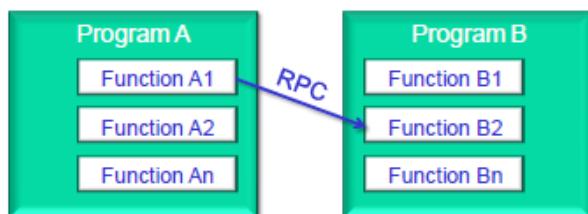


Figure 112 Using RPC

### **Message-oriented middleware:**

Message-oriented middleware is program-to-program communication middleware that relies on the exchange of messages. It makes sure that message processing can be fully automatic by asynchronous message passing. Message-oriented middleware ensures that every sent message is delivered exactly once and not lost, every messages are delivered to a recipient in the same order as they were sent by the sender and messages are delivered within a certain timeframe.

### **Object-oriented middleware:**

Object-oriented middleware supports object-to-object method invocation in a system based on a distributed object architecture (DOA). This means that this class of middleware takes a component-oriented architecture style as a starting point. The middleware software allows objects to easily communicate with each other despite differences between them with respect to implementation characteristics, underlying platform, technical or geographical location, and technical interconnection between their underlying platforms (Grefen, 2015). The main standard that is used is CORBA. The CORBA specification is part of the OMA specification, which are both standards by the OMG. It can be seen as an advanced remote object interaction mechanism that identifies, locates, and accesses objects. It offers dynamic interfaces, interface repository, platform transparency, and location transparency.

### **Service-oriented middleware:**

Service-oriented middleware is comparable to object-oriented middleware, but follows the more recent service-oriented paradigm for architecture. In service-oriented architecture (SOA), takes business services as the main building blocks. The Web Service paradigm is regarded as the standard paradigm for the realization of distributed information systems that use the Internet (and intranet) as communication infrastructure. Using the Web Service paradigm implies using the Web Service (WS) technology stack. This technology stack defines a number of related standard languages and protocols for communication and synchronization in a service-oriented context, see Figure 113. Below the languages are explained.

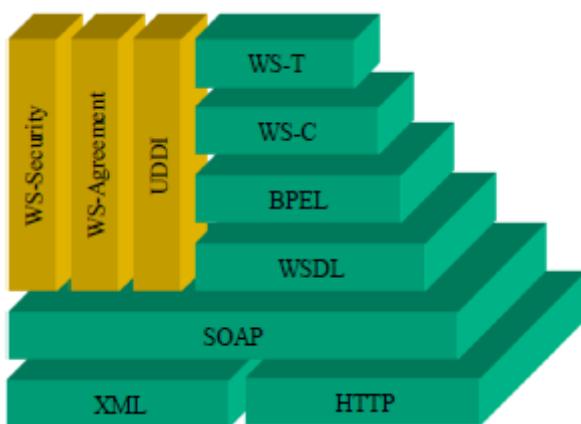


Figure 113 web services technology stack

**XML:** The eXtensible Markup Language is a tag-based (hence markup) meta-language to define other languages (hence extensible) in the context of the Web.

**HTTP:** The HyperText Transfer Protocol is the basic protocol for transferring messages via the Web using URLs (Uniform Resource Locators).

**SOAP:** The Simple Object Access Protocol is a communication protocol allowing objects to access each other, using HTTP and XML as its underlying standards.

**WSDL:** The Web Service Definition Language is a language to describe the interface of Web Services, i.e., the way functionality of components can be accessed.

**BPEL:** The Business Process Execution Language is a language to specify business processes in terms of Web Services; as such, it can be seen as a language to specify the control flow of a business process in which the activities (steps) are specified as Web Services.

**WS-C/WS-T:** The WS Coordination and WS Transaction standards specify standards to coordinate the distributed execution of related Web Services, i.e., ensure that a set of Web Services has a consistent behaviour.

**UDDI:** Universal Description, Discovery and Integration is a standard for platform-independent, Extensible Markup Language (XML)-based registries (brokers) by which businesses worldwide can list themselves on the Internet, and a mechanism to register and locate web service applications.

**WS-Agreement:** WS-Agreement is a standard for specifying agreements (such as service level agreements) between parties collaborating through Web Services.

**WS-Security:** WS-Security is a standard for specifying security requirements to Web Service infrastructures.

The most common form of service-oriented middleware is an Enterprise Service Bus (ESB), which is a communications broker that connects services in the context of a corporate information system, see Figure 114.

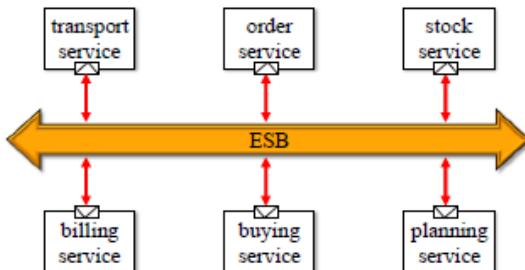


Figure 114 ESB in CIS