Minna Hautamäki

CO-CREATING VALUE-IN-USE FOR PUBLIC HEALTHCARE CUSTOMER THROUGH MODULARITY OF LOGISTICS SERVICES

Master’s Thesis
Department of Marketing
April 2015
UNIVERSITY OF OULU
Oulu Business School

ABSTRACT OF THE MASTER'S THESIS

<table>
<thead>
<tr>
<th>Unit</th>
<th>Department of Marketing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author</td>
<td>Hautamäki, Minna</td>
</tr>
<tr>
<td>Supervisor</td>
<td>Pekkarinen, Saara, Senior Research Fellow</td>
</tr>
<tr>
<td>Title</td>
<td>Co-Creating Value in Use for Public Healthcare Customer through Modularity of Logistics Services</td>
</tr>
<tr>
<td>Subject</td>
<td>Marketing</td>
</tr>
<tr>
<td>Type of the degree</td>
<td>Master's Thesis</td>
</tr>
<tr>
<td>Time of publication</td>
<td>April 2015</td>
</tr>
<tr>
<td>Number of pages</td>
<td>111 + 8</td>
</tr>
</tbody>
</table>

Abstract

The healthcare industry today is in the search for efficient solutions. However, currently services, such as logistics, supporting the hospital core processes are often produced in-house. Recent findings have shown internally produced services may not always be as efficient as their external alternatives. This has led to hospitals outsourcing their non-core activities which allows the external service providers to expand their markets to the healthcare industry.

In this thesis, a logistics service provider’s business opportunities will be explored in the context of public healthcare. Furthermore, this study considers modular service architecture as a facilitator for creating value. The research emphasises the role of operational-level customer i.e. nursing staff’s conception of value created by logistics as well as its value creation processes in a university hospital. By gaining an understanding of how logistics creates value-in-use to the hospital customer, business opportunities can be discovered.

The purpose of this thesis is to find new business opportunities for a logistics service provider organisation aiming to increase its market share in the public healthcare sector. In order to achieve this goal, the researcher investigates current logistics issues in the university hospital’s surgical ward emphasising value creation processes in the ward and the operational-level customer point-of-view. In addition to addressing a practical need, this study contributes to existing research in co-creation of value and modularity in the context of logistics and healthcare.

This is a qualitative study where the research phenomenon is approached utilising three divergent research methods that are semi-structured interviews, observations and a group discussion. Although this research emphasises the role of the medical staff consisting of nurses, interviews are carried on both strategic- and operational-levels in the healthcare customer and logistics service provider organisations. The group discussion is regarded to be a data collecting method enabling representatives from the logistics service provider and healthcare customer organisations to co-create value.

The results of this study support existing research on modularity and its suitability in markets with heterogeneous needs, such as the healthcare industry where hospitals often contain a number of internal customers that may differ from each other in terms of their needs. Furthermore, current research on modularity emphasises monetary benefits, such as efficiency and cost reductions, created for the customer. However, this research suggests modular services may additionally create non-monetary value-in-use to the customer by improving well-being and trust among the medical staff. In other words, modular services are not solely a facilitator for efficiency.

The results of this study may be applied by practitioners looking for new business opportunities through co-creation together with the customer. Furthermore, the results suggest organisations wanting to gain more market share in the healthcare industry ought to consider modular service design to be able to respond to heterogeneous customer needs.

Due to the qualitative nature of this study as well as the narrow amount of empirical data, the results of this study cannot be generalised.

Keywords: Value Co-Creation Process, Interaction, Resources, Operational-level

Additional information
This study is part of a project called Effective, User-Centered and Scalable Support Service Models in Long Distance Healthcare Systems at the University of Oulu and Oulu Business School.
Table of Contents
1 INTRODUCTION .................................................................................................................. 6
  1.1 Introduction to Value Co-Creation through Service Modularity .......... 6
  1.2 Purpose of Research and Research Questions .................. 8
  1.3 Research Methodology ......................................................... 9
  1.4 Defining key terms ................................................................ 9
  1.5 Research Structure ............................................................... 11
2 CO-CREATING VALUE FOR THE CUSTOMER ........................................... 12
  2.1 The Value Discussion ............................................................ 12
    2.1.1 Co-Creation of Value According to Service Dominant Logic ...... 15
    2.1.2 Relationships and Interactivity in Value Co-Creation ............ 17
  2.2 Elements of Customer Value .................................................. 19
  2.3 Customer Experience of Value ................................................. 20
3 RESOURCES IN VALUE CO-CREATION ........................................ 23
  3.1 Co-Creation of Value and Resource Sharing in Business-to-Business Services ................................................................. 23
  3.2 Resources in Dyadic Business Relationships ......................... 25
    3.2.1 Customer Resources ...................................................... 27
    3.2.2 Supplier Resources ........................................................ 29
    3.2.3 Value Co-Creation Process ............................................. 31
4 SERVICE MODULARITY IN BUSINESS-TO-BUSINESS VALUE CREATION .............................................................................. 35
  4.1 Modularity – A Definition ....................................................... 35
  4.2 Dimensions of Modular Service Design .................................. 39
    4.2.1 Modularity in Services .................................................... 40
    4.2.2 Modularity in Processes .................................................. 41
    4.2.3 Modularity in Organisation ............................................. 42
5 CO-CREATING VALUE THROUGH SERVICE MODULARITY .......... 44

6 RESEARCH DESIGN ........................................................................................................... 46
  6.1 Research Methodology ................................................................................................. 46
  6.2 Method of Empirical Enquiry ......................................................................................... 48
  6.3 Data Collection and Analysis Method .......................................................................... 49

7 EMPIRICAL RESEARCH ON CO-CREATION OF VALUE THROUGH MODULAR SERVICES ........................................................................................................... 54
  7.1 Description of Service Provider Company ..................................................................... 54
  7.2 Modularity in Service Provider Organisation .............................................................. 55
    7.2.1 Challenges in Serving Public Sector Customer ....................................................... 57
    7.2.2 Modularity in Services ............................................................................................ 59
    7.2.3 Modularity in Processes ......................................................................................... 60
    7.2.4 Modularity in Organisation ..................................................................................... 61
  7.3 Description of Customer Organisation .......................................................................... 63
  7.4 Co-Creating Value-in-Use for the University Hospital through Modularity of Logistics Services ........................................................................................................... 66
    7.4.1 Diagnosing Challenges ............................................................................................ 67
    7.4.2 Solution ..................................................................................................................... 76
    7.4.3 Modular Service Delivery ......................................................................................... 81
    7.4.4 Value-in-Use for the University Hospital Customer ................................................. 86

8 CONCLUSIONS .................................................................................................................. 92
  8.1 Theoretical Implications ................................................................................................. 96
  8.2 Managerial Implications ................................................................................................. 97
  8.3 Evaluation of the Research ............................................................................................. 99
  8.4 Research Limitations and Directions for Future .......................................................... 101

REFERENCES ...................................................................................................................... 103
APPENDICES

Appendix 1. Interview Nurses, University Hospital..........................112
Appendix 2. Interview Procurement, University Hospital.................114
Appendix 3. Interview Logistics Service Provider, Strategy Level........116
Appendix 4. Interview Logistics Service Provider, Operational Level...118
Appendix 5. Guiding Questions for Group Interview..........................120
Appendix 6. Analysis Nodes.............................................................121
Appendix 7. Observations on Possible Logistical Challenges at the University Hospital Central Surgery Ward.........................................................122
Appendix 8. Value Co-Creation Process and Shared Resources..........125

FIGURES

Figure 1. The Emerging of Value-in-Use............................................14
Figure 2. Modules and Interfaces......................................................39
Figure 3. Co-Creation of Value through Modularity.........................45
Figure 4. Levels of Interview with the Service Provider Organisation....53

TABLES

Table 1. Value Co-Creation Process and Supplier and Customer Resources.34
Table 2. Interview Information.........................................................51
1 INTRODUCTION

1.1 Introduction to Value Co-Creation through Service Modularity

The healthcare industry today is in the search for services offering high value at low cost. Traditionally, hospitals have produced services, such as logistics, supporting the core processes focused on patient care internally. However, recent findings suggest logistics services produced internally are not designed to achieve requirements for efficiency and value. (Kriegel, Jehle, Dieck & Mallory 2013.) The inefficiently produced internal services have led to a trend of outsourcing logistics services to an external provider in the field of healthcare making it a relatively common arrangement across the world (Nicholson, Vakaria & Erenguc 2004, 272). Despite this, logistics research and value created by logistics in the context of healthcare has not received much attention among researchers to date.

In the context of business-to-business services, understanding the customer is important in order to create value for them. What makes this complicated in the field of healthcare is the number of internal customers, such as wards and units, and their heterogeneous needs (Kriegel et al. 2013, 47).

Scholars in the field of services research currently acknowledge value no longer is embedded in goods but instead it is created through use (Vargo & Lusch 2004; Grönroos & Voima 2013). This notion has increased interest in research focused on assessing customer value-in-use. The concept may be defined as an outcome, purpose or objective achieved by the customer through a certain service, and it emphasises a process based view to customer benefits achieved through the service providers processes fusing with the customer ones.

(MacDonald, Wilson, Martinez & Toossi 2011, 671.)
Although understanding complex customer needs may be challenging, one way to increase understanding of customer value-in-use in the context of healthcare is to facilitate interaction between the service provider and the customer (Aarikka-Stenroos & Jaakkola 2012). In fact, it is stated by Lin, Pekkarinen and Ma (2015, 2) that in logistics outsourcing situations communication between the two parties is of crucial importance with regards to success.

In this study, new business opportunities for a large logistics service provider will be explored in the context of the public healthcare sector limited to a large public university hospital. The study further limits itself to examine the research phenomenon dyadically, i.e. between two different actors to avoid complexity (Grönroos & Voima 2013). The study will focus on gathering data from strategic and operational-level actors at the logistics service provider and university hospital organisations.

Furthermore, this study is focused on co-creation of value. Although existing research on the phenomenon emphasises value created for both the customer and the firm (Grönroos & Voima 2013, 134) the researcher chooses to emphasise the customer point-of-view (Aarikka-Stenroos & Jaakkola 2012). This limitation is based on an observation according to which the existing literature on value co-creation is supplier focused even though value is determined by the customer (Grönroos 2011, 240). Thus, the service provider ought to, “[i]nstead of focusing on how customers can be engaged in co-creating with the firm, […] rather focus on becoming involved with the customers’ lives” (Grönroos & Voima 2013, 134). This statement is in line with existing logistics literature as logistics service providers have the tendency to focus more on operational excellence than delivering superior customer value. This, on the other hand, commonly leads to difficulties to identify customer needs. (Yazdanparast, Manuj & Swartz 2010, 376.)

In addition to exploring new business opportunities through customer point-of-view and value co-creation literature, this study further draws on existing literature on modularity and adopts this concept as a means for creating value to the university
hospital customer. The decision to explore value arising through modularity is based on results from previous studies that show modular service architecture fits well in environments with heterogeneous needs (Pekkarinen & Ulkuniemi 2008) such as hospitals (Kriegel et al. 2013). Despite this, modularity has rarely been examined in the context of logistics services (Lin & Pekkarinen 2011, 344) or healthcare (de Blok, Luijkx, Meijboom & Schols 2010).

This thesis aims to contribute to existing academic discussion on value co-creation and services modularity. More precisely, the relevance of this study is based on the lack of existing research in service modularity explored in the context of logistics (Lin & Pekkarinen 2011) and healthcare (Kriegel 2013). Furthermore, the study emphasises benefits created to the customer during the value co-creation process (Grönroos & Voima 2013). Additionally, as opposed to focusing on the more traditional strategic-, or managerial-level healthcare customer (Kriegl et al. 2013), this study emphasises the role of the operational-level customer, namely nursing staff (de Blok et al. 2010).

This research will be carried out as a part of a multi-discipline project within supportive healthcare logistics named Effective, User-Centered and Scalable Support Service Models in Long Distance Healthcare Systems at the University of Oulu and Oulu Business School that has received funding from Tekes (Finnish Funding Agency for Innovation) as well as several private and public sector actors.

1.2 Purpose of Research and Research Questions

The purpose of this study is to advance knowledge in opportunities for co-creation of value in the context of logistics and public healthcare. The researcher aims to utilise existing literature on co-creation of value and modularity to develop a process framework with focus on resources shared to create customer value-in-use facilitated by modular logistics services.
The research phenomenon will be approached with one primary research question

What kinds of value co-creation opportunities exist for the logistics service provider?

To be able to answer the primary research question, the following sub-questions are proposed

What kinds of logistical challenges currently exist in the customer organisation?

What resources are shared in the logistics value co-creation process?

How does the customer benefit from the modular services in its own processes?

1.3 Research Methodology

This study is qualitative in nature. Application of a qualitative research method can be further justified through Myers (2009, 5) who argues that a qualitative method allows the researcher to better understand individuals and their behaviour. Additionally, this method provides the researcher opportunity to see and understand the context where decisions are made and where certain actions take place. Both of these may be regarded important considering the purpose of this particular study.

1.4 Defining key terms

In order to assist the reader to better understand the content of this study, some of the key terms must be defined. Considering this paper on value creation within the logistics services field, words, such as value, logistics and service will be defined
shortly in this section. These terms will be discussed more in-depth in the theoretical discussion.

Value

In this study, value consists of both monetary and non-monetary elements that are further perceived as a trade-off between the total of benefits gained and the total of incurred sacrifices (de Chernatony, Harris & Dall’Olmo 2000). In this study, value arising from services is argued to realise through during service consumption, i.e. through value-in-use (Ballantyne & Varey 2006b, 337) that implies value is experienced when the customer achieves its objectives by utilising a service provider’s resources in its own processes (MacDonald et al. 2011, 671; Grönroos & Voima 2013). Resources creating value for the customer may be either *operand* or *operant* meaning value may be embedded in goods or in knowledge (Lusch & Vargo 2014, 123). However, the resources emphasised in this study will be mainly operant, and may consist of areas such as expert knowledge, experiences, and industry expertise (Aarikka-Stenroos & Jaakkola 2012).

Logistics

Logistics is a value adding function (Rutner & Langley 2000, 73) concerned with distribution, and more precisely flow of materials through a supply chain (Croom, Romano & Giannakis 2000). Logistics creates value for the customer efficiency and effectiveness. More concretically, logistics creates value for the customer through service elements such as product availability and timeliness as well as delivery consistency (Fugate, Mentzer & Stank 2010, 44.) that are organised in “an efficient manner necessary to enable the organization to contribute to the explicit goals of the company” (Vitasek 2013, 25). In other words, logistics is a support service emphasising all activities that the service provider produces either alone, or together with the customer within the customer processes.
Service

The early conception of a service suggests service is a performance that has certain qualities different to the production of goods. These distinctive qualities are intangibility, heterogeneity, inseparability of production and consumption and perishability (Zeithaml, Parasuraman & Berry 1985.) However, this research adopts a more recent view stating services may, in fact, be tangible, homogenous, separable and durable (Johnstone, Dainty & Wilkinson 2008, 521). For instance, services have become homogeneous through automatisation and standardisation achieved through means such as modularity (Pekkarinen & Ulkuniemi 2008). In this study, a service is furthermore regarded a combination of skills and knowledge possessed by one actor that are applied to benefit the customer (Vargo & Lusch 2004). Thus, value created through a service is achieved collaboratively (Vargo, Maglio & Archpru Akaka 2008, 145).

1.5 Research Structure

This thesis consists of eight chapters. In the first chapter the reader is provided with a narrow introduction to the research topic and the context as well as possible outlines. Additionally, the introductory section presents the proposed research questions, methodology and some key terms vital for understanding the content of the research followed by an introduction to the research structure. In the second, third and fourth chapter, theoretical concepts relevant to the study in value creation, resources, and modularity will be critically discussed. At the end, a framework formed based on existing theory will be proposed. In the sixth chapter the research methodology, empirical data and a specified description of the data collection and analysis method will be introduced. In the seventh chapter, an in depth analysis of the collected data will be carried. Finally in the eight chapter, conclusions and suggestions for future research will be drawn based on the analysis. In this section validity and reliability of the study will also be evaluated.
2 CO-CREATING VALUE FOR THE CUSTOMER

In this section, different theories on value and, especially, customer value will be critically discussed. These theories will later on be related to further discussions on service modularity and sharing of resources to create a framework for increasing customer value-in-use through modularity of logistics services. The decision to propose a framework for increasing customer experienced value-in-use is based on e.g. Woodruff’s (1997, 140) observation on the lack of existing operational tools for achieving customer focus within organisations.

2.1 The Value Discussion

In this study, value is perceived as a trade-off between the total of benefits gained and the total of incurred sacrifices (de Chernatony et al. 2000). Furthermore, this study considers value is experienced phenomenologically in accordance to the service dominant logic, through value-in-use (Lusch & Vargo 2014, 15) that implies “value is created by the user during the process of using resources/processes/outcomes” (Grönroos & Voima 2013, 144). Furthermore, value-in-use may be created either individually or socially, and the usage process may be physical, virtual, or mental in nature. (Grönroos & Voima 2013, 138.)

The core nature of value has been under discussion and debate since Aristotle (Vargo et al. 2008, 146) yet the concept remains relatively vaguely defined even today (Grönroos & Voima 2013, 135). The elusiveness of this particular concept is based on the oblique meanings related to value that “have been embedded in the foundations of economics and the study of market exchange” (Vargo et al. 2008, 146). To specify, there are two ways to consider value and value creation: value may either appear through value-in-exchange or value-in-use (ibid.) Approaching value from the perspective of value-in-use is a rather novel way to consider the concept in question as previously value was regarded to be the ratio between the service quality and its costs (Sandström, Edvardsson, Kristensson & Magnusson 2008, 112).
The concept of value creation remains unclear to date (Grönroos & Voima 2013, 145). However, it may be understood in the following manner:

"The underlying, [...] view of value creation is of an all-encompassing process, including activities by service providers, customers, and possibly also other actors, which leads to the conclusion that everything is value creation and everyone co-creates value." (Grönroos & Voima 2013, 144.)

Value creation is the most important purpose as well as the most central process of economic exchange (Vargo et al. 2008, 145). Maybe this is why the concept of value has remained one of the central points of academic discussion in the field of marketing for several decades (Möller & Törrönen 2003, 110). The popularity of this particular topic has perhaps led to a situation where there is no one way to define what value is (Flint, Woodruff & Fisher Gardial 2002, 102–103). As a result of, the concept of value appears relatively fragmented in terms of a unified definition (de Chernatony et al. 2000; Walters & Jones 2001, 319).

It is argued by Porter (1988, 138) that value is created to a customer by cost reduction or activity enablement. Additionally, value is perceived to be a benefit that increases the well-being of a particular actor. The benefit experienced by the actor is achieved through activation of interlinked operant and operand resources which will be discussed in more detail later in this paper. (Lusch & Vargo 2014, 57.)

According to Grönroos (2004, 26–27; Lusch & Vargo 2014, 7), the early view on value creation suggests value is created by the seller and it is embedded in the physical offering. However, this view has later been challenged by a relationship perspective on value (Grönroos 2004, 27) and a concept known as service-dominant logic (Lusch & Vargo 2014) based on the presumption that every offer is a service and that value emerges through the use of a particular service in customer’s own value generating process. As a result, before the moment of use, resources only exist and wait to be activated through use (Grönroos 2007, 4). Thus, value does not exist in value-in-exchange but rather value-in-use situations (Lusch & Vargo 2014, 15).
The emerging of value-in-use is described below (Figure 1). The picture suggests, value-in-use takes place when the service provider’s value creation processes fuse with the customer processes (MacDonald et al. 2011, 671). Value-in-use creates both benefits and experiences when the customer is able to reach its own objective by integrating an external service to its own value creation process (Grönroos & Voima 2013).

![Figure 1. The emerging of value-in-use](image)

As stated previously in this paper, Porter’s (1988, 138) general view on value is based on cost reduction and activity enablement. Considering what value is to the customer on a more in-depth level, this study relates to Woodruff’s (1997, 140) suggestion stating that customer value is based on customer’s desires and evaluation of the benefits the customer will gain if it purchases and uses the service provider’s offering. According to a more recent view presented by Lusch and Vargo (2014, 57) value itself is a benefit. Furthermore, value is activated when a particular actor, who within the context of this research is a person or representative within a healthcare organisation, experiences increase in his or her well-being.

Although widely explored, studying value may be relatively challenging. The argument is based on the nature of value experience that is considered to be actor specific, contextually dependant and unique. In other words, value as a concept is always experiential in nature. (Lusch & Vargo 2014, 57.) Thus, one’s value experience may not be shared with others. This factor may impair the reliability of this study.
2.1.1 Co-creation of Value According to Service-Dominant Logic

Service-dominant logic suggests goods no longer form the core of marketing. Instead, every marketing interaction is considered a service. (Ballantyne & Varey 2006b, 337.) Furthermore, the service-dominant logic by Vargo and Lusch (2004, 10) no longer perceives the customer as a passive actor targeted by the service provider. Instead, it is now viewed as a co-creator of value, meaning the service provider firm is together with its customer responsible for value created during the service process. Value is created when the firm and the customer exchange unique capabilities with each other to increase their own well-being (Lusch, Vargo & O’Brien 2007, 5). The emphasis on collaboration suggests value creation takes place through interactive processes (Vargo & Lusch 2008, 7) which implies value does not only emerge during the consumption of a particular service or good (Ballantyne & Varey 2006a).

Considering service-dominant logic from a practical point of view, the process of value co-creation requires contribution of two actors, namely, the service provider and the customer. The role of the service provider is to create a value proposition to the customer. The role of the customer is then to actualise value through use (Gummesson 2008, 15.) Vargo and Lusch (2008, 7) argue that the service provider is not able to deliver value by itself. Instead, it may only create value propositions the acceptance of which leads to an interactive value creating process together with the customer. Thus, the service provider is not able to create or deliver value independently but together with the customer.

By making the customer an essential actor in value creation process (Merz, He & Vargo 2009) the service-dominant logic adopts a process view to value creation contrary to the previously popular output orientation. As a result, the service-dominant logic does not limit itself to only consider the service provider’s output that may consist of products, services or information. Instead, it also acknowledges the role of resources possessed by the customer and its network. (Edvardsson, Tronvoll & Gruber 2011, 328; Vargo & Lusch 2008, 3.)
Vargo and Lusch (2004, 9) also discuss the role of tangible goods from the value creation point-of-view and argue products no longer are the actual target of this process. Instead, products are rather appliances that facilitate the service performance (Ballantyne & Varey 2006b, 337). Goods are found to embody a particular service and the intangible resources that are related to them. This is in line with an earlier observation presented by Porter (1985, 163–164) who discovered that the customer is the one to determine the utilities gained from a particular good as well as the way it should be used. Porter’s understanding is further supported by Gummesson (1995, 250–251):

“Customers do not buy goods or services: [T]hey buy offerings which render services which create value […] The traditional division between goods and services is long outdated. It is not a matter of redefining services and seeing them from a customer perspective. The shift in focus to services is a shift from the means and the provider perspective to the utilization and the customer perspective.”

Thus, value does not exist within the good itself but the value creation process continues when the customer learns to use, repair and adapt the product features in such a way that it serves its own purposes in a meaningful way (Vargo & Lusch 2004, 11; Gummesson 2008, 15).

On a similar note, Grönroos and Voima (2013, 135) find that the customer creates value by combining different resources. However, the way resources are combined is dependent on the value-in-use context. Based on this view and the argument on how value is always determined by the beneficiary, perceiving the customer as a co-creator of value is crucially important for the service provider (Grönroos 2008; Lusch & Vargo 2014, 15) to remain competitive. In fact, co-creation of service is a necessity as the provider and the customer are interdependent actors (Gummesson 2008, 17). Additionally, the customer ought to take an active role in adapting the co-created services in its own processes to truly benefit from them (Nätti, Pekkarinen, Hartikka & Holappa 2014, 978).
As opposed to value being embedded in tangible goods, the service dominant logic further emphasises the role of intangible resources. These may come in the form of, for instance, knowledge, competences or organisational processes. Generally, the service-dominant logic suggests resources are either operand or operant. An operand resource is defined as a form of resource that requires an action or an operation in order for it to produce a certain effect. (Vargo & Lusch 2004, 2–5.) An example of an operand resource is a physical good that in the context of this study may be a medical instrument. The service-dominant logic emphasises the importance of operant resources which form the fundamental source of competitive advantage to the service provider (Vargo & Lusch 2008, 7). Operant resources are ones that the service provider may employ to act on certain operand resources (Vargo & Lusch 2004, 2). For instance, a nurse’s knowledge in how to use a certain instrument to perform some medical procedure is regarded an operant resource.

2.1.2 Relationships and Interactivity in Value Co-Creation

Interaction is a fundamental element to value co-creation, and it makes value creation a dialogical process meaning value is created together by the service provider and the customer through interaction. Interaction may be classified either direct or indirect. “A direct interaction refers to a process by which the customer’s and firm’s resources (personnel, system, service-scape) interact” whereas “[An] indirect interaction refers to situations in which the customer uses or consumes resources that are outputs of the firms processes […] and thereby interacts with this resource.” (Grönroos & Voima 2013, 123.) For instance, in the context of this study, a direct interaction takes place when a nurse engages him/herself in a dialogue with a service provider representative. The same nurse is indirectly interacting with the service provider while using the service provider’s service.

Although, the service-dominant logic acknowledges the role of interaction in the value creation process (Vargo & Lusch 2004, 2008; Lusch & Vargo 2014, 145), Ballantyne and Varey (2006b, 336) argue this logic does not necessarily emphasise the role of it. Instead, interaction is treated as a given. On the contrary to the ignored
role of interactivity in the customer value-creation process, Ballantyne and Varey (2006b) argue value-in-use is, in fact, created through interaction. In their article, the researchers discuss three different forms of interaction that may improve customer’s value-in-use process. These interactions are referred to as relating, communicating and knowing. (ibid.) These may also be considered to be possible forms of collaboration between two different actors involved in a business relationship.

According to Ballantyne and Varey (2006b, 336) relationships (relating) result from interactions that take place between different actors. These may be viewed as structural support in the process of creation and application of knowledge-based resources. However, in order to establish a mutually beneficial relationship that will increase value-creation opportunities, managing the relationship is regarded to be of importance. Collaborative relationships are a rather common form of working in services marketing as well as business-to-business marketing (ibid; Nätti et al. 2014) where there are often high requirements for customisation (Kriegel et al. 2013). Furthermore, some researchers argue that maintaining a good relationship increases customer loyalty (Rauryen & Miller 2007), trust and commitment, as well as customer satisfaction (Gil-Saura, Frasquet-Deltoro & Cervera-Taulet 2009). Thus, co-creation of value supports mutual ongoing learning (Lusch & Vargo 2006) which enables constant evolution of the offered service (Kowalkowski 2011).

As a second form of value-creating interaction, Ballantyne and Varey (2006b) discuss the role of communication (communicating) that is considered a tool for furthering the established business relationship. In addition to relationship development, dialogical interaction between actors increases generation of knowledge (Ballantyne & Varey 2006b, 338–339) which is often treated as a cornerstone of maintaining competitive advantage (Aarikka-Stenroos & Jaakkola 2012; Nordin & Kowalkowski 2010). Furthermore, dialogue between the actors is viewed as an essential basis for innovations and other kind of market creativity as dialogue is argued to hold the promise of novel ideas (Ballantyne & Varey 2006b, 339). The role of communication is emphasised in service recovery situations as it
may, for instance, reduce perceived risk on the customer’s side (Nätti et al. 2014, 979).

Last, it is argued by Ballantyne and Varey (2006b, 335, 340) that value-in-use may be improved through increasing knowledge (*knowing*) in how the customer experiences the service offered by the service provider. More precisely, knowledge may be defined as a form of resource (Vargo & Lusch 2004, 9). Although, knowledge may be considered a cornerstone of competitive advantage (ibid.), it is to be remembered that it expires in a relatively fast pace. This phenomenon is rather common in fields where the external business environment changes rapidly. (Storbacka & Lehtinen 2001.) This has led to an increasing need for knowledge renewal (Ballantyne & Varey 2006b, 340).

### 2.2 Elements of Customer Value

In business-to-business context, possible benefits of value gained from using a certain offering may contain both *monetary* and *non-monetary* elements (Möller & Törrönen 2002, 110). According to monetary perception, value is considered a trade-off between the customer’s evaluation of benefits gained and sacrifices made. It is, however, to be acknowledged that purchase decisions are rarely made solely based on price but also on *customer value* that implies purchase decisions are made if the benefits gained from a certain offering exceed the costs. (Leszinski & Marn 1997, 100.) This understanding is further supported by Ulaga and Eggert (2006, 119) who argue that the price no longer is regarded to be the only thing creating value to a business customer.

de Chernatony et al. (2000) adopt a wider view where the non-monetary dimension of value is acknowledged. According to their findings, other scholars argue sacrifices are not only monetary but instead they may also appear in the form of *time* or *effort* spent by the user. Additionally, Lapierre (1997) argues provider qualities such as responsiveness, *reliability, flexibility*, and *communication skills* may add value to the customer. For example, within the context of logistics and healthcare industry,
outsourcing logistical activities, such as mail delivery in the hospital to a logistics service provider instead of having the nurses deliver the mail, may be considered valuable as this arrangement allows more efficient use of time (Landry & Philippe 2004, 28).

According to more recent findings made in the context of knowledge intensive business services, value is argued to result from benefits gained through use. In this context, value is experienced in the form of direct monetary benefits, such as decreased costs or increased revenues, indirect monetary benefits that are considered to be benefits gained through usability of the implemented solution, reliability and comparability with future solutions, and non-monetary benefits that may increase “decision making aplomb” as well as sense of relief due to expert support (Aarikka-Stenroos & Jaakkola 2012, 22.) Within the context of this study on value creation opportunities between a logistics service provider and the public healthcare customer, the elements of value discussed above may be considered applicable as logistics service providers are knowledge intensive in nature in that they are formed to solve problems that require external assistance (Miles 2005, 39–40). Thus, the researcher supports the abovementioned three-dimensional understanding of value, meaning value consists of direct, indirect monetary as well as non-monetary elements.

2.3 Customer Experience of Value

In this research, customer experience of value is approached through consumer and business research. This decision is based on an argument suggesting the customer organisation is an entity where the individuals have both organisational and individual goals impacting their experiences

Experience of value is defined in accordance with Gupta and Vajic (1999) who in the context of consumer marketing state that service experience can be any form of sensation or knowledge acquisition followed by interaction between the customer and the service provider. A service experience may be either positive or negative.
Experiences are built upon one’s expectations which means one’s previous experiences, competitive offerings as well as one’s current situation have an impact on his/her expectations (Meyer & Schwager 2007, 3). Furthermore, experiences may be divided into emotional and technical dimensions (Berry, Carbone & Haecker 2002).

According to Bitner (1992) the way the customer experiences different activities is closely related to one’s perception of value. In the field of consumer marketing, Prahalad and Ramaswamy (2004a, 137) have acknowledged that value is centred in the customer experience. This is in line with the previously discussed concept of service-dominant logic that considers value to be experienced through use (Sandström et al. 2008, 112; Vargo & Lusch 2004).

In the context of business-to-business services, experiences are connected to the value-chain thinking. More precisely, it is argued that a business customer’s experience is related to improvement in the customer organisation’s ability to serve its own customers after being served by a particular service provider. Thus an experience in business markets is often considered from the functional improvement and monetary sacrifice point-of-view. Additionally, as opposed to consumer experiences the following impression applies in a business environment: ”In a B2B context, a good experience is not a thrilling one but one that is trouble-free and hence reassuring to those in charge.” (Meyer & Schwager 2007, 3.)

In this study, value is regarded to emerge through co-creation activities. The experience develops during the value creation process (Grönroos & Voima 2013), and is shaped by heterogeneous interactions that take place during the collaborative phase (Prahalad & Ramaswamy 2004b). Thus, service experiences may vary between different customers (Sandström et al. 2008, 115). This, on the other hand, impinges one’s ability to conceive elements relevant to customer experience.

According to principals of service-dominant logic, the role of the service provider is to develop a value proposition the value of which is determined by the customer
through a value-in-use experience (Vargo & Lusch 2004). However, due to the interactive nature of this particular logic, the value proposition is always different. As a result, the customer experience is also different. Based on these factors, defining the elements of a service experience may be considered relatively challenging (Sandström et al. 2008, 117).
3 RESOURCES IN VALUE CO-CREATION

In this section, resources possessed by the actors engaged in a dyadic business relationship will be discussed. The following discussion draws mainly from theories introduced by Vargo and Lusch (2004; 2014) and Aarikka-Stenroos and Jaakkola (2012). The discussion will more precisely concentrate on resources from the service dominant logic point-of-view as well as value creation in the context of knowledge intensive business perspective similarly to e.g. Nätti et al. (2014).

3.1 Co-Creation of Value and Resource Sharing in Business-to-Business Services

Organisations may be regarded as unique resource entities (Håkansson & Snehota 1995, 134). Resources, possessed by actors engaged in a business relationship, form the foundation for services according to the service-dominant logic. Services according to Vargo and Lusch (2008) consist of resources that are activated for the benefit of another actor. On a similar note, it is argued by Yazdanparast et al. (2010, 386) that co-creation of value in the context of logistics is based on organisational learning enabled by sharing of knowledge that may further be regarded as a central resource for value creation in organisations (Rollins, Pekkarinen & Mehtälä 2011, 957). Organisational learning, on the other hand, refers to different actors’ abilities to both “integrate and utilise pieces of knowledge” (Yazdanparast et al. 2010, 386).

Thus, in order to achieve competitive advantage, it is of importance for the logistics service provider to learn from its customers (ibid.).

Considering resources further, it is stated by Lusch and Vargo (2014, 57, 120) that resources may be defined as anything that a specific actor may draw on for support for value creation purposes. They further argue that there was no preceding set of resources until man exercised his agency by learning how to utilise potential tangible or intangible resources by first acting to co-create them. Having co-created the resources, one may use them to forward viability of an existing system as well as the whole human condition. To sum, resources do not exist unless they can be drawn on one’s support. (Lusch & Vargo 2014, 120–121.)
What comes to the service-dominant logic and its relation to resources, it is argued by Vargo and Lusch (2004) that resources may appear in operant and operand forms. As stated previously in the theoretical discussion on value, operand resources, such as physical goods, are ones that do not create value unless they are acted upon. According to Vargo and Lusch (2004, 2; Lusch & Vargo 2014, 57) operant resources, such as know-how are considered to form the foundation for competitive advantage. Moreover, it is stated by Arnould (2008, 21) that the reason for why operant resources may generate sustainable competitive advantage is because they may be valuable, rare, difficult to imitate by competitors, and difficult to substitute by other similar offerings available in the marketplace.

Furthermore, operant resources are employed in order to activate value embedded in operand resources, i.e. tangible goods. Thus, one may argue that operand and operant resources are often interlinked. In addition, the use of operant resources to act on operand resources is what benefits individuals by creating value for them. (Lusch & Vargo 2014, 57.) To exemplify the previous statement in the context of the healthcare industry, operand resources may consist of various different medical instruments whereas the medical professional using his/her know-how and expertise to use these instruments to operate a patient may be regarded as a form of operant resource.

The service-dominant logic also implies that in the process of co-creating value the roles of the participating actors, are not distinct. In other words, the logic implies value is always co-created jointly and reciprocally through interaction between the actors involved in the value-creation process. Furthermore, the service-dominant logic acknowledges integration of resources as well as application of respective knowledge to be of great importance considering co-creation of value. (Vargo et al. 2008, 146.) In fact, it is the integration of the unique set of resources that both motivates and constitutes transactions (Lusch & Vargo 2006, 284). Although the concept of service-dominant logic may be considered a relatively significant contribution to existing marketing literature (Gummesson 2008, 15) it has received
criticism for the rather theoretical and non-specific approach to the integrated resource discussion (Aarikka-Stenroos & Jaakkola 2012; Lusch & Vargo 2006, 284).

The Service-dominant logic is founded on services science and the study of value creation in service systems. They further state that the previously mentioned areas of academic marketing research consider that the main function of co-creation of value is to make progress and to innovate through interaction and cooperation. As a conclusion, one may argue the main purpose behind co-creation of value being improvement of the existing processes. (Maglio & Spohrer 2008, 18–19.) This view is further supported by Lusch and Vargo (2014, 121) who acknowledge that development of new resources would not be possible without co-creation of value.

Considering resources and co-creation in a more concrete manner, resources activated in the service provider organisation may take the form of knowledge application, certain skills and capabilities to produce a tangible good. However, according to the principles of service-dominant logic, the manufactured good itself does not have any value if the customer does not possess enough knowledge and/or a certain set of skills to be able to use the good for its own purposes. In other words, the customer may activate value through applying its own skills and knowledge to provide a service that will, in turn, benefit the customer in its own value creating activities. That said value is co-created through a reciprocal and mutually beneficial relationship. (Vargo et al. 2008, 146.) In sum, value results from the interactive process of activating and integrating resources possessed by both participating actors, namely the service provider and the customer.

3.2 Resources in Dyadic Business Relationships

In an organisational context, resources possessed by different firms have previously been considered either heterogeneous or homogenous in nature. Heterogeneous resources and internal capabilities form the basis for competitive advantage which, in turn, enables rivalry organisations to compete with one another. Furthermore, organisations possessing heterogeneous resources are argued to have the ability to be
efficient as well to create value to the customer through economies of scale or a superior service or good. However, it is to be noted that heterogeneous resources are not an endless source of competitive advantage as in order to maintain competitiveness, the service provider is required to be able to separate itself from rivalries with a distinctive set of resources. (Peteraf 1993, 179–180, 182.) This may be interpreted as a need for constant development of operant resources. Homogenous resources, on the other hand, are defined as a set of resources that may be activated to create value however, they are not acknowledged as potential sources for competitive advantage. (Håkansson & Snehota 1995, 135).

Considering organisational resources, it is argued by Aarikka-Stenroos and Jaakkola (2012; Miozzo & Grimshaw 2005, 1420) that value creation, and furthermore, value-in-use requires dyadic collaboration as well as resource activation enabled through activities carried out by the service provider and the customer. Especially, in the business-to-business context, specialisation, knowledge intensiveness and complexity of technology utilised grow in a rapid manner (Möller 2006). The ever-evolving complexity of the surrounding environment may have led to an increasing knowledge and resource dependency between the service provider and the customer. (Nordin & Kowalkowski 2010). In fact, it is argued by Möller and Törrönen (2003) that the complexity of exchange increases the dependency between the service provider and the customer. Complex exchanges are relatively common in many fields of business in the occurrence of which value creation may take place through a joint problem solving process (Lindgreen, Antioco & Palmer 2009) where both engaged actors combine their resources to create value-in-use (Aarikka-Stenroos & Jaakkola 2012).

As stated previously in this chapter, the service-dominant logic has received criticism for being too theoretical and vague (Aarikka-Stenroos & Jaakkola 2012, 15–16). On a similar note, one may also question whether the categorisation of resources possessed by different actors to operand and operant ones is too broad. Thus, in addition to the previously mentioned rough grouping of existing resources, this study further draws on Aarikka-Stenroos and Jaakkola’s (2012) study with more specific
comprehension of possible resources available in the service provider and customer organisations.

Aarikka-Stenroos and Jaakkola (2012) present a set of resources possessed by actors involved in a dyadic business relationship. Furthermore, it is proven by the researchers that, in the context of knowledge intensive business relationships, resources are shared among the engaged actors. These firms are described as enterprises that add value by creating or utilising knowledge to create a customised service (Zhou & Lin 2014, 868). Thus, the customer has the opportunity to participate to the formulation of the value proposition through contribution of its own resources. (Aarikka-Stenroos & Jaakkola 2012, 23) This observation is further supported by the field of service science that suggests that co-creation of value is supported by combination of different integrated resources (Maglio & Spohrer 2008).

In their study, Aarikka-Stenroos and Jaakkola (2012) propose a framework to describe a joint problem-solving process aiming towards an optimal value-in-use experience. In their research, the authors emphasise the role of supplier and customer resources shared mostly through interaction to solve a particular problem. The content of the abovementioned categories will be discussed in more detail in the following three sections.

3.2.1 Customer Resources

Aarikka-Stenroos and Jaakkola (2012) consider not only supplier but also customer resources and identify six different forms of resources which will be discussed shortly in this section. This study further acknowledges and discusses information on customer experience as a resource (Grönroos & Voima 2013).

The first potential form of resource customer organisation, Aarikka-Stenroos and Jaakkola (2012) discuss *information on needs*. Understanding the customer needs is emphasised due to its importance to the whole value co-creation process which begins by identifying the customer needs. It is furthermore remarked by Sawhney
(2006) that the customer’s ability to define its objectives with regards to the co-creation process may be regarded a resource itself. The customer may have individual, relational and collective goals (Epp & Price 2011).

Additionally the customer organisation is further able to create value through sharing information on context. This implies that the customer has a deep understanding of its operational environment. Thus, the customer is able to participate the value co-creation process by functioning as an expert acknowledging the complexities of its own business environment. Furthermore, the customer may share its perception of previously implemented solutions. (Aarikka-Stenroos & Jaakkola 2012, 22.) In the context of logistics research, it is argued by Yazdanparast et al. (2010, 381) that developing a deep understanding of divergent competitive and environmental factors faced by the customer organisation is of crucial importance.

The customer is further able to facilitate the process of value co-creation by sharing its industry expertise. More specifically, the customer may be considered to have special knowledge related to the industry it is active in. Furthermore, the customer may be more aware of other factors such as conventions and regulations applied in its field. (Aarikka-Stenroos & Jaakkola 2012, 22.)

Production material may also be regarded to be a form of resource. To specify, this category includes information on existing solutions together with other additional materials (Aarikka-Stenroos & Jaakkola 2012, 22). For instance, a healthcare customer may be able to share information on the current logistics arrangements and their suitability to the hospital environment.

In addition to knowledge-related resources the customer effort and time are also discussed and acknowledged to have a role in the co-creation of value process. (de Chernatony et al. 2000). It is argued by Prahalad and Ramaswamy (2004a, 6) that the value co-creation process may be relatively time-consuming, for instance. More precisely, the authors point out that entering into an in-depth dialogue with the customer, may require significant investments with regards to time-related resources.
This applies also to the customer. For instance, customer time and effort is required especially in the early stages of the value co-creation process where the customer is expected to participate in the need diagnosis as well as solution related discussions. Additionally, the customer utilises its time and effort related resources when learning to use a particular service or good for its own purposes (Vargo & Lusch 2004).

As a final form of resource possessed by the customer organisation, Aarikka-Stenroos and Jaakkola (2012) discuss financial resources. Utilisation of financial resources may be considered a sacrifice the customer must activate in order to be able to gain access to value-in-use through a particular service. In Finland, the public healthcare sector is funded by the government and thus the use of financial resources is steered by the Public Procurement Act (Ministry for Foreign Affairs in Finland 2003).

Drawing on service experience literature, information on customer requirements and experiences may be regarded as an important resource in order to create a satisfying service experience (Patrício, Fisk & Cunha, 2008). In the context of logistics, it has been noticed that “[m]any service offerings are above the expectations of the customers” (Lin et al. 2014, 6). Thus, by gaining an understanding on the exact customer needs through interaction, the service provider may also develop its own services (ibid.).

3.2.2 Supplier Resources

Aarikka-Stenroos and Jaakkola (2012, 17) state that co-creation of value is a process consisting of collaboration and integration of resources possessed by actors engaged in a dyadic relationship. Considering potential useful resources present in the service provider organisation, the researchers are able to distinguish and divide them into six different categories. These will be discussed next in this section.
The first resource possessed by the service provider is expert knowledge that may be considered especially helpful in co-design and co-production processes (Aarikka-Stenroos & Jaakkola 2012, 21). In a company providing logistics services the expert knowledge may, for instance, be related to managing and integrating certain value chains. It is pointed out by Vargo and Lusch (2004) that knowledge may be considered a source for competitive advantage. According to Liu (2006) the service provider’s professional knowledge and competences both contribute to the value-creation process.

According to Lapierre (1997) the customer organisation may not always be able to express or understand its own needs. This may, in turn, make the customer relatively dependent on the service provider’s ability to interpret and diagnose the problem present at the customer organisation. Thus, the provider needs to utilise its own expertise and diagnosing skills in order to resolve the unsolved problem. (Tuli, Kohli & Bharadwaj 2007.)

In addition to operant resources, the service provider may create value to the customer by concretely offering its facilities and professional equipment (Olaru, Purchase & Peterson 2008, 559). To exemplify, a logistics service provider may utilise its warehouses and production lines to store physical goods and sort them. However, as stated by Vargo and Lusch (2004) operand resources, such as warehouses, create value only if operant resources, such as knowledge is applied.

The service provider’s experience may also be one form of resource. To clarify, the customer may feel that service provider’s experience alongside with its expertise allow the actor to predict and potential consequences resulting from making a certain decision. Furthermore, provider’s experience may have the potential to facilitate value-in-use (Aarikka-Stenroos & Jaakkola 2012, 21.) when the customer is able to improve its own value creation processes through external knowledge (Thong 2001, 145).
Objectivity and integrity may also be considered a potential resource possessed by the supplier organisation (Aarikka-Stenroos & Jaakkola 2012). It is stated by Mills and Moshavi (1999) that the service provider’s judgement should be based on the assumptions of objectivity and professional ethics. This, on the other hand, in some occasions means that the customer may not get the solution it would otherwise have preferred.

As the final form of service provider resource, Aarikka-Stenroos and Jaakkola (2012; Ballantyne & Varey 2006b) discuss relational capital that relates to the service provider’s ability to understand the customer. Relational capital may be activated through interactivity between the actors engaged in the value co-creation process. According to Payne, Storbacka and Frow (2007) service provider’s ability to provide meaningful interactions and encounters is relatively important with regards to the customer’s value perception as (Grönroos 2011) this may have an impact on customer trust and commitment, for instance.

3.2.3 Value Co-Creation Process

According to Aarikka-Stenroos and Jaakkola (2012) there are four phases in the process of co-creating value in knowledge intensive business services. These are problem identification, solution, implementation, and value-in-use. On a similar note, in the context of logistics research three divergent phases namely, learning phase, innovation and execution, and outcomes phase have been identified (Yazdanparast et al. 2010, 386).

Aarikka-Stenroos and Jaakkola (see 2012, 17) state the process of problem solving begins with the identification of customer needs. More precisely, the problem identification (In this study Identifying Challenges) phase aims to clarify what may be considered to be the content of exchange alongside with the overall goal of the actual exchange. Identifying challenges may be a complex process as the customer is not always able to communicate its needs to the service provider (Lapierre 1997). This, on the other hand, makes the customer dependent on the service provider (Tuli
et al. 2007) as the responsibility of defining the problem shifts to the supplying actor. Similar to the problem identification phase, Yazdanparast et al. (2010, 387) propose a learning phase the purpose of which is to obtain novel knowledge from different actors.

Having identified the problem, the supplier is expected to provide a solution. A solution is regarded a bundle of products and services combined to meet the customer needs. Additionally, an extended view to solutions considers solutions to be “heterogeneous, intangible problem solving processes” (Hakanen & Jaakkola 2012, 594.)

In industrial contexts, resources possessed by the customer are crucial considering the solution. In this phase of the problem solving process, the customer role is significant as the customer may be considered a specialist in its own field and thus, it has a deep understanding of its area of specialisation including technological information, market insight and project objectives (Bettencourt, Ostrom, Brown & Roundtree 2000). Similarly to the solution phase (Aarikka-Stenroos & Jaakkola, 2012) Yazdanparast et al. (2010) present a phase combining innovation and execution. The main objective of this phase of the value-creation process is to apply knowledge obtained from the learning phase to develop an innovation that may be implemented together with the customer.

Sometimes the unsolved problems may appear ill-structured and contain elements that are unknown. In these situations, an appropriate degree of judgement is required for resolution. (Nordin & Kowalkowski 2010.) The complexity of exchange present in problem solving may appear relatively challenging with regards to co-creation of value, as the service provider may face difficulties communicating the value proposition to the customer in order to manage the service process and achieve the best possible outcome. The customer, on the other hand, might find it challenging to understand the proposal and evaluate its value potential. (Aarikka-Stenroos & Jaakkola 2012, 17.)
As a result, the quality of interaction is often heavily emphasised by the customer. Researchers have identified that qualities such as responsiveness, flexibility, reliability and communication skills on the service provider’s side may be regarded a source of value in the customer organisation (Lapierre 1997) as the customer may feel insecure whilst purchasing professional services. The uncertainty results from the customer’s limited ability to assess the value of the offered service. (Aarikka-Stenroos & Jaakkola 2012, 17.) Referring back to the discussion on value in the previous chapter, it is argued by Ballantyne and Varey (2006b) that value-in-use results from interaction that may appear in the form of knowing, relating and communicating.

After the service provider and the customer have resolved the problem, the plan needs to be implemented (In this study, Modular Service Delivery). During the service delivery the customer is able to evaluate the service through value-in-use as the customer uses the provided services in its own processes to create value (Grönroos & Voima 2013). Thus, the service delivery and value-in-use phases exist in parallel. According to Grönroos (2011) value-in-use experienced by the customer may, in the business-to-business context, be related to, for instance increase in growth and revenue, effects on customer costs, such as lower costs, higher margins, and effects on perceptions examples of which may be increase in trust, commitment, interaction, comfort, or attraction. However, customer’s ability to create value-in-use is dependent on the service provider’s ability to keep the schedule, for example.

In comparison with the value-creation process described in Aarikka-Stenroos and Jaakkola (2012) Yazdanparast et al. (2010) refer to value-in-use as the outcomes phase the purpose of which is to collect information on services innovations from the marketplace in order to further develop the services.
Table 1. Value Co-Creation Process and Supplier and Customer Resources

<table>
<thead>
<tr>
<th>Customer Resources</th>
<th>Value Co-Creation Process</th>
<th>Supplier Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information on Needs</td>
<td><em>Diagnosing Challenges</em></td>
<td>Expert Knowledge</td>
</tr>
<tr>
<td>Information on Context</td>
<td><em>Solution</em></td>
<td>Diagnosing Skills</td>
</tr>
<tr>
<td>Industry Expertise</td>
<td><em>Modular Service Delivery</em></td>
<td>Facilities and Professional Equipment</td>
</tr>
<tr>
<td>Production Material</td>
<td><em>Value-in-Use</em></td>
<td>Experience</td>
</tr>
<tr>
<td>Effort and Time</td>
<td></td>
<td>Objectivity and Integrity, Ethical Codes</td>
</tr>
<tr>
<td>Financial Resources</td>
<td></td>
<td>Relational Capital</td>
</tr>
<tr>
<td>Experiences</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Although there are similarities between the value creation processes models presented by Aarikka-Stenroos and Jaakkola (2012) and Yazdanparast et al. (2010), it is argued by Yazdanparast et al. (2010) that the Outcome phase further leads to learning phase. Thus, the process of value co-creation may be regarded an iterative process.
4 SERVICE MODULARITY IN BUSINESS-TO-BUSINESS VALUE CREATION

In this section, the concept of modularity will be first defined and then discussed in more detail. Although the notion of modularity is relatively widely spread among both product and services fields, it is currently lacking a unified definition. Due to the existing fragmentation, the author first aims to define modularity in the context of this research conducted in the context of healthcare and logistics after which the discussion will return to a more generalised level on modularity and service modularity.

4.1 Modularity – A Definition

In this study, modularity of services is regarded and viewed as a means for creating value to the customer mainly through improvements in efficiency (Pekkarinen & Ulkuniemi 2008). As the purpose of this study is to develop a process based framework to explore opportunities for value-in-use achieved through modularity, a detailed discussion on what dimensions modular service design consist of is needed.

Research in service modularity is currently in its infancy (Rahikka, Ulkuniemi & Pekkarinen 2011) also in the field of healthcare (de Blok et al. 2010). Interestingly, despite the wide applicability in practice there have so far been only a few formal attempts to define the concept of modularity (Kusiak 2002, 225). However, curiosity towards applicability of modularity to services has begun to grow among researchers (de Blok et al. 2010, 76, 79.)

According to Voss and Hsuan (2009, 543) modularity can be defined as follows:

“Modularity refers to the scheme by which interfaces shared among components in a given product architecture are standardized and specified to allow for greater reusability and commonality (or sharing) of components among product families.”
Furthermore, modularity may be regarded as “the degree to which a system’s components can be separated and recombined” (Schilling 2000, 315). With regards to modularity of tangibles, it is discussed by Schilling (2000, 312) that modules be a general systems concept and a continuum describing to which degree certain systems components may be separated and recombined.

Modularity is a commonly employed logic especially in product design (Mikkola 2006). In fact, over the time, modularity has become one of the most commonly adopted strategies used provide and manage product variety (Salvador 2007; Campagnolo & Camuffo 2009). Although previously modularity has been related to tangibles i.e. manufactured goods, the logic is now commonly employed in the services business as well (Lin & Pekkarinen 2011, 345; Rahikka et al., 2011). In fact, according to Meyer, Jekowsky and Crane (2007, 25) modularity is currently a relatively common form of service design in, for instance, educational and financial industries, and logistics services (Lin & Pekkarinen 2011; Lin et al. 2015).

Modular services are in accordance with Ulkuniemi and Pekkarinen (2011, 131) viewed to be a group of tasks that are highly interdependent on each other yet loosely dependent on other modules. Thus, modular services are packages or bundles of modular units that can be combined in different ways to satisfy customer needs (Ulkuniemi & Pekkarinen 2011, 128; Rahikka et al. 2011, 357; Zhou & Lin 2014, 869). In the context of healthcare, modularity of logistics could create value to the customer through efficiency achieved through flexibility or service quality (Kriegel 2013, 47).

From the logistics service provider perspective, offering services with high customer relevancy, such as tailored bundled solutions, may increase customer ability to succeed in its environment as well as service provider’s competitive advantage (Yazdanparast et al. 2010, 382). Furthermore, modular service design increases the service provider’s competitive advantage as adoption of modularity increases its ability to respond to changes in the competitive environment (Sanchez & Mahoney 1996, 63.)
Superior value is of importance in intensively competitive and dynamic markets. Several service providers engaged in business-to-business activities are required to develop a service offering enabling both flexibility and tailor-made solutions to the customers. In other words, service providers are challenged by having to offer services designed to fit the needs of an individual customer and, furthermore, they are expected to achieve competitive prices through efficiency that is, in respect, achieved through standardisation of processes. (Rahikka et al. 2011, 357.)

According to Ulkuniemi and Pekkarinen (2011) these objectives may be reached by adopting the logic of service modularity. Economies of scale reached through the means of modularity may result from lower production and delivery costs resulting from higher volume of combined parts used in delivering several divergent services. To illuminate, costs may be decreased in the context of logistics by, for instance, using the same vehicle to transport several different types of goods. (Pekkarinen & Ulkuniemi 2008, 89.)

Service modularity may further be considered one’s attempt to develop a service offering that enables flexibility of tailoring as well as production efficiency achieved through standardisation (Rahikka et al. 2011, 357; Pekkarinen & Ulkuniemi 2008, 85). Modular services may be broken down to components that represent the smallest service building blocks. The components may further be classified as standard or unique components. (Zhou & Lin 2014, 869.)

Service modularity allows the service provider to function in a standardised manner while the customer experiences the services offered as customised (Ojasalo & Ojasalo 2008, 46). In the healthcare context, modular logistics services may, for instance, improve patient flow efficiency when resources needed to treat a patient are combined in the most efficient manner (Modig & Åhlström 2012). In addition to efficiency and flexibility, service modularity may create value to the customer by making the intangible service offering more visible (Ulkuniemi & Pekkarinen 2011; Baldwin 2007).
The modular system is superior when both demand and supply are heterogeneous. Respectively, if the input is heterogeneous and the demand is homogeneous, the non-modular design is more cost efficient. (Pekkarinen & Ulkuniemi 2008, 86.) According to Grönroos and Ojasalo (2000; Rahikka et al. 2011, 357) internal efficiency cannot be managed without acknowledging its dependency on customer perceived value. As a consequence, it is of importance for the service provider to gain an extensive understanding of how the customer evaluates a particular service, and how the different elements of value impact its value perception in the service delivery situation (Ulaga 2003; Ulaga & Eggert 2006). This may be challenging in those services sectors where the customer-base or the customer needs are sometimes heterogeneous in nature. The diverging customer needs, on the other hand, call for tailoring of services to match the needs of each individual customer. (Rahikka, Ulkuniemi & Pekkarinen 2011, 357.) However, the challenge posed by heterogeneous needs may be addressed with customer participation (Bask 2001, 477) and communication (Voss & Mikkola 2007, 7).

A critically important requirement in developing modular products or, in this case, services is that there be connectable interfaces between different modules (Figure 2, p. 39) (Lin et al. 2015). The shared interfaces may be a common rule or a set of narrowly defined goals that built up a solid ground on top of which different modules can be developed. (Nonaka & Teece 2001, 159.) More precisely, interfaces may appear in the form of information and material flow, people and process standards (de Blok, Meijboom, Luijkx & Schols 2007; Stefansson & Russell 2008). These commonly shared interfaces facilitate development of individual modules which, in turn, increases flexibility as well as enables module-specific innovativeness (Nonaka & Teece 2001, 159; Miozzo & Grimshaw 2005, 1421).
Referring back to successful employment of modularity, it is further argued by Ulkuniemi and Pekkarinen (2011, 131) that a modular strategy calls for a seamless service. This, on the other hand, means that the various different elements of a particular service must be organised and managed in a way that enables interaction between service modules as well as between the service provider and the customer. Smoothness of interaction is considered to be important in order for the service to appear to the customer as a whole instead of separate modules. (Ulkuniemi & Pekkarinen 2011, 131.)

### 4.2 Dimensions of Modular Service Design

Service modularity is in this research is argued to consist of three divergent elements that are *process modularity*, *organisation modularity* and *modularity in services*. This perception of modularity is largely built upon Pekkarinen and Ulkuniemi (2008) who acknowledge service modularity to offer “a fruitful approach to service development” (Pekkarinen & Ulkuniemi 2008, 85).

Modular services consist of both visible elements perceptible to the customer and invisible, i.e. intra-organisational elements (Pekkarinen & Ulkuniemi 2008). The visible element is of relevance to modularity in services. The invisible elements, on the other hand, consist of both modular organisations and processes. All the elements are built upon the service provider’s knowledge and the existing technology (Rahikka 2009, 26). The modules may be combined in a flexible manner in response to each customer’s needs (de Blok et al. 2007). For instance, in the context of
healthcare, application of modularity in logistics could address challenges related to availability of necessary resources at the point of care (Kriegel 2013, 48).

4.2.1 Modularity in Services

A modular service purchased by the customer may consist of one or more service modules which may, in turn, consist of service (or product) and process elements, or a combination of both. The parallel existence of the aforementioned functional elements is regarded to form service characteristics. (de Blok 2010, 80.) To clarify the concept of elements, modularity in services is argued to consist of an individual unit regarded as a service equivalent to a product component previously discussed. A concrete example of a service module in the logistics context may, for instance be warehousing. Respectively, the space needed to produce a particular service may be considered a service element. (Pekkarinen & Ulkuniemi 2008, 87.)

According to Pekkarinen and Ulkuniemi (2008, 88) the service module is the only element in the modular system visible to the customer. Thus, service modules may be considered especially important from the value creation and customer experience point-of-view as it is argued by Grönroos (2000, 48) that the visible part of the service process matters the most in the customer’s mind. He further supports his argument by stating that the evaluation of services processes may only be based on one’s evaluation of the service result.

In consumer research, Prahalad and Ramaswamy (2004c, 10) argue that the visible part of the service process may in some occasions allow the customer to engage itself to personalised co-creation services in which the service provider provides the circumstances and the customer can choose interaction modes that suit its needs in the best possible manner. Considering modularity from this point-of-view, the logic in question may create value to the customer through an improved customer service experience by enabling an array of alternatives in service delivery as well as a more specified definition of the service offering. (Rahikka 2009, 21.) In order to understand the customer needs to begin with, the content of the service offering
needs to be in line and discussed with the customer’s needs. The individual customer may be regarded a customer module. (Pekkarinen & Ulkuniemi 2008.)

To consider modular services in-depth, a more practical approach is introduced by de Blok et al. (2007; 2010, 81). The authors present the structure of modular services in the context of elderly care services in the form of a three-level model consisting of a general level, a segment level and an individual level. The general level contains modules consisting of standardised processes common to producing services offered by an organisation. The segment level, on the other hand, is regarded as a customised level made up of processes and products chosen by the customer. The third and highest level is one allowing personalisation in the form of individualisation of modules or module combinations. (de Blok et al. 2007; 2010, 81.) The aforementioned view is in line with Hölttä-Otto (2005) who suggests that modules of a product or, in the case of this study, service ought to retain unchanged to enable easy recombination, for instance, in the occurrence of changed customer needs or requirements (Pekkarinen & Ulkuniemi 2008, 95).

Similar to findings presented by de Blok et al. (2007) and Hölttä-Otto (2005), Bask (2001) presents three levels of services in the context of logistics that are routine, standard and customised services. Routine services are regarded as services with no specific arrangements whereas standardised services require simple modifications to existing operations. Customised services, on the other hand, call for interaction due to heterogeneous customer needs. (Bask 2001, 475–477.)

4.2.2 Modularity in Processes

It is argued by Pekkarinen and Ulkuniemi (2008, 88) that modular processes are not visible to the customer. Instead, modular processes are often conducted intra-organisationally within the service provider organisation. Zhou and Lin (2014, 870) classify process modules as “satisfiers that are what needs to be done to fulfil the customer’s order.” According to Kusiak (2002, 228) a process may be defined as a group of activities organised to follow one another in a specific order. In addition,
processes require clearly defined inputs and outputs, where the output may take the form of either a product or service.

A service process may also be perceived as a process step characterised by standardisation and inseparability (Pekkarinen & Ulkuniemi 2008, 87–88). On a similar note, Hyötyläinen and Möller (2007, 308–310) argue modularity consists of a set of functions. For instance, in the context of logistics services, an ordering process activates two divergent modules that are sending and receiving of orders. (Pekkarinen & Ulkuniemi 2008, 87).

As stated before, modularity enables the service provider to combine different service modules with relatively little effort through shared interfaces. Referring back to the practical example of ordering process, a shared interface in this context may, for instance, be contact with a customer representative or placing and receiving the order through the internet (Voss & Mikkola 2007, 6).

4.2.3 Modularity in Organisation

Alike with modular processes, organisational modularity is not visible to the customer. Instead, the aforementioned dimension is regarded as a means to create a modular service making it intra-organisational in nature. Furthermore, modularity in organisations is seen as a way to utilise the services provider’s own resources and combine those with the ones possessed by other firms. This is regarded as a way to increase flexibility. (Pekkarinen & Ulkuniemi 2008, 88.)

In this study, a modular organisation is perceived to be a composition of individual organisation modules. These, on a similar note to service modularity in accordance with Hyötyläinen and Möller (2007), exist on a functional level and can, as a result, be defined as functional units. Thus, modularity may, for instance, cover functional business units, such as manufacturing or marketing. In addition to internal modularity, a wider view to this service design may further be extended to include various diverging service provider network configurations. For instance, outsourcing,
alliances and leased staff may be considered to facilitate organisational modularity. The main benefit of utilising external network is to decrease time used to develop new services and increase cost efficiency. (Pekkarinen & Ulkuniemi 2008, 88, 99.)
5 CO-CREATING VALUE THROUGH SERVICE MODULARITY

Based on the literature review conducted in chapters 2–4, a framework describing the value creation process taking place between a healthcare customer and a logistics service provider is proposed.

The framework describes a value co-creation process which may be divided into four phases identifying challenges, solution, modular service delivery and value-in-use. Alike with extant frameworks presented by Aarikka-Stenroos & Jaakkola (2012), and Yazdanparast et al. (2010) the framework created for the purposes of this study aims to describe “a developmental step-by-step process” for co-creation of value (Yazdanparast et al. 2010, 395) with emphasis on customer value-in-use (Grönroos & Voima 2013; MacDonald et al. 2011).

The actors involved in the value co-creation process are an operational-level representative from the healthcare customer organisation and a strategic-level actor from the logistics service provider company. The framework (Figure 3, p. 45) suggests, both actors engaged in the co-creation process possess a certain set of resources, such as industry expertise and expert knowledge (Aarikka-Stenroos & Jaakkola 2012). These resources are shared through interaction between the customer and service provider throughout the value creation process to create customer value-in-use (Lusch & Vargo 2014; Grönroos 2007), however all of the proposed resources are not expected to be shared in each of the four stages. Instead, they may vary.

In this study, co-creation of value is explored through the means of service modularity. As a result of this, the researcher only acknowledges resources related to the design and delivery of modular services in the service delivery phase. A modular service design consists of modularity in services, processes and organisation (Pekkarinen & Ulkuniemi 2008). This may, in turn create novel resources for the context of the current study conducted in the context of healthcare and logistics.
The fourth stage of the value co-creation process focuses on *customer value-in-use achieved through the modular service delivery*. The value is categorised in accordance with Aarikka-Stenroos and Jaakkola (2012) who identify value consisting of direct and indirect monetary benefits as well as non-monetary benefits.

**Figure 3. Co-Creation of Value through Modularity.**

The framework presented above may be regarded an iterative process model as the existing literature (Yazdanparast et al. 2010) suggests more value creation opportunities may be discovered by utilising current information on customer value-in-use and other customer resources to address and discover new needs in the customer organisation. As the interest of this study lies in customer value-in-use achieved by means of modular logistics services, value experienced by the service provider will not be included.
6 RESEARCH DESIGN

In this chapter, the applied research method as well as the empirical data gathering and analysing are described in a detailed manner. Furthermore, the aim of this chapter is to present arguments to support the selected form of research methodology in order to assure that the theoretical, as well as the empirical evidence are consistent with regards to the research phenomenon.

6.1 Research Methodology

Scientific research paradigms are regarded as generic conceptual frameworks containing certain types of assumptions of the surrounding environment (Healy & Perry 2000). According to Healy and Perry (2000) the qualitative research exists in the form of three diverging paradigms that are constructivism, realism and critical theory each of which respectively consists of three elements that are ontology, epistemology and methodology. In brief, ontology is considered to be the reality within which research is conducted, epistemology describes the researcher’s relation to reality, and, finally, methodology is regarded to be the technique through which the researcher approaches the research phenomenon in the existing reality. The research paradigm applied in the present study is constructivism that assumes the truth being context dependant. Furthermore, reality is regarded to consist of several divergent realities existing in individuals’ minds. Due to the aforementioned complexities, the role of interactions between the interviewer and the respondent is emphasised making the researcher an “a passionate participant”. It is the role of the researcher that further creates subjective results. (Healy & Perry 2000, 118–120.; see Myers 2009, 5)

The objective of this study is to examine potential value co-creation opportunities between a logistics service provider and a public healthcare customer enabled by modularity. However, existing research on service modularity is still in its infancy making the literature relatively scarce (Rahikka et al. 2011) and fragmented. Due to
limited research conducted in service modularity, the research phenomenon is approached through a qualitative method.

According to Trumbull (2005, 102) qualitative research may be regarded as a multi-method in focus. Qualitative research allows the researcher to approach the phenomenon under examination in an interpretative and naturalistic manner. In other words, the discussed form of research is interested in studying things and phenomena in their natural surroundings by focusing on interpreting and making sense of them in terms of the meanings individuals bring to them. Approaching the examined phenomenon by means of qualitative research is regarded especially useful when the existing body of knowledge is considered to be inadequate (Bonoma 1985, 207). A qualitative researcher tackles this problem by creating broad research questions based upon a theoretical framework.

The qualitative research has its shortcomings that impact the reliability of the study conducted. On one hand, it is argued by Myers (2009, 5) that qualitative research allows the researcher to see and understand individuals and their behaviour in their natural surroundings. This, furthermore, provides the researcher with an opportunity to better see and understand the context in which decisions are made and certain behaviour takes place. Understanding the research phenomenon may be regarded as challenging without personal participation and contact. On the other hand, it is the researcher’s participation that may be considered problematic in terms of reliability as she may be able to manipulate the surroundings (Trombull 2005, 102, 107; Healy & Perry 2000, 119).

Due to lack of existing research, this study conducts scientific reasoning through the application of abductive logic which may be regarded as an approach suitable for theoretical development. Abductive logic is considered a process of systematic combining where the researcher advances her understanding of the phenomenon under examination by utilising existing theory and improving current knowledge by adding new concepts derived from reality. In addition to abductive logic there are two other science philosophies, namely, deduction and induction. Deduction suggests
that existing theory be utilised to develop propositions that are to be tested in real world whereas induction relies on grounded theory where theory is built through systematic data extraction. (Dubois & Gadde 2002, 559.) The selection of the use of abductive logic is based on limitations posed by deduction and induction. It is, for instance, argued by Perry (1998, 788–791) that pure induction may prevent utilisation of existing theories and pure deduction, on the other hand, is subject to impeding development of new theories.

6.2 Method of Empirical Enquiry

According to Hirsjärvi, Remes and Sajavaara (2006, 125), there are three traditional research strategies that are experimental, survey and case study. The experimental strategy is often preferred in research where a correlation between two variables is measured. Survey research, on the other hand, may be useful in studies where data is gathered from a focus group to explain a phenomenon. The case study method is preferred when the aim of the research is to gather detailed and intensive knowledge of a certain research phenomenon or a small grouping of interrelated cases. The research method to be chosen is determined by the research problem (Uusitalo 1991, 50).

As the current study aims to find out how a logistics service provider may increase its presence in a university hospital, the method suitable for this research is case study. The decision is further supported by Yin (2009, 8) who argues that a case study method is appropriate when the research question begins with “How”. Additionally, this method is applied in studies where the research is concerned with processes. In this study, value is regarded to be released through value-in-use, and thus the research acknowledges the role of processes. Furthermore, the case study method allows the researcher to choose one case to represent a larger phenomenon, and investigate the case study data and its relation to its surroundings. The case study data are often gathered from multiple sources, such as through observations, interviews and existing documentations. (Hirsjärvi et al. 2006, 126.)
According to Koskinen, Alasuutari and Peltonen (2005, 154) the case study method enables examination of one or more events. One of the main advantages in choosing a case study method is that it allows one to develop a holistic understanding of the research phenomenon. This research is a case study where process of co-creating value through logistics modularity is studied between two organisations, namely the logistics service provider and the public healthcare customer. A thorough single case study may shed attention to some important factors (Hirsjärvi, Remes & Sajavaara, 1997, 182). According to the researcher’s understanding, there hardly exists literature in co-creation of value through modularity and logistics. Thus, approaching the research phenomenon through a single case study may provide novel knowledge about the research problem.

Uusitalo (1991, 80) states that the researcher ought to gather data from a relevant source that embodies certain features central to the research problem. Due to this, selecting the case carefully is of importance. However, as the research problem emerged as a result of practical needs, the case company and its target customer were determined a priori to theory construction. On the other hand, the unit representing the regional public healthcare customer was selected based on its role as the largest annual cost provider in the university hospital.

### 6.3 Data Collection and Analysis Method

The primary data for this study were collected using three different methods to promote triangulation and understanding of the research context. All the interviews were carried in Finnish and more detailed information is in Table 2 (p. 51). In addition to the researcher’s own input during the interviews, a research fellow participated the sessions taking notes and asking possible specifying questions. First, semi-structured interviews with the surgical ward nurses (Appendix 1) and university hospital procurement (Appendix 2) as well as the service provider on strategy and operational levels (Appendices 3–4) were carried. After the first interview with the nurses on the 8th of January 2015 a guided tour lasting approximately 45 minutes was organised on the behalf of the interviewees.
Last, a group discussion was organised to enable and simulate co-creation of value process involving one representative from the logistics service provider organisation and the university hospital. The utilised data gathering methods complimented each other as they all allowed the researcher to be in close contact with the actors present at the service provider company and the customer organisation (Hirsjärvi et al. 2006, 183).

Having conducted the semi-structured interviews, a report on logistical challenges was created and sent to both the service provider and healthcare customer organisation (see Appendix 7). The report highlighting logistical challenges in the healthcare customer organisation was then utilised as source material in the group interview allowing the service provider organisation to identify most central logistical issues present at the customer organisation, and prepare ideas on how to respond to the challenges for the purposes of the group interview. In the beginning of the group interview session, the participants were presented the four stage model to co-creation of value presented by Aarikka-Stenroos and Jaakkola (2012). Although the aim of the group interview was to otherwise allow a free flow of ideas, some supportive questions (see Appendix 5) were presented to the participants in the second stage of the interview session discussed in the section below. Despite of these questions, the role of the researcher was not to participate to the conversation in ways other than ask for specifications, and make sure the interviewees followed the four-stage process.

After the participants had completed the actual value co-creation session, the researcher initiated a conversation on the report (Appendix 7) highlighting logistical challenges at the surgery ward, and asked the medical staff representative to point out possible misunderstandings in the report. After this, both the medical staff and logistics service provider were asked to highlight and discuss most significant logistical challenges at the university hospital. At this stage, the guiding questions (Appendix 5) were presented.
Table 2. Interview Information

<table>
<thead>
<tr>
<th>Interviewee(s)</th>
<th>Organisation</th>
<th>Date</th>
<th>Length</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff Nurse &amp; Nurse, Anaesthesiology</td>
<td>University Hospital</td>
<td>8.1.2015</td>
<td>1h 7min</td>
<td>Operational</td>
</tr>
<tr>
<td>Head of Procurement</td>
<td>University Hospital</td>
<td>12.1.2015</td>
<td>1h 3min</td>
<td>Strategic</td>
</tr>
<tr>
<td>Staff Nurse, Surgery</td>
<td>University Hospital</td>
<td>13.1.2015</td>
<td>46 min</td>
<td>Operational</td>
</tr>
<tr>
<td>Area Manager &amp; Business Manager*</td>
<td>Service Provider</td>
<td>15.1.2015</td>
<td>46 min</td>
<td>Strategic</td>
</tr>
<tr>
<td>Production Manager &amp; Area Manager*</td>
<td>Service Provider</td>
<td>15.1.2015</td>
<td>41 min</td>
<td>Operational</td>
</tr>
<tr>
<td>Area Manager</td>
<td>Service Provider</td>
<td>15.1.2015</td>
<td>25 min</td>
<td>Strategic</td>
</tr>
<tr>
<td>Staff Nurse, Anaesthesiology &amp; Area Manager</td>
<td>University Hospital &amp; Service Provider</td>
<td>4.2.2015</td>
<td>1h 58min</td>
<td>Operational &amp; Strategic</td>
</tr>
</tbody>
</table>

* The interview was carried partially as a conference call in the service provider’s local office with the Business and Production Manager’s participating from elsewhere.

Interviews were recorded and carefully transcribed. The transcriptions were analysed using Dedoose software enabling processing of qualitative data. The data were analysed by first creating nodes (see Appendix 6) based on the theoretical framework and dividing the data in accordance with the nodes. During the encoding process, the researcher took additional notes on further ideas and conclusions that could be drawn from the material. After the data processing phase, the researcher recombined the data and analysed it in reflection to the theoretical knowledge and the proposed research questions.
Additionally, secondary data were collected from the service provider and customer organisation web sites. Furthermore, the researcher utilised ideas risen from informal conversations with the logistics service provider organisation as empirical material. The researcher also visited another regional hospital where logistical issues were discussed to increase her understanding of logistics arrangements in other healthcare organisations.

As stated previously some of the primary data for this study were collected through semi-structured interviews. The use of semi-structured interview method requires the interview questions be selected in accordance to the proposed theoretical framework (Tuomi & Sarajärvi 2002, 77–78). Conducting semi-structured interviews may be regarded as a suitable data gathering method when the researcher wishes to develop a deep understanding of the research phenomenon (Harrell & Bradley 2009, 27). Furthermore, this method improves the fit between the theoretical and empirical material as the interview questions based on theory direct the answers in a way that corresponds to the purpose of the research.

The empirical data were gathered from the logistics service provider and employees representing the public healthcare customer organisation. To gain a deeper insight to value creation opportunities existing between the service provider and the customer, interviews were carried on different organisational levels by loosely applying de Blok et al.’s (2010) interpretation on streams of healthcare research areas discussed below. Both the service provider and the healthcare customer were contacted and asked to suggest individuals with insight to the topic of research. Thus, the interviewees were selected by utilising the snowball sampling method (Bailey 1994, 438).

According to de Blok et al. (2010, 77) existing research carried within the context of healthcare may be divided into two categories that are cure and care. Activities such as professional services with focus on medical treatment are considered to belong to the cure category. Respectively, the care category consists of professional activities related to maintenance of one’s health. The care activities may further be divided
into two sub-groups namely, *institutional care* and *home care*. Institutional care consists of professional services that include living conditions whereas home care contains same services provided at the customer’s home. As this study concentrated on value-creation between a university hospital and a logistics service provider only, the care category was excluded from the study. Additionally, interviews and observations were carried in one hospital ward, namely unit of surgery, due to the size of the organisation. The choice of ward was based on an insight by a research colleague.

Furthermore, given the context of the present study involving a public sector actor, the role of procurement is also considered of relevance (Ministry for Foreign Affairs in Finland 2003). Thus, interviews with the public healthcare client will also be carried on a more strategic-level that is *procurement*.

As this study builds on theories related to co-creation of value, interviews were also carried with the logistics service provider. Similarly to the structure of the customer interview, interviews with the logistics service provider were conducted on levels described in Figure 4. The main levels of interview are *strategic* and *operational*. Furthermore, the operational-level was divided into three sub-categories in accordance with the service provider’s three main domestic areas of business that are *courier services*, *logistics services* and *financial control and transaction services*. (Service Provider 2014.)

![Figure 4. Levels of Interview with the service provider organisation.](image-url)
7 EMPIRICAL RESEARCH ON CO-CREATION OF VALUE THROUGH MODULAR SERVICES

In this chapter the researcher will first introduce the logistics service provider and discuss and analyse the presence of modularity in the logistics service provider organisation that said modularity in services, organisation and processes. After this, the customer organisation will be introduced. Finally, an analysis based on the data from the value co-creation phase will be conducted.

7.1 Description of Service Provider Company

The case company analysed is a Finnish service provider owned by the state. The service provider focuses mainly on producing courier, logistics and financial services to corporate customers in 11 different countries. (Service Provider 2014.) According to the Finnish law the service provider is classified as a large company. The company employs 26,000 people and it has a turnover of 1,977 million euros (Service Provider 2014).

The service provider serves both the consumer and corporate markets under different names. Its major corporate customers may be divided into three major segments that constitute approximately 96 percent of its annual turnover. These segments consist of actors operating in the fields of commerce, services and media.

The service provider offers its customers courier, logistics and financial services. The courier services include the delivery of letters, parcels and additional postal services all over Finland. Additionally, this business area aims to provide corporate customers new ways to reach their own customers through multi-channel solutions. The logistics services offered by the service provider aim to support and develop the customer business by offering the customer a range of diverging logistics solutions covering, for instance, cargo, warehousing and other additional 3rd party logistics arrangements. Finally, the aim of the financial control and transaction services is to assist the customer organisation to develop its financial control processes. The
service covers everything from order placements to billing and paying, control of incoming cash flow and possibly even all functions related to accounting and payroll management. (Service Provider 2014.)

7.2 Modularity in Service Provider Organisation

The logistics service provider who participated in the research may be regarded a modular organisation. According to the researcher’s observations, modularity appears in all three levels discussed in the literature review section that are modularity in services, processes and structures. Modularity is relatively commonly adopted in logistics, and in the case of the case service provider organisation, modular service architecture allows the company to provide the customer with a with a comprehensive set of services that are tailored according to needs expressed by each individual customers.

"[W]e aim to offer comprehensive solutions covering the whole chain from order placement to delivery where the warehousing service represents only one phase. [I]t is also possible to create solutions where we pick up the goods from the supplier’s factory and deliver it from the wholesaler [or] distributor to the warehouse.” (Business Manager 2015.)

The logistics service provider aims to further tailor the service solutions developed in accordance to the customer need by offering additional services to increase flexibility experienced by the customer. These create value for the customer by allowing it to focus on its own core competences making the customer organisation more efficient and competitive.

“[T]he warehousing services are accompanied by additional services […] meaning we make certain types of packages in accordance with the customer need and so on…but these contracts are negotiated separately […]. By Negotiating with the customer we can do things that the customer can normally do by itself, but we can offer it as a service.” (Area Manager 2015.)

In order to match divergent customer needs the logistics service provider has adopted the modular structure. Modularity allows the service provider to build solutions to respond to individual customer needs through combination of services appearing
tailored to the customer that, in fact, are a combination of standardised services. The service modularity creates value for the customer by responding to the exact customer needs. For instance, services, such as deliveries arranged for a specific time and place support the customer value processes.

“Although different target groups have different needs […] everything from Helsinki to Oulu is dispatched similarly through road transport. In our production system we transport goods utilising the same network.” (Product Developer 2015.)

“[T]hese services appear modular to us, and it is the customer that selects [certain services] from our offering which creates the tailored feeling. For instance, some do not want a standard delivery at 2PM because they do not need it. (Area Manager 2015.)

What makes modularity a competitive strategy is efficiency achieved through standardisation. Standardisation of modules is accomplished through refinement of individual services processes. Modular structure allows the service provider to combine these efficient processes through shared interfaces in accordance with the customer need. Considering modularity from the logistics service provider’s perspective, an example of modularity and standardisation may be the mail delivery service where efficiency results from the extensive utilisation of existing delivery networks.

“[T]he basic strength is in our nationwide network meaning we have access to dense transportation and delivery network, and additionally our parcel and letter sorting capacity allows us to deliver letters, parcels and even trolleys from one place to in a fast pace overnight” (Business Manager 2015).

Furthermore, careful planning of processes creates financial savings both for the service provider and the customer when services are produced and planned by maximising, for instance, the load area. This, in turn reduces costs caused by unnecessary transportation and facilitates economies of scale for the customer.
7.2.1 Challenges in Serving Public Sector Customer

Currently, the logistics service provider aims to develop its business through expansion in the foreign markets and the domestic public sector. However, expansion to the public sector may be regarded challenging due to existing organisational complexities and customer specific differences. For instance, processes such as decision-making are more challenging in the public than private sector. Thus, it may be difficult to find business opportunities in the public sector.

“[E]ach organisation is different and there exists both political and practical decision making. It is more challenging to find who is in charge of which sector when each municipality, city and hospital district is different. This makes it more challenging considering sales too as these organizations are more complex and decision making processes are more difficult than in the industrial sector, for instance.” (Area Manager 2015.)

In addition to complexities created by challenging decision-making processes, establishing a relationship with a public sector actor may be difficult due to legal requirements. Processes such as tendering and limited contract periods may make it hard to invest resources in a relationship with a public sector actor.

“[C]ustomer relationship is greatly different from the beginning. The difference is based on the fact that when certain threshold value is exceeded in the public sector, tendering is required. And once something has been bidden, the contract runs only for a certain time.” (Business Manager 2015.)

Although the public sector rarely seeks solutions instead of individual services, the role of collaboration is great in gaining an understanding of the customer needs. Although bidding is regarded as a challenge in terms of relationship building, collaboration and mutual flexibility may assist both the logistics service provider and the customer to create an efficient solution to the existing problem.

“[Collaboration] is extremely important as it facilitates and condenses cooperation and productivity. […] If the public sector representative is clever we can remodel the operations model in a way that creates value for both of us. Perhaps we are able to utilise our own existing network more effectively, and the customer may benefit through cost reductions.” (Business Manager 2015.)
Readiness to collaborate must stem from both the logistics service provider and the public sector customer organisations. Through collaboration and sharing of resources the service provider is able to create value for its customer through service improvements and refinements. Furthermore, the service provider experiences value through service development and process efficiency. In order to create value throughout the whole contract period, collaboration ought to take place in a similarly throughout the whole contract period. Some of the public customers have already recognised the value gained from logistics services and they are interested in collaboration extending through the whole contract period.

In discussing the role of public healthcare customers in the logistics service provider organisation, it is stated that this particular group is not yet a significant customer. Serving a public healthcare customer is considered to be challenging due to requirements of urgency and efficient cost structure which do not allow utilisation of standardised processes.

“[I]n public healthcare there are special needs responding to which is challenging if the service provider is not able to use the existing network” (Product Manager 2015.)

As examples of services requiring fast reaction times, the service provider names express laboratory sample and drug deliveries. Both of these forms of deliveries must be further tailored by the service provider as they do not exist as standardised services. Furthermore, the public healthcare customer may often have needs that do not allow utilisation on standardised processes. This becomes apparent when the customer has a special need that requires additional special arrangements from the logistics service provider.

“[T]hose instruments are often costly and they must be picked up quickly [after use] for disinfection after which they need to be delivered back. [...] Even if there often is other goods needing to be transported within the hospital district, additional transportation arrangements are designed in a way that acknowledges this need for special delivery which is fairly challenging for us.” (Business Manager 2015.)
In addition to their special needs, public healthcare customers are challenging due to structural reasons. Public healthcare organisations have become isolated “silos” by dividing themselves into operational divisions. This, in turn, is regarded challenging by the logistics service provider as the structural isolation impedes its chances for offering the customer comprehensive solutions. Instead public healthcare customers commonly invite private logistics service providers to tender for individual routes.

It is stated by the logistics service provider that the importance of and value gained from logistics service arrangements is seldom understood from the patient care development point-of-view due to patient centricity. In other words, logistics is not regarded as a supportive means for developing both patient flow and the whole healthcare process.

“[H]owever, they do not see the holistic picture of material flows, and how those could be developed by further organising them into divergent service levels [based on their urgency]. Instead [of solutions], we must now offer them our price for this one route.” (Area Manager, 2015.)

Although, the current trend in the Finnish healthcare sector favours requests for quotation be arranged for a specific logistics service, the logistics service provider recognises a growing interest towards solution-based logistical arrangements.

7.2.2 Modularity in Services

The case logistics service provider organisation has adopted the modular strategy in all levels that are modularity of services, processes and organisation. Theory on service modularity suggests modularity in services being the only dimension visible to the customer.

In the logistics service provider organisation, modularity is approached through processes that are shared by all customers until the point-of-delivery. The modules activated and required for transporting a good from one point to another are fixed. However, the modularity in services realises and creates value when the customer
chooses a preferred delivery method and combines those with possible additional services.

“[T]ake the Business Day product where the order is delivered by 2PM as an example. [I]t arrives in Oulu similarly to other orders. Then we have a service named Flex which similarly arrives in Oulu, however, if the customer chooses this service we either phone or send an SMS to the customer to arrange a suitable delivery time. If we think about consumer deliveries, [the customer] more than likely is not at home at 9AM [… so we arrange an evening delivery. […] Furthermore, Flex may be complemented with additional services, such as installation.” (Product Developer 2015.)

In the context organisation, additional services are often produced by a subcontractor. Subcontractors are also utilised when producing services for the public sector customers. For instance, deliveries that require certain temperature conditions and measuring systems, such as laboratory deliveries are subcontracted as the logistics service provider does not have access to such resources. Subcontracting allows the logistics service provider to offer the customer more a comprehensive offering which in turn appears to the customer as an increase in service delivery options and additional services. In other words, the experience of value is improved through tailoring.

7.2.3 Modularity in Processes

Process modularity is a part of modular service design invisible to the customer. In the logistics service provider organisation, modularity is approached mainly as processes. More precisely, the organisation is divided into service production modules where each phase of the service delivery process has its own established unit, such as sorting. Each process module consists of internally standardised and optimised processes that may be combined with each other and with other service production modules to create tailored solutions to suit individual customer needs.

“When we consider our final services, the transportation is standardised, parcel handling process in the sorting centre is standardised. In this way we aim to promote modularity.” (Product Developer 2015.)
Discussing service delivery processes at the service provider organisation more concretely, the process modularity becomes more apparent. Despite of individual differences in the service delivery interfaces, the internal production processes appear to be shared by all deliveries transported from one place to another. This, in turn, allows the service provider to reach economies of scale enabled by delivery optimisation.

“[We] have a delivery product option called Morning with a delivery by 9AM. Inbuilt to this service we have a service known as Collection and Delivery where we collect [the parcel] from the customer. That is one product that we use in all routes, so using this modular Collection and Delivery service we collect the Morning products. And then we also have a product called Business Day. All these services are produced through regional transportation. Regional delivery is one of our transportation borders. […] [T]he regional transportation is regarded as one module combining deliveries from a specific area and transporting them to the post centre to be sorted. This product also includes output sorting. If a delivery is to be shipped today from Helsinki to Oulu, it is first sorted in Helsinki in the logistics centre in Vantaa like all of our services. After this, we transport the delivery to Oulu together with other parcels stored in trolleys. All deliveries are transported to the post centre in Oulu where they will be further sorted. This is one module. Finally, what makes the Morning service different is the delivery method that is its own module. It is noted in the delivery unit in Oulu that this parcel paid to be delivered by 9AM.” (Product Developer 2015.)

Standardised processes within different service production process modules are designed according to lean principles to achieve efficiency. Practically, utilisation of the lean principle means that processes are designed to be as efficient as possible. In other words, all the unnecessary activities and phases are removed from processes.

7.2.4 Modularity in Organisation

In the logistics service provider organisation modularity is applied in both operational- and strategic-levels. In practice this implies that operational units, such as delivery and sorting are regarded as fully separate entities. Furthermore, each unit has its own process manager responsible for his/her own unit only. This enables constant development of processes to achieve efficiency.
“[W]e have our own organisations for deliveries, sorting, transportation, and each of these units in our matrix have a process manager who is in charge of its own unit and a specific part of the entire delivery process. In addition we have a process manager for the freight process including parcel deliveries looking at the whole product delivery process holistically.” (Product Developer 2015.)

Another example of organisation modularity is related to the logistics service provider’s geographical distribution. For instance, the wide distribution of physical branch offices and pickup outlets often placed in shops allow the customer to decide where it wants to collect the parcel. This in turn, ought to increase customer experience of a tailored service.

“[O]ne of our assets is the nationwide network. We have the widest transportation network. In addition, we have the widest branch office network which includes customer delivery pickups at the branch offices.” (Product Developer 2015.)

Thus, the wide distribution network with standardised unit specific processes together allow the customer to experience both monetary and non-monetary value created by the logistics service provider’s services. Considering the value created though organisational modularity from the corporate customer point-of-view, it is stated by the logistics service provider that these actors benefit especially from the trust created by the wide range of services and areas covered. Although there are several benefits to modularity from both from the service provider and the customer side, the modular strategy may be regarded rather challenging in terms of management.

“[O]ne must be able to manage the modules. [I]f the customer for instance wants to purchase shelving or installation services through us […] the most important thing to consider with regards to module management is to make sure the need is fulfilled. One must know how to produce a specific service.” (Product Developer 2015.)

Considering the context of this study, it is stated by the logistics service provider that in order to address to special needs and requirements in the public healthcare sector, some services need to be produced by subcontractors.
“[I]f the need for thermostatic equipment is expressed in the request for quotation then we are in the mercy of subcontractors since we do not produce these services ourselves” (Business Manager 2015).

The role of subcontractor resources in the logistics service provider organisation is regarded important in each service production process phase. The utilisation of external resources allows the logistics service provider to cover a wider geographical distribution area and reach a larger group of customers faster. This also allows the service provider to widen its service offering to better respond to customer needs as exemplified above.

“We optimise our transportation resources according to specified needs. That is why we often utilise subcontractor resources because that fits well into this kind of cyclical transportation.” (Product Developer 2015.)

The need for subcontractor resources is forecast by utilising calculations from previous years. Due to modular organisation architecture, responding to unexpected changes is fast.

### 7.3 Description of Customer Organisation

The customer organisation is a large university hospital representing one of the five university hospitals in the country. The hospital is in charge of providing specialised and demanding healthcare services for approximately 741,000 patients in its area of responsibility covering more than a half of Finland’s geographical area. In 2013, the hospital employed circa 6,600 staff and it had an operating budget of 555 million euros. (University Hospital 2013.) The university hospital is divided into four main areas of responsibility that are *children and women, medical, operative* and *psychiatric* (University Hospital 2014).

In this study, the operational-level personnel, i.e. nurses employed in the surgical ward form the target group. The surgical ward represents the largest cost centre and division at the University hospital consuming approximately 1/3 of costs in the annual budget (Procurement Manager 2015).
The staff in the surgical ward consists of approximately 200 medical professionals in divergent occupational groups. In the ward an average of 10 000 operations are conducted annually. The surgical personnel are spread nearly around the entire university hospital, and procedures are performed around the clock daily. (University Hospital 2015.) The operational-level actors at the university hospital interviewed for the purposes of this study represent both anaesthesiology and surgery professionals. Their units employ approximately 100 staff each (Staff Nurse, Anaesthesiology 2015; Staff Nurse, Surgery 2015).

The surgical ward has access to 18 theatres and one room for anaesthetic procedures. Furthermore, there are two recovery rooms one of which is open around the clock while the other one receives patients until 8PM. In total, there is room for 27 patients recovering from a surgical operation. (University Hospital 2015.)

Next, logistical processes and challenges are shortly discussed highlighting the nurse point-of-view. A more detailed analysis can be found in Appendix 7. Due to the challenge-oriented approach to logistics arrangements at the university, the researcher chooses to emphasise situations where logistics does not serve the medical staff value creation processes. As a result, the analysis may at times appear critical.

The surgery ward in the university hospital is regarded one of largest internal units in terms of flow of material. The material flow is assumed to be significant due to the complexity and number of operations conducted daily. For instance, large operations such as heart and brain surgeries require an extensive utilisation of both disposable goods and reusable equipment.

"[T]he amount of material needed here is huge. [...] after a large heart operation there may be five big refuse sacks full of trash. The amount of stuff used during one operation is really big.” (Nurse, Anaesthesiology 2015.)
As the surgery ward medical staff operates both scheduled and emergent patients it is important to have a well-functioning logistics system to guarantee access to all the needed equipment and goods at all times.

The logistics process in the surgery ward from a nurses’ point-of-view can be described as a six-phase process starting off from need, order placement, delivery, pre-operative tasks, operation and post-operative tasks.

The responsibility for need identification in the theatres is partially shifted to the operative nurses. Having identified a need of some particular good in the theatre the nurse informs the staff nurse about the need who places an order for the item through the hospital central warehouse.

The medical staff in the hospital places orders through a database system, Eemeli. Orders are placed only during the week days due to which needs requests placed by the operative nurses during the weekend may cause a rush for orders during the early week. In addition to the manual database system, the surgery ward has recently automatised its order processes by investing in Pyxis, a medical dispensing system responsible for maintaining the inventory. However, Pyxis has not met the staff expectations.

What comes to order delivery in the university hospital, factors such as reliability and trustworthiness are valued among the nurses. More precisely, it is of importance to be able to trust that orders are delivered according to an agreed schedule to avoid patient care delays. This is in line with business-to-business literature suggesting factors such as reliability are valued by customers so that they can guarantee their own operations.

It isn’t always understood how important it is to have stuff on hand. We can’t wait for a year until the next batch is ready. […] [I]t is important to be able to react fast in case we can’t have some product delivered.” (Staff Nurse, Anaesthesiology 2015.)
Malfunctions in logistics may, in addition to impeded patient care, cause financial damage to the university hospital.

In the surgery ward some of the delivered items will be used in operations. Prior to the beginning of an operation the nurse responsible for preparing the theatre makes sure all the needed equipment and material is available in the theatre and, if needed, restocks the anaesthetic cabinet containing medication for anaesthetic procedures.

During the operation the nurse may have to leave the theatre to pick up a certain piece of equipment from the nearby small warehouse called induction or the central warehouse. Sometimes, the searching for a specific item may be difficult due to illogically placed items in the induction. Furthermore, the critical time spent away from the patient may impede the success of operation.

The post-operative phase following the operation contains tasks such as garbage disposal, restocking and equipment care. The purpose of the post-operative process is to prepare the theatre for the next operation.

7.4 Co-Creating Value-in-Use for the University Hospital through Modularity of Logistics Services

In this section, logistical challenges at the surgery ward are discussed and analysed. Additionally, solutions to the existing difficulties are identified and practical modular implementations are proposed to address the identified challenges. Finally, value-in-use and outcomes created by the modular service delivery will be analysed from the customer point-of-view.

In the analysis, the university hospital representative will be referred to as customer. The customer is represented by an operational-level medical professional working at the unit of anaesthesiology in the surgery ward. The logistics service provider is referred to as service provider and is represented by a strategic-level logistics professional. Despite given the names, the informants are currently not engaged in an actual business relationship.
In the analysis the researcher has taken the freedom to organise the data in a manner that follows *a logical storyline and flow of conversation*. That said, the resources identified are not analysed in the same order in each section of the analysis and the order in which the actors sharing resources vary depending on the phase.

7.4.1 Diagnosing Challenges

In this section, the researcher aims to organise and analyse information that she argues to belong to the challenge diagnosis phase modified from Aarikka-Stenroos and Jaakkola (2012). As a reminder, diagnosing challenges is the first stage of the four-step joint problem-solving model and it is concerned with sharing of resources to identify a specific challenge in the customer organisation.

7.4.1.1 Customer

*Information on context*

According to the customer patient need for intensive care has increased majorly in the anaesthesiology unit. This, on the other hand challenges the operational staff in several ways as they are required to purchase and adopt new equipment and medical supplies to provide the patient with best possible healthcare.

"Patient need for care has increased over time […] Patients are divided into risk groups 1-5, sometime in the 80’s our patients represented risk groups 1-2, they were not too sick nor old, nor were they difficult cases at that time. However, nowadays all of our patients belong to risk groups 4 and 5 meaning they require extremely intensive care. This poses challenges to our equipment as well as medical supplies, know-how, induction and these kinds of things.” (Customer 2015.)

Furthermore, patients needing anaesthetic healthcare are placed in different parts of the university hospital facilities based on their need for care. The units responsible for offering anaesthetic healthcare further differ from each other based on opening hours.
"In addition to theatres we must of course have a post-operative care unit, hence we have arranged monitoring for 12 patients that is open 7/24. Here we take care of [patients] with a need for intensive postoperative care. […] We have another recovery unit in Avohoitotalo and it is open until 8PM. Patients with need for a slightly less care are placed there. We aim to organise the patient flow in such way that patients requiring long term care go straight to the monitoring room overnight.” (Customer 2015.)

With regards to logistical issues present at the surgery ward’s anaestesiology unit, the most significant challenge identified by the customer is posed by the constant equipment size growth leading to lack of space. Previous assumptions suggested that medical equipment would grow smaller in the future removing storage issues at the ward. However, it has been noticed that equipment, on the contrary, grows in size. This on the other hand, has created lack of storage space in the surgical ward.

"What comes to the amount of stuff and equipment, we used to think that in the future, both equipment and stuff would be smaller in size, so much so that microchips attached to people would present us with all the necessary information. However, the reality has proven to be different, all the equipment become larger in size. We constantly get larger equipment, for instance we have had an O-arm for five years and soon we will have another one.” (Customer 2015.)

For instance, the O-arm, a surgical imagining system, is estimated to be five meters long and three meters high. Although, the equipment is regarded to be large by the customer, she acknowledges they are crucially important in guaranteeing the patient with best possible care. However, the physical size of the equipment is considered worrying as due to lack of space the equipment is often placed in different places. This, in return, may imperil patient care as the equipment needed may not always be at hand.

"[W]e lack room and warehouses already. When we took a tour around our facilities there was stuff all over the place. While the surgery ward covering theatres 1-6 was under renovation we dreamt of storing all of our equipment to their own places in the theatres. Unfortunately, this has not become reality, [the equipment] are still found all over the place.” (Customer 2015.)
Production material

The university hospital produces its internal logistics services in-house. In the past, organisation of goods logistics in the anaesthesiology unit was handled by instrument care specialists specifically trained to operate in the unit. Currently these services are produced internally by so called shelving services that employ approximately five members of staff. The shelving services staff does not specialise in any particular ward, instead it operates all over the university hospital. In addition to changes in organisation of internal logistics, goods consumption in the anaesthesiology unit has been automatised by investing on a Pyxis dispensing system. However, this system and the shelving services are currently unsynchronised meaning they do not create a seamless interface.

"[W]e were introduced to automated dispensing cabinets named Pyxis. This task was taken over by the so called shelving services. In total, they are five people working in the warehouse specialised in this and they are in charge of shelving and ensuring availability in house. Here we have experienced some small challenges in how we can match the articles in such way that we have what we need but not too much of anything." (Customer 2015.)

According to the customer, the shelving services do not operate similarly to the instrument care specialists. Differences occur especially in the delivery unloading processes and methods. The instrument care specialists used to unload a large delivery in multiple inductions, storage spaces outside of theatres, to reduce lack of space, whereas shelving services currently deliver goods in unopened boxes. This in turn, has increased the time nurses spend in the induction looking for a specific item. Additionally, the unloaded boxes placed in the storage area and on top of Pyxis may be regarded a sign of excessive delivery batches which may impede patient care.

In addition to delivering items in unopened boxes, shelving services restock inductions two times a week. According to the customer, the current restocking cycle does not suit needs at the anaesthesiology unit. Due to re-organisation of internal logistics, delivery times for items ordered to the ward are prolonged as a result of
deliveries being stored in the central warehouse, or in the ward corridors waiting to be unloaded in inductions by shelving services.

"But before shelving services unload the deliveries on the shelves, they may lie in the corridors for 2-3 days. […] It doesn’t really even look really nice when there is stuff placed all over the corridors, and they may even end up in wrong hands.” (Customer 2015.)

Prolonged delivery times as well as utilising corridors for temporary storage purposes may endanger both patient and nursing staff well-being. For instance, items placed alongside the corridors may hinder patient logistics and cause physical injuries to the medical staff.

Considering additional logistical challenges in the on-call anaesthesiology unit, the central warehouse is discussed. The central warehouse in the university hospital operates only between 9AM and 3PM. Although, there are several wards operating around the clock, the central warehouse ready to change its opening hours to better respond needs at on-call wards, such as the surgery ward. Due to internal logistical inflexibilities, healthcare personnel sometimes have to have goods delivered directly to the ward against recommendations.

"[Direct deliveries to the ward] are not recommended but sometimes we have no other options. Once I asked if the central warehouse could scale up its opening hours so that some would come to work a little later as this need isn’t daily, but they refused.” (Customer 2015.)

In addition to inflexible opening hours, further logistics challenges in the anaesthesiology unit are caused by internal delivery failures. The customer assumes these may be caused by unclearly marked addresses or lack of knowledge of the hospital facilities.
Information on experiences

According to customer the logistical arrangements at the university hospital may be regarded a source of stress among the medical staff in the anaesthesiology unit. The stress, on the other hand, may result from lack of understanding the customer. It appears that internal logistics service provider does not fully understand the hospital core processes formed to provide patient healthcare. In the anaesthesiology unit, the lack of customer understanding appears, for instance, in the form of independent modifying of shelf structures as well as item relocation in the inductions which complicate the nurses’ work.

"We tried to organise the shelves in a way that we would store everything related to breathing, such as breathing tubes, masks and filters in Pyxis so that they all would be physically there. However, this has not been a success as the boxes were of different sizes. As a result, the logistics services have re-organised the shelf structures. At least in the beginning it has been really difficult to find [anything] and the shelves are not all similar in all of our storages rooms, in fact they all are placed a little differently. (Customer 2015.)

Additionally, stress is caused by inaccurate inventory stemming from manuality of the previously discussed Pyxis system. In order for the system to be up to date, a nurse taking an item from the dispensing cabinet is expected to press a button. However, due to human errors caused by, for instance, acute rush or a simple lapse of memory, the system is not always up-to-date as the nurses sometimes forget to press the button. An outdated inventory, on the other hand creates stress among the medical staff when they are unaware of whether they have rapid access to a certain item, or whether they need to rush to the central warehouse to collect it.

"Last weekend I received an SMS saying ‘Endobronchial tube out 39 left, what do we do?’ Then I told them to check our emergency storage however, there were none left. Then I told them there were left-side tubes in the central warehouse […] On Monday, I discussed […] [this] with shelving services. […] Then we printed out a Pyxis report and it showed that Friday evening there had been five items [in the cabinet] as there should have been. It had been the case that we had not pressed the button when we had taken stuff from there.” (Customer 2015.)
**Effort and Time**

In addition to stress and inflexibility of logistics arrangements at the university hospital, the outdated inventory causes the medical staff *indirect work* i.e. any work unrelated to patient care when they rush to the central warehouse to collect items not on hand in the induction. Furthermore, the disorganised inductions increase the time nurses spend looking for certain items. This in turn, decreases *direct work* spent with the patient and increases indirect work.

In addition to inaccurate inventory and disorganised inductions, indirect work is caused by inefficient delivery times. According to the customer, internal delivery failures as well as urgent delivery tracking and pick-ups reduce time spent with the patient.

"Even before […] I had paid attention to the fact that orders even all the way from China arrived faster than [deliveries] from downstairs to upstairs, unless you go and pick up the deliveries yourself” (Customer 2015).

**Information on needs**

Considering logistics and its role in supporting the patient healthcare processes as well as the overall functionality of the anaesthesiology unit, the customer emphasises the importance of trust. Similarly to existing theoretical findings, it is of crucial importance in business relationships that the customer, i.e. the medical staff can trust logistics to guarantee access to a correct item in the correct place at the correct time. Failures to respond to the previously mentioned needs create uncertainty.

"[R]ecently one of our contract suppliers informed us they were not able to deliver these items for half a year. The shelving services is in charge of this particular item, and as a result it is their responsibility to find a replacement supplier. […] I asked them if they had placed an order for a replacement product. This Morning, I received an answer saying ‘[W]e will wait and see.’” (Customer 2015.)
In addition to delivery certainty and trust, the customer stresses the importance of logistical arrangements and safety at the ward. She argues logistics ought not to imperil patient care processes nor staff well-being.

"[S]toring of goods [in the corridors] impedes patient logistics and patient safety. Additionally, it may create dangerous situations to nurses as well due to things falling on their feet and crashes. That is really challenging." (Customer 2015).

7.4.1.2 Service Provider

*Diagnosing skills*

Based on the customer’s description of current logistical challenges at the ward, the logistics service provider is able to diagnose a larger issue present at the anaesthesiology unit. Instead of focusing on improving smaller internally produced logistic services, the service provider representative states that the current organisation of internal logistics does not to serve the university hospital’s core processes built around patient care.

“[H]ere we can see that the problematics are related to internal logistics. An order from Italy is delivered within one day and it may take up to two to three days without you even knowing the delivery has arrived.” (Service Provider 2015.)

Failures to support the hospital core processes formed around patient care may lead to inefficiency as the medical staff, mainly nurses are partially responsible for doing logistics. According to service provider the internal logistics further does not seem to understand its supportive role in the hospital organisation alongside with ward specific needs. This, on the other hand, is suspected to be the reason for why logistics arrangements appear inflexible and unable to respond to individual needs.

"If the warehouse is currently open between 9-15 while you are 24/7, the warehouse doesn’t serve you. [L]ogistics causes you manual work which affects patient and medical staff safety. All this [poses a question of] whether the customer need has been understood to begin with.” (Service Provider 2015.)
“[T]he most important starting point in logistics planning is to understand the customer. Logistics creates value when there exists a great number of service episodes and customers with different needs. [Based] on this the logistics professional comes up with the optimal solution to respond to everyone’s needs.”（Service Provider 2015.）

According to the service provider, the internal logistics provider does not appear to be customer focused as services are not provided in accordance with ward and unit specific needs. However, the customer value creation process and the customer experience of value ought to be the starting point for logistics planning. Additionally, logistics services should be designed in a manner that enables the internal actor to respond to heterogeneous needs across the hospital.

”I argue that everything depends on customer understanding. There is no communication, you need the respirators but logistics feel they would rather organise items in this way, or that if they consider them just as things. But if the customer has a need for having these right here in this place that means your voice should be heard.” （Service Provider 2015.）

In addition to challenges related to communication and lack of customer orientation the service provider finds the internal logistics resource planning model problematic. More precisely, lack of staff is regarded a challenge as some logistics services have not been able to be produced despite of the need due to lack of resources. The service provider states a support service ought to be able to respond to ward and unit specific needs to guarantee successful conduction of patient care related processes.
"If logistics announces they lack resources, and you are the customer and your customer is the patient. I find it terribly unfair that the customer, the person in need, is not being heard. Instead, [you] are just told we have no resources and we can’t do something. However, if we think about why hospitals exist, everything should be organised to facilitate effective and fast patient care." (Service Provider 2015.)

Relational capital

Although gaining an extensive understanding of the customer value creation processes is regarded to be of importance when co-creating value, softer aspects to co-creation are highlighted during the co-creation process taking place between the customer and service provider. When talking the service provider expresses empathy that is the ability to see the logistical challenges from the nurse point-of-view. Among other things, the service provider expresses her concern towards the unreliability of the internal logistics arrangements which leads to stress among the medical staff. Stress is, for instance, caused by unexpected modifications in the storage areas.

Comparing the private and public sector, the inability to understand the supportive role of logistics in the customer organisation is not an option in the competitive market. Instead, to remain competitive the external logistics service provider must provide the customer with resources needed to guarantee efficiency in the customer core processes. Doing this, stress related to logistics service availability among the medical staff may be avoided.

However, the existing logistics resource planning method in the university hospital does not function alike external competitors. Instead, perhaps due to insufficient understanding of the hospital core processes resource planning does not allow the nurses to concentrate solely on direct work.

"Everything should be done in a way that facilitates efficient and fast patient care. That is far more critical than logistics telling you they don’t have enough staff to process your orders leaving you deal with the problem. This makes your job more difficult and you have less time for the patient.” (Service Provider 2015.)
7.4.2 Solution

In this section, the researcher analyses resources shared between the customer and the service provider to find a solution to the problem identified in the previous phase.

7.4.2.1 Service Provider

Relational capital

The logistics service provider diagnoses the lack of understanding the customer and the end customer as the main reason for the existence of internal logistical challenges encountered in the university hospital. As the internal logistics is supposed to be organised in a way that supports and makes the core processes more efficient, the logistics service provider expresses its concerns with regards to existing internal resource planning leading to inflexibility and inefficiency in the hospital.

"I find it terribly unfair that the customer, the person in need, is not being heard. Instead, [you] are just told we have no resources and we can’t do something. […] This complicates your work and you have less time for the patient.” (Service provider 2015.)

Expert knowledge

According to the service provider a solution to the lack of understanding the customer may be systematic interaction and collaborative development. Co-development would increase mutual knowledge in possible solutions to the existing challenges at the anaesthesiology unit and systematic communication would, in turn, allow the internal service provider to make constant refinements to the developed solutions.

Additionally, regular sharing of information would allow the internal logistics to learn about unit specific needs. This, in turn may significantly improve patient care processes when patients would be guaranteed the needed medical treatment. Ideally
in practice, increase in communication would also increase understanding of the customer and result in tailoring of internally produced logistical services to support and facilitate core processes in the university hospital.

According to the service provider all actors from different units at the university hospital affected by certain logistical arrangements should participate in the co-development process. Especially topics related to delivery needs and delivery monitoring systems could be discussed among internal logistics and units with shared concerns. Through collaborative development activities novel approaches to the detected issues may be discovered. Additionally, a large number of internal customers participating in the co-development process would increase the pressure to address the expressed needs in the internal logistics organisation.

It is also stated by the service provider that this form of customer-oriented service development and flexibility of services would also create value in the future as changing customer needs would be addressed quickly and based on specific customer needs.

”[The solutions] ought to be modular so that in 50 years when there are new needs a little different from the current needs, the [solution] would allow modifications so when new things are introduced there should also be compartments of different sizes. Things should be designed with both present and future needs in mind. This should reduce the amount of stuff stored in the corridors. And [this] would also be more individually [tailored] service.” (Service provider 2015.)

The value arising from tailored and flexible logistics services would realise in the form of increased direct work among the medical staff meaning nurses would have more time to focus on patient care. In addition, a more accurate planning of resources and other solutions ought to increase trust to internal logistics among the medical staff.
Diagnosing skills

The internal logistics services in the university ought to be both flexible and tailorable to respond to divergent ward and unit specific needs. The solution to the current logistical challenges related to inflexible service delivery could be in modular service design. Modular service design is based on individual service components that can be combined according to customer specific needs. However, in order to create a well-tailored modular service solution, the service provider must have an extensive understanding of the customer needs. Currently, the internal logistics services such as the warehousing or shelving do not respond to unit specific needs effectively. However, through improved communication, customer-orientation as well as modular service design, the challenges related to internal logistical inflexibilities could be addressed in a manner adopted from the external service provider.

"[W]e do exactly what the customer wants. In this case, shelving services or whoever produces this service, should deliver you batches according to your needs. If someone has a need for a batch of 100 items, a batch of 100 is delivered.” (Service provider 2015.)

As the modular service design is based on individually developed solutions, modular thinking must be applied in process, organisation and service levels. In the logistics service provider organisation, even contracts are made modular to guarantee the customer an optimal services experience. In addition to practical improvements, modular service architecture creates financial benefits achieved through effective resource planning. Thus, the application of modular service design to internal logistics may create both monetary and non-monetary value to the different customers.

As stated above, modular services architecture is based on individual solutions and cost efficiency. This combined with challenges created by the ever changing customer needs force the external logistics service provider organisation to seek opportunities for further optimisation and development.
“[T]he customer need changes all the time, and that is why we need to develop constantly. This on the other hand means that the service provider must constantly control its service quality. The warehouse, distribution and delivery ought to be informed daily whether they have managed to serve you as well as possible.” (Service provider 2015.)

Comparing the external and the internal service providers within the context of this study, it is stated by the service provider that one of the main differences between the two actors is in their level of customer focus. It is argued that due to competition in the private market, logistics service providers constantly monitor their performance to achieve best possible customer satisfaction. Possible service failures are rectified by systematically utilising tools such as deviation management.

"As a large actor we can’t even think of having a 3-day delay in internal logistics. Instead, we critically monitor daily whether all the millions of deliveries in Finland have been delivered correctly with 99,8 % accuracy. […] I don’t know if you internally monitor deviations […] to identify what causes 2-3-day delays and quickly fix the [problems].” (Service provider 2015.)

Furthermore, the internal and external providers differ from each other in terms of resource management. The external service provider applying modularity in its service planning finds itself to be more capable to estimate resources needed to produce a service than the internal provider. Additionally, the external provider has a better access to other resources, such as staff in case of unexpected changes. According to the service provider, the resource planning in the hospital ought to be based on an extensive understanding of internal customer needs to provide the optimal support to guarantee the patient care related core processes.

"[M]anagement of resources will improve when the customer need is understood. As a result, you will never get an answer like we couldn’t unload the delivery due to people being sick, or that our warehouse is too small and so on.” (Service provider 2015.)

To sum, the solution to the logistical challenges in the university hospital may be approached and addressed through modularity. By increasing the understanding of the customer as well as flexibility and optimisation, both well-being and safety of the
medical staff and patients would be improved. Furthermore, modular service would create monetary benefits, such as cost savings.

7.4.2.2 Customer

*Information on needs*

The customer acknowledges that increase in communication between the internal logistics and the medical staff would be a way to provide the patient the best possible care. Currently, the medical staff in the anaesthesiology unit collaborates with, for instance, shelving services to optimise the service in question. However, collaboration has so far been challenging due to lack of staff in the internal logistics service provider organisation.

*Information on experiences*

According to the customer, increase in communication and understanding would allow the nurses’ to focus on direct work. Additionally, improvement of communication would increase trust to the internal logistics as the nurses would no longer need to worry whether they had a rapid access to specific items and whether they would be placed correctly. However, currently, shelving services, for instance operate similarly everywhere in the hospital meaning deliveries are unloaded twice a week despite of unit specific needs. Furthermore, shelving services have modified the inductions, which has led to stress among the medical staff.

"Logistics service provider has now made modifications to the shelf structures. In the beginning, it was really challenging to find [items] as all the inductions are a little different. [...] That is really challenging.” (Customer 2015.)

Currently, shelving services store and place deliveries in unpredictable locations. This, in turn challenges the hospital core processes as delivery failures, incorrectly placed items, and long delivery times impede successful completion of acute patient care. According to observations made by the customer, even urgent orders are
delivered faster by an external than an internal logistics service provider. This, in turn, shifts logistical responsibilities to the nurses.

"In fact, deliveries arriving from anywhere else in the world, seriously speaking, I can’t recall a single situation where a delivery would have gone missing on the way here. Instead, it goes missing here. Furthermore, storing things [in the corridors] may hinder patient logistics and safety. Additionally this may cause dangerous situations to the nurse as well if stuff falls on her feet or if she runs into [something]. That is really challenging. (Customer 2015.)

Information on context

The university hospital has a long tradition of internal production of logistics services. As a result, the customer suggests that challenges related to communication and trust could be addressed through training of logistics staff.

"[I] don’t know if the in-house logisticians have been trained. I don’t know if it would be a bad thing to educate them so that they know what these [things] are and why [things] need to be this way. Maybe they feel they don’t need to be trained. It is, however, obvious that they don’t [understand] since they had re-organised the shelves. They don’t care which box goes where.” (Customer 2015.)

7.4.3 Modular Service Delivery

In this section, the researcher analyses practical arrangements such as systems and services regarded as means for addressing logistical challenges in the university hospital and the anaesthesiology unit. Different to previous sections, the researcher organises and analyses resources according to the dimensions of modularity that are modularity in services, organisation and processes. Furthermore, in this section, resources are only shared by the service provider.

As stated previously, the internal logistical challenges, mostly related to inflexibility of services and lack of customer orientation, present at the university hospital could be addressed by adopting the modular service architecture in the planning of logistics. Alike with existing theoretical findings, in this study value created by modularity will be discussed on three levels that are modularity in services,
organisation and processes. Due to the study being carried at a relatively early stage, specific implementation related solutions will not be presented, instead the discussion remains on a general level.

**Expert Knowledge**

*Modularity in services* is the only dimension of the service modularity architecture visible to the customer. In the context of this study, modularity in services could create value to the medical staff, and especially nurses through improved and more flexible delivery times scheduled in accordance with individual customer needs. On a practical level, adoption of modular planning would, for instance, allow different equipment to be labelled as urgent or non-urgent deliveries meaning orders would be delivered from the central warehouse to the internal customer in a specific pace.

As modular services are customer specific solutions, building of these services to address a specific customer need requires collaboration with the customer. More precisely, it is stated by the service provider that logistics services ought to be planned together with the customer with the customer in focus.

"[T]he most important starting point in logistics planning is to understand the customer. [...] Logistics creates value when there exists a great number of episodes and customers. [...] [Based] on this the logistics professional comes up with the optimal solution to respond to everyone’s need, sometimes when it is wise by combining things.” (Service provider 2015.)

According to the service provider, the hospital processes could be made more efficient through adoption of modularity in the internal logistics. For instance, currently, nurses at the university hospital are partially responsible of organising logistics manually in their respective wards when using shelving services. However, modularity is based on process efficiency achieved through means of monitoring as well as automation. Thus, it is stated by the service provider that through modular thinking shelving services could be automated through organisation of automatic deliveries to different internal customers in pre-determined intervals to avoid having the medical staff do manual logistics.
“[I]f Pyxis is supposed to be automatic the inventory information should be updated to the system without one having to push a button. It feels really manual to me.” (Service provider 2015.)

In addition to tailored solutions and automatisation, the modularity may, according to the service provider, increase trust to the internal logistics among the medical staff as delivery times and points are agreed between the medical staff and the logistics service provider. Furthermore, the service provider finds possible additional services such as internal delivery tracking improving trust to logistics services in the university hospital.

**Modularity in organisation** is a dimension of modular architecture used to describe the internal organisation as well as geographical distribution of the service provider firm. In the value co-creation discussion taking place between the customer and the service provider two forms of organisation modularity were identified, namely contracts and agreements and facility and equipment.

**Contracts and agreements**

Currently, the internal logistics service provider functions similarly all over the hospital meaning needs communicated by individual units and wards are not responded to. Instead, shelving services, for instance, unload deliveries twice per week although some units, such as anaesthesiology has a need for more.

The unified service production method of logistics services at the university hospital thus implies each internal customer has similar needs although this is not the reality. To guarantee each customer the service it needs, the service provider states the internal logistics ought to make unit and ward specific contracts with its internal customers. For instance, in the external logistics service provider organisation, heterogeneous customer needs with regards to shelving services requires customer specific contracts.
"We offer shelving services for specific products all over Finland to different types of companies and each contract is different. [One] may have need for two times a week while the other prefers daily [deliveries]. […] The [service] is built around the need.” (Service Provider 2015.)

In practice, internal contracts and agreements would, for instance, enable the internal logistics service provider to response to unit and ward specific delivery size requirements to create value for the internal customers.

"All the information should be saved there, so that you are not [delivered] items in batches of 100 if you have a need for a batch of 10. The order should be not be delivered to the ward in a batch of 100 items, instead there should be delivery batches to respond to your needs.” (Service provider 2015.)

Although, creating separate contracts with different customers may require extensive utilisation of resources, value may be created for instance through increase in cost efficiency achieved through combination of several similar processes to serve different customers.

_Facilities, equipment and resources_

Additionally, organisational service modularity facilitates more efficient resource management. According to the service provider, the external logistics service provider organisation differs from the internal provider at the university hospital significantly in terms of its access to resources, such as staff, in urgent situations, which guarantees minimal damage to the customer organisation core processes which within the context of this study are related to successful patient care. Currently, the internal logistics services are challenged by lack of resources which may impede patient care.

“We are widely spread and our strength is that we have plenty resources. For instance, when delivering critical meal deliveries to old people in shelter homes some other actor may say, the driver is ill, however, we can say the driver is ill but we will deliver the meal. It is our responsibility and we get the sanctions. We simply can’t say we can’t unload some delivery due to lack of staff. Instead, we just get more staff. It is almost like we had a [staff] bank.” (Service provider 2015.)
In addition to optimised human resource planning, flexibility of logistics services is enabled through solutions such as intermediary storage. According to the service provider, utilisation of a geographically widely spread network of external storage space enables quick deliveries in emergency situations. Furthermore, collaboration with an external storage provider creates cost savings when urgent deliveries do not need to be shipped from a supplier warehouse most often located abroad.

"When it comes to goods, using intermediary storage is a positive thing. Sometimes an external actor can function as an intermediary storage so that if something needs to be delivered within an hour, it will be delivered within an hour. And if you had an intermediary storage space here, a delivery could be made in just 10 minutes, and the cost would be smaller than having the order sent in batches of six all the way from Italy." (Service provider 2015.)

Expert knowledge

**Modularity in processes** describes how and the extent to which different service processes have been made individually efficient and combinable with other process modules. In the external logistics service provider organisation process modularity is emphasised. According to the service provider, adoption of process modularity allows one to create a wide service offering. Furthermore, this form of modularity further enables the service provider to address individual needs through combination of separate process components. Were process modularity adopted to the internal logistics in the university hospital, unit specific needs regarding, for instance heterogeneous delivery requirements could be responded to. In addition to service quality improvements, process modularity further creates savings resulting from efficiency of processes as well as efficient combining of processes. For instance, the external service provider achieves low unit costs by combining several orders in its transportation.

"Logistics creates value when there exists a great number of episodes and customers. And this one has this kind of a need and that has that kind of a need. [Based] on this the logistics professional comes up with the optimal solution to respond to everyone’s need, sometimes when it is wise by combining things. […] In our transportation, we achieve lower unit costs by combining things.” (Service provider 2015.)
According to the service provider services processes are continuously developed due to constant changes in customer needs. That said, processes are optimised further by gathering information regarding service quality directly from the customers as well by internal monitoring.

"[T]he customer need changes all the time, and that is why we need to develop constantly. This on the other hand means that the service provider must constantly control its service quality. The warehouse, distribution and delivery ought to be informed daily whether they have managed to serve you as well as possible, and where there has been deviations and how these have been fixed." (Service provider 2015.)

As a result of constant quality control and monitoring, deviations such as delivery failures are addressed rapidly to maintain high customer satisfaction.

[T]ransparency is [important]. As a large actor we can’t even think of having a 3-day delay in internal logistics. Instead, we critically monitor daily whether all the millions of deliveries in Finland have been delivered correctly with 99,8 % accuracy.” (Service provider 2015.)

In addition to creating value for the customer, monitoring of deviations increases efficiency arising from systematic gathering of information on inefficiencies within processes in the logistics service provider organisation.

7.4.4 Value-in-Use for the University Hospital Customer

In this section, value-in-use created by modularity of logistics services is discussed. The benefits of modularity are analysed utilising the classification presented by Aarikka-Stenroos and Jaakkola (2012) that suggests value-in-use may realise as direct monetary value, indirect monetary value or non-monetary value when the customer integrates the modular service into its own processes (MacDonald et al. 2011, 677).

As stated previously in this study, the core logistics challenge identified at the university hospital is the internal logistics service provider. According to the
customer, current challenges relate to inflexibilities that do not support hospital care processes revolving around patient care. These have, in return widened the medical staff responsibilities to cover logistics tasks such as delivery pick-ups and inventory. This, on the other hand has created lack of confidence towards internal logistics among the medical staff.

Considering value-in-use in the context of the current study, it is stated by the service provider in the external logistic service provider organisation that through adoption of the customer focused modular architecture, internal logistics at the could be improved.

7.4.1.1 Service Provider

*Expert knowledge*

Considering value-in-use created for the customer through modular services, the service provider representative uses her expert knowledge by discussing direct and indirect monetary value as well as non-monetary value. All the information shared in this phase is classified as expert knowledge.

**Direct Monetary Value as Savings**

Modularity is generally regarded to be a cost efficient and flexible means for achieving high customer satisfaction through individually tailored service solutions. In the context of the current study, modularity of logistics services would allow the internal logistics to respond to all the rather heterogeneous needs at the university hospital by combining its processes to build an optimal service solution.

“Logistics creates value when there is a great number of episodes and customers. […] [Based] on this the logistics professional comes up with the optimal solution to respond to everyone's need, sometimes when it is wise by combining things. As I said, some [orders are delivered] at scheduled times whilst other [deliveries] are regarded as urgent.” (Service provider 2015.)
In addition to savings created by customer specific and optimised service solutions, the modular service architecture aims for actual cost efficiency. According to the service provider, low costs are achieved through combination of orders and processes. That said, adoption of modularity in the internal logistics would have an impact on both logistics and patient care processes. Cost savings achieved through optimal planning of resources and processes would increase financial resources in the hospital increasing its efficiency and allow other investments.

**Indirect Monetary Value**

In this section, indirect monetary value achieved through modular logistics services are classified as process efficiency, space efficiency, and current and future value.

Process efficiency:

Modularity is based on achieving high customer satisfaction at low cost. That said, modular organisations, such as the external logistics service provider in this study, aim for development of existing processes to achieve efficiency. Were modularity adopted to logistics at the university hospital, the patient care process would become more effective as a result. More precisely, the increase of effectiveness would stem from nurses having the opportunity to focus on direct work meaning the time spent taking care of the patients would increase. Consequently, nurses would no longer need to be partially in charge of doing logistics related tasks, such as independent delivery pick-ups in the central warehouse.

Reductions in time spent doing indirect work increases care process efficiency as nurses would be able to focus on the patient. That said, modularity and logistics development would increase the amount of direct work in the university hospital. Improved patient care efficiency would, in turn, have a positive impact on public health in the country.
"[T]he service provider must constantly control its service quality. This benefits you in the form more efficient patient flow and improved patient safety [...] when [the nurse] doesn’t need to run around during an operation. This, in turn, creates cost savings that increase your productivity." (Service provider 2015.)

Space efficiency:

According to the customer at the anaesthesiology unit in the university one major current logistical challenge is lack of space. More precisely, this is argued to be caused by the size of existing medical equipment and appliances as well as utilisation of corridor space for the purposes of storing unloaded deliveries. Lack of space is further considered to be a factor impeding patient care and safety of staff.

The challenges described above could be addressed through logistics service modularity. According to the service provider, logistics modularity improves the efficiency of deliveries when certain items would be delivered at a previously agreed point in time whereas urgently needed items would be delivered separately in a flexible manner.

"[W]hat equipment needs to be stored close to the place where the operation is performed, and supposedly there is equipment that can be stored somewhere else. And as the need for more intensive care has increased, presumably the need for having orders delivered to the right place at the right time has similarly become ever more important." (Service provider 2015.)

Furthermore, modularity would enable tailored delivery sizes. These, in turn, would increase storage and corridor space in wards partially removing challenges related to lack of space. Increased corridor space would increase patient and staff safety by reducing risks related to patient logistics and physical damages caused by possible crashes.
Current and future value:

In addition to creating value for the present, modularity may be regarded a long term solution through which logistical issues in the university hospital could be addressed even in the future.

"[The solutions] ought to be modular so that in 50 years when there are new needs a little different from the current needs, the [solution] would allow modifications so when new things are introduced there should also be compartments of different sizes.” (Service provider 2015.)

Non-Monetary Value as Well-Being and Trust

In addition to creating monetary value-in-use in the hospital, logistics modularity may be regarded a creator of non-monetary value. Non-monetary value-in-use experiences result from improved well-being at workplace. More specifically, motivation among the nurses would, for instance, increase when they could focus on their area of expertise without having to take on logistics tasks in the ward. In addition to improvements in well-being among nurses, the increase in direct work would increase patient well-being through reduced time spent at the hospital.

"It was mentioned here that sometimes the nurse would in the middle of an operation head to the central warehouse to pick up some item. This prolongs the critical time spent in the theatre. By [making modifications] to logistics, we could influence the time spent in the hospital. […] I think this allows the nurse to focus on what she is good at that is the patient care. Thus, their time would not be [wasted] doing something that is not as important.” (Service provider 2015.)

In addition to increase in direct work, modularity of logistics services based would increase trust and decrease stress experienced by the nurses. It is, for instance, argued by the service provider that solutions often related to modularity, such as automatisation would decrease stress related to remembering among nurses. More precisely, automated solutions would reduce stress related to human errors possibly leading to lack of inventory and delayed patient care.
“[C]onsidering modern technology, one may question whether things could be done differently because pushing buttons creates a risk for a human error. [I]f Pyxis is supposed to be automatic […] the inventory information should be updated to the system without one having to push a button.” (Service provider 2015.)

Furthermore, automated solutions such as delivery tracking would improve trust to logistics among the nurses. On a practical level, an up-to-date delivery tracking system would reduce stress and increase well-being and trust when the nurses would constantly be informed about the estimated delivery time. This would also improve planning of schedules as possible delivery delays would be acknowledged beforehand.
The purpose of the present study was to examine value co-creation opportunities between a logistics service provider and a public healthcare customer. The research was conducted as a qualitative case study with embedded units of analysis (Yin 2009, 46). However, supportive secondary data were collected from another public healthcare actor. The empirical data were collected utilising three divergent methods that were semi-structured interviews, observation and a group interview involving a representative from the logistics service provider organisation and the operational-level medical staff.

The logistics service provider organisation is a large government owned actor serving both consumers and corporate customers. The public healthcare customer, on the other hand, is a university hospital responsible for organising special healthcare in an area geographically covering over half of Finland’s surface. However, due to the size of the university hospital as well as rather divergent unit and ward specific needs, the empirical data collection was limited to the surgical ward only.

The current study was born due to practical reasons. The logistics service provider organisation needed suggestions on how it would be able to increase its presence in the public healthcare system. As a result, the primary research question proposed for the study aims to provide the logistics service provider with concrete answers. Thus, the main research question is: “What kinds of value creation opportunities exist for the logistics service provider?” Answers for the primary question were explored utilising theories such as the service-dominant logic and modularity literature. The utilisation of literature from the previously mentioned theories led to the proposal of three secondary research questions that were, “What kinds of logistical challenges currently exist in the customer organisation?”, “What resources are shared in the value co-creation process?” and “How does the customer benefit from the co-created modular services in its own processes?”. In addition to guiding the research to provide an answer to the primary question proposed, the researcher considered the secondary questions as a means for enabling a scientific contribution.
In Appendix 8 the researcher presents her theoretical contribution to the existing understanding in co-created value-in-use created by modular services in the context of logistics and public healthcare sector in Finland. Next, the researcher will provide answers to the presented research questions starting from the theoretical questions and moving on to the primary question.

The customer organisation, namely the university hospital and its anaesthesiology unit in the surgery ward face difficulties with the internal logistics. More precisely, logistical issues are caused by lack of understanding the internal customer and the rather heterogeneous, unit specific needs inside the hospital. The lack of customer understanding, in return, appears to the medical staff as inflexibility which is considered to impede the patient care, and cause feelings of distrust and stress among the medical staff.

In practice, the lack of customer understanding and inflexible internally produced logistics services are considered to have led to relatively homogeneous service arrangements across the university hospital. That said, the internal logistics services are organised in a similar manner despite of unit and ward specific needs. In the anaesthesiology unit, logistical challenges are, for instance, related to disorganised inductions, unloaded deliveries, the use of corridors as storage space, lost deliveries and inflexibilities with regards to internal delivery schedules, and central warehouse opening hours. All the previously mentioned challenges combined with lack of human resources in the internal logistics services have led to reductions in direct work among the medical staff as anaesthesia nurses, in addition to their own work, are involved in organising logistics in their unit.

Reductions in the amount of direct work have led to inefficiencies in the patient care as the nurses use more of their working day to do indirect work that in this study is limited to logistics. Time spent, for instance, in looking for instruments in a disorganised induction to perform an operation, or impeded patient care are caused by lack of inventory in the automatic dispensing cabinet, Pyxis, are identified as
logistical challenges leading to an inefficient healthcare process realising as prolonged patient recovery and less optimal patient flow.

The second sub-research question was “What resources are shared in the value co-creation process?” Value co-creation is based on sharing of resources, such as information. In the context of this study, resources are shared between the healthcare customer and the external logistics service provider. The resources are shared in a four-step process consisting of identification of challenges, solution, modular service delivery and value-in-use and their more specific content are presented in Appendix 8 where resources written in *italics* do not appear in the context of this study but that describe hypothetical resources adopted from theoretical literature. The lack of customer input may have been due to the hypothetical relationship between the service provider and the customer making it challenging for the customer to comment on the value created by modular services. Furthermore, the content of the shared resources is shortly explained in brackets“( )”.

What comes to shared resources, it appears that resources are more versatile during the first two phases of the value co-creation process whereas they are more homogeneous in the last two phases. In the first two phases, the customer, for instance, shares information on the context, experiences and needs whereas the service provider shared resources such as relational capital, expert knowledge and diagnosing skills. However, in the last two phases, the service provider only shares information based on its expert knowledge (Appendix 8).

The third proposed sub-question was “How does the customer benefit from the co-created modular services in its own processes?” In this research, value-in-use created by the application of modular design in the hospital logistics is analysed applying Aarikka-Stenroos and Jaakkola’s (2012) study identifying indirect and direct monetary value and non-monetary value. Furthermore, the value arising from modularity is considered to be beneficial for either the strategic or operational-level actors in the hospital. The direct monetary value is achieved through cost savings stemming from more efficient design of logistics. The direct monetary value is,
however, argued to be more meaningful and visible to the strategic-level actors in the university hospital meaning the direct benefits of cost savings achieved through modularity may not be visible among the medical staff consisting of nurses.

The indirect monetary value is considered to result in value-in-use among the nurses. In practice, application of modularity in the logistics services in the hospital would create process and spatial efficiency. Furthermore, by investing in modular logistics design in the hospital, changing needs could be responded to both present and in the future. Increases in process efficiency is experienced through reduction of indirect work among the nurses. More precisely, modularity of logistics would allow the nurses to focus on patient healthcare which would lead in reductions in patient recovery time making the in-out patient flow more effective.

In addition to enabling process efficiency, logistics modularity is also noted to create spatial efficiency. Spatial efficiency would be achieved through flexible delivery planning and times leading to an increased amount of space in the corridors and inductions, for instance. The space efficiency would, in turn, create value-in-use to the nursing staff through improvements in patient logistics and safety.

Modularity is also noted to create non-monetary value-in-use for the nurses. The application of modular logistics would increase both well-being and trust among the medical staff. In practice, well-being among nurses would rise as by focusing on their actual work that is the patient care they would be more satisfied at workplace. Furthermore, well-being would increase due to increase in trust to logistics services.

In this study, the primary research question proposed was: “What kinds of value creation opportunities exist for the logistics service provider? Based on the strong presence of the internal logistics service provider in the university hospital, as well as safety restrictions limiting the external logistics service provider’s possibilities to take over the hospital logistics activities, the researcher does not advice the external service provider to look for opportunities to participate in the production of in-house logistics at the hospital. Instead, the greatest value creation opportunities within the
context of this study lie in consultancy due to the non-existent business relationship between the service provider and the customer. More precisely, the external provider could offer its expertise in modular service production as well as its knowledge in customer orientation to the internal logistics service provider to increase efficiency in the university hospital. Furthermore, the service provider could create value-in-use in the hospital by, for instance, educating the in-house logistics personnel. Additionally, the logistics service provider may offer the university hospital its resources to facilitate efficiency of internal logistics.

8.1 Theoretical Implications

The purpose of the current study is to explore a logistics service provider’s opportunities for increasing its market share in the public healthcare sector. That said, this research serves a practical need. However, to contribute to academia, the researcher combines existing literature and concepts from value co-creation, sharing of resources and modularity in the context of logistics services and the public healthcare sector.

The contributions of this study are two-fold: the research further confirms existing theories in value co-creation and modularity, and creates new knowledge that results from the combination of the original value co-creation models (Aarikka-Stenroos & Jaakkola 2012; Yazdanparast et al. 2010) and modularity (Pekkarinen & Ulkuniemi 2008; Rahikka et al. 2011) applied in the context of the current study.

Although modular design architecture is relatively common in the production of physical goods, research in modularity of services is still in its infancy (Rahikka et al. 2011; de Blok et al. 2010). According to existing research, modularity is regarded to be a superior form of service design in organisations serving customers with heterogeneous needs (Pekkarinen & Ulkuniemi 2008). The current study conducted in the context of logistics and healthcare further supports this argument. More precisely, this research suggests that application of modularity in the organisation of
logistics in the healthcare sector created value-in-use to the customer in several ways: in addition to creating monetary value, such as cost savings and process efficiency (Pekkarinen & Ulkuniemi 2008), modularity is also noted to create non-monetary value that is generated through co-creation activities that, in return, reinforces trust to logistics, stress, and well-being in the customer organisation.

Furthermore, the suitability of modular service design in the context of healthcare is expanded from covering elderly care (de Blok et al. 2010) and general logistic processes and the focus is shifted from the conventional service provider and strategic-level healthcare customer (Kriegel et al. 2013) viewpoint to operational staff, i.e. nurses and their experiences of value-in-use created by modular logistics services (de Blok et al. 2010).

In addition to contribution to literature in modularity, the current study supports the value co-creation model introduced by Aarikka-Stenroos and Jaakkola (2012) and its applicability to knowledge intensive business context. Moreover, this study contributed to the model by assessing its suitability to function as a simulative framework for hypothetical business opportunity explorations. Furthermore, the researcher modified the original model limiting it to only cover modular services. Through this limitation, the model is noted to be relatively adaptable. Finally, in addition to modifications to the value co-creation framework, this study suggested the model could be expanded into an iterative process model looping from the value-in-use phase to the needs identification stage similarly to Yazdanparast et al. (2010) as information on current value-in-use facilitated by modular services could be used to develop internal logistics at the university hospital.

8.2 Managerial Implications

To the practitioners this research will provide ideas and notions for increasing market share in the customer or potential customer organisation through co-creation and value-in-use. This study proposes a framework with focus on the value co-creation process (Aarikka-Stenroos & Jaakkola 2012; Yazdanparast et al. 2010, share of
resources and customer value-in-use (Aarikka-Stenroos & Jaakkola 2012; Grönroos & Voima 2013) achieved through modularity of services (Pekkarinen & Ulkuniemi 2008). The findings of this study are manifold and may be applied in practice.

In this study, value co-creation is regarded a four-stage process consisting of phases named identifying challenges, solution, modular service delivery and value-in-use. Seeking opportunities for market expansion, the service provider ought to focus on the customer and its need. Even so, sometimes the customer may not know what the need is. That is why, it is important in the challenge identification stage to allow the customer freely tell and share information about the organisation to gain an insight of the customer organisation and its environment in order to detect possible internal weaknesses and possible business opportunities. That said, in the challenge identification phase, the customer organisation ought to take a dominant role. However, it is of importance to enable a mutual sharing of information in this phase and throughout the whole process.

Once challenges in the customer organisation have been detected, the service provider organisation may wish to take a leading role for the three up-coming phases that are the solution, implementation and value-in-use. In the solution phase ideas on how to address the existing challenges in the customer organisation are proposed and discussed.

In the service delivery phase, the service provider may discuss actual practical service delivery methods to provide the customer with a more concrete understanding of the problem solution. For instance, in the context of this study, the means for achieving customer value-in-use was services modularity, a concept aiming for tailored services at low cost.

In the final phase, that is value-in-use the service provider presents ways in which the value created by, for instance, the application of modularity to in-house logistics in a large hospital realises in the customer processes. To clarify, in this phase, the service provider is to present concrete benefits and outcomes on how the intended means for
addressing the detected issue or challenge *improves processes* in the customer organisation creating customer value-in-use.

Although, this study suggests, the service provider ought to take a dominant role due to its expertise and understanding in the solution, service delivery and value-in-use phases of the value creation process, it is of importance to retain the customer focus and allow the customer to suggest ideas for improvement with regards to the detected challenge.

In addition to proposing practical ideas for the general value co-creation process, this study is concerned with value created through modularity of logistics in the context of a large university hospital. Based on the findings, modularity is alike with findings presented by Pekkarinen and Ulkuniemi (2008) a rather attractive means for addressing heterogeneous customer needs regarding, for instance, diverging internal delivery time or inventory requirements. Thus, practitioners currently operating in or wishing to expand to markets with heterogeneous needs may consider modularity a suitable means for achieving and maintaining competitive advantage.

### 8.3 Evaluation of the Research

In evaluating the quality of a case research, it is suggested by Yin (2009) as well as by Beverland and Lindgreen (2010) that four different criteria be used. The criteria commonly used in case evaluations are *construct validity, internal validity, external validity* and *reliability*. Especially, in qualitative research concepts of *validity* and *reliability* are used assess whether the research results can be trusted (Koskinen et al. 2005, 253).

Validity refers to the fit between the models as well as divergent figures theories and concepts used to assess the reality. Thus, one may consider validity to describe the extent to which the researcher has successfully managed to study the phenomenon under examination (Gummesson 2000, 91–92.)
According to Yin (2009, 40) construct validity aims at “identifying correct operational measures for the concepts being studied.” In other words, the researcher ought to use his/her own personal judgement in order to determine appropriate measures for the chosen concepts. Construct validity is addressed through data triangulation where the researcher collects data from multiple divergent sources or interviews. Furthermore, construct validity is increased by illustrating data gathering related information using tables and direct quotes. Additionally, the researcher may improve validity of his/her study by allowing the interviewees to review the study and give feedback. (Beverland & Lindgreen 2010, 57.) This way, misunderstandings may be avoided. In this study, construct validity was increased by collecting data using three divergent methods that were semi-structured interviews, observation and group discussion. Furthermore, the transcribed interviews and the analysis were sent to the interviewees for feedback purposes.

Another way to assess a case research is to consider its internal validity. Internal validity is related studies where an established causal relationship suggests that “certain conditions lead to other conditions” (Beverland & Lindgreen 2010, 57; Yin 2009, 41). That said assessing internal validity is not necessary in case studies that are either descriptive or exploratory in nature (Yin 2009, 43). As the current study may be regarded experimental, analysing internal validity is not considered relevant.

In addition to construct and internal validity, Yin (2009, 43) suggests assessment of external validity to be relevant in the context of case studies as this validity form is used to analyse whether the results may be generalised or not. External validity may be operationalised in case research by specification of the chosen population and “replication logic in multiple case studies” (Beverland & Lindgreen 2010, 57) As the present study may be regarded as a case study containing a relatively narrow amount of empirical data, the results are not to be generalised as they are context dependent. However, the framework created for the purpose of this study is built upon existing, tested theory and thus, the framework may be replicated. Furthermore, the population for the current study was specified and identified as actors involved in the customer organisation and the service providing organisation.
Having assessed validity, the reliability of the study is to be evaluated. Reliability is related to replicability of a given study. More precisely, the objective of this concept is to make sure that the study is described in such detail that another researcher following the research procedures is able to replicate the study and arrive at similar findings and conclusions” (Yin 2009, 45). According to Beverland and Lindgreen (2010, 57) reliability may be improved through establishment of a standardised interview protocol, well-defined constructs based on existing literature and providing access to data. In this study, reliability is achieved through a thorough explanation of the research process, including description of data collecting and analysing methods. Additionally, interviews were transcribed and the research fellows involved in the project were granted a free access to the interview data. Furthermore, the transcribed material was sent to the interviewees to allow them to make corrections to the transcriptions.

However, a factor influencing the reliability of this study occurred during the service provider organisation interviews conducted on the 15th of January 2015 as the interview structure designed for the operational-level interview as well as the research questions had to be partially modified during the interview. More precisely, the interviews on both operational- and strategic-level were supposed to be conducted separately, however, the situation changed and both of these interviews were conducted as one joint conference call in the area manager’s office to allow the participation of the business manager and production manager based elsewhere. Due to the production manager joining the strategic-level interview, some of the shared questions the purpose of which was to warm-up the interviewees were no longer needed. Instead, the researcher developed some new questions based on information shared by the production manager during the interview (Table 2, p. 51).

8.4 Research Limitations and Directions for Future

In this study, the focus was to explore a logistics service provider’s business opportunities in the public healthcare sector. The researcher adopts a customer-oriented approach to the research problem emphasising operational-level value-in-
use outcomes excluding the strategic-level point-of-view. Furthermore, the researcher did not involve the internal logistics service provider at the university hospital in the research process meaning this particular actor was not given a voice in the study. Thus, the empirical material may be regarded skewed. However, logistics arrangements at the case hospital have been studied previously from the internal logistics service provider point-of-view (Piuva 2015). Additionally, the number of conducted interviews could have been higher to increase the research validity.

Considering the abovementioned limitations, future research ought to involve all relevant actors to avoid missing relevant information. Furthermore, there appears to be a lack of research in operational-level value-in-use carried in the context of public healthcare, however, more research is needed as operational-level value-in-use experiences differ from those of strategic-level (MacDonald et al. 2011, 677).

Furthermore, considering existing research in modularity, the current findings including those of this study are rather vague in nature. Thus, research with a more concrete approach is needed.

This study is a part of a multidisciplinary project where topics similar to this study will be analysed from different viewpoints.
REFERENCES


**Internet sources**


**Empirical Sources of Primary Data**

University Hospital & Service Provider. (2015) Group Discussion. 4.2.2015.

**Empirical Sources of Secondary Data**

Regional Hospital. Meeting. 16.12.2014. 10:00-12:00.
Appendix 1. Interview Nurses, University Hospital

I) Haastateltavan Yleistiedot/ General information
1. Nimi/ Name
2. Toimenkuva organisaatiossa/ Position in the organisation
3. Osamisalueet/ Areas of knowledge

II) Työpäivän kulku (prosessi) Common day at work (process description)
4. Kertoisitteko vapaamuotoisesti toimintaympäristöstänne (esimerkiksi osastosta)?
   Freely describe your working environment (ward, for instance)
5. Kertoisitteko vapaamuotoisesti tavallisesta työpäivästänne? Millaisia toimintoja..
   Freely tell about a common day at work? What kinds of activities..
6. Kertoisitteko vapaamuotoisesti omasta toimekuvastanne?
   Freely tell about your own job.
7. Kuuluuko työpäivässä varsinaiseen työtehtävään kuulumattomia tehtäviä?
   a. Millaisista tehtävistä on kyse?
   b. Miltä tehtävät omasta mielestänne tuntuvat?
   Do you take on tasks that do not necessarily belong to your job? a) What kinds of tasks? b) How do they make you feel?
8. Millainen vaikutus työhönkuulumattomilla tehtävillä on osastonne/ oman toimenkuvanne näkökulmasta?
   What kind of meaning does logistics (no patient logistics) have to your ward/ your own work?
9. Kertoa vapaammin tehtävistä, joiden ongelmia tuo osastolle?
   How do the additional tasks influence your own performance at work? Elaborate.
10. Kertoa vapaammin tuotantoon kuulumattomista tehtävistä, joiden ryhmää on määritelty?
    How do you think the impact of additional tasks on your own work/environment could be reduced?

III) Logistiikka leikkausosastolla + Palveluntuottaja/ Logistics at the surgery ward + the service provider
10. Millainen merkitys logistiikalla (ei potilaskuljetus) on osastonne/ oman toimenkuvanne näkökulmasta?
    What kind of meaning does logistics (no patient logistics) have to your ward/ your own work?
11. Miten tavarantoimitus on järjestetty osastollanne? Miten tavaraa toimitetaan, minne toimitetaan jne, kuka jakelee?
    How have delivery related activities been arranged in your ward? How are orders delivered, where are they delivered and who delivers?
12. Oletteko havainneet työympäristöonnestun tuotantoon kuulumattomia logistiisia ongelmia/tekijöitä? Pyydä
    Have you identified logistical challenges in your work environment? Ask for examples.
13. Osa osastollanne on käytössä hylytyspalvelu, kertoisitteko vapaasti hylytyspalvelun käytöstä. Jos e osoaa kertoa, kysy vaikka seuraavia:
    a. Ketkä käyttävät hylytyspalvelua?
    b. Miten sitä käytetään?
    c. Millä tavoin hylytyspalvelua voitaisiin kehitellä?
    You use shelving services in your ward. Can you freely tell, how you use these services? If needed, ask a) Who uses b) How it is used c) How could the services be developed?
14. Toimitetaanko osastollanne tavaraa muutoin kuin hylytyspalvelun kautta? Pyydä
    tarkennus.
Do you receive deliveries by actors other than shelving services? Ask for specifications.

15. Miten osastonne tavarantoimitusjärjestelyjä voitaisiin kehittää (siten, että ne vastaisivat paremmin osastonne tarpeisiin)?
   How do you think delivery arrangements in your ward could be developed (so that they would better respond to your needs)?

   What services does the service provider provide to your ward? If no knowledge, ask for what other providers they know.

   What do you think about the service provider’s services? Ask for specifications. NOTE! If no knowledge, ask how they feel about logistics arrangements in general.

18. Millaisissa tilanteissa koette Palveluntuottajan palveluista olevan hyötyä? Miten itse hyödytte tavarantoimituksesta?
   In what situations do you benefit from the service provider’s services? How do you benefit from deliveries?

19. Miten arvioisitte palveluntuottajan luotettavuutta?
   How do you evaluate the service provider’s reliability?

20. Miten luonnehtisitte palveluntuottajan asiakaspalvelua?
   How do you evaluate service provider’s customer service?

21. Onko Teillä ollut työuranne aikana kokemusta muitten Palveluntuottajan-kaltaisten palveluntottajan palveluista? Kysy tarkentavia kysymyksiä esimerkiksi:
   a. kilpailijan palveluista?
   b. palveluntottajien välisistä eroavaisuuksista?
   Do you have experience with other logistics service providers’ services here at the hospital? Ask, for instance, a) How the services were experienced b) If there are differences between the service provider’s and competitors offerings.
Appendix 2. Interview Procurement, University Hospital

I) Yleistiedot/ General information

1. Nimi/ Name
2. Työnimike ja kokemus/ Task and experience
3. Tehtävät ja vastuualueet organisaatiossa/ Tasks and areas of responsibility in the organisation

II) Yleistiedot, ostoprosessi/ General information procurement process

6. Millä tavoin hankintatoimen budjetti on jaettu palvelujen ja hyödykkeiden kesken? How has the annual budget been divided between services and goods procurement?
7. Onko tavaroiden ja palvelujen hankintaprosesseissa eroavaisuuksia? Millaisia? Are there differences in procurement of goods and services? How do they differ from each other?

III) Logistiikka ja logistinen palveluntuottaja / Logistics and Service provider

8. Kertoisitteko vapaamuotoisesti logistiikan merkityksestä organisaationne toiminnan kannalta. Could you freely describe the role of logistics in your organisation?
11. Kertoisitteko vapaamuotoisesti yhteistyöstänne palveluntuottajan kanssa? Kysy tarvittaessa miten yhteistyö sujuu. Can you freely discuss your collaboration with the service provider? If needed ask about experiences regarding the collaboration.
12. Mitä palveluita ostatte palveluntuottajalta? (jakelu, varastointi, hallinto) What services do you buy from the service provider?
13. Millaisia odotuksia/mielikuvia liitätte palveluntuottajan palveluihin? What kinds of expectations and thoughts do you relate to the service provider’s services?
14. Mitkä organisaationne osastot, prosessit, tehtäväalueet ovat merkittävimmäät Palveluntuottajan asiakkaita? Which ones your wards, processes and operational areas do you consider to be the most important customers to the service provider?
15. Millaiset tekijät ovat vaikuttaneet päättöseen ostaa kyseiset palvelut Palveluntuottajalta jonkin muun Palveluntuottajan sijaan? What kinds of factors have influenced your decision to buy these services from the service provider instead of a competitor?
16. Miten Palveluntuottajat mielestänne eroaa kilpailevista palveluntuottajista? How does the service provider in your opinion differ from its competitors?
17. Miten arvioisitte Palveluntuottajaa palveluita tällä hetkellä? Arvioikaa vapaasti esimerkiksi palveluitten mahdollisia hyötyjä ja puutteita?
How would you evaluate the service provider’s current services offering? Freely discuss possible benefits and weaknesses, for instance.

To what extent has the service provider succeeded to fulfil your expectations? Ask for examples.

a. Keneltä? 
b. Millaista palautetta?  
c. Millaisissa tilanteissa palautetta on tullut?  
Have you received feedback considering the service provider’s services from the hospital staff, such as nurses? If necessary, ask a) From whom? b) What kind of feedback? c) In what situations have you received feedback?

20. Millaisia logistisia palveluita hankitte sellaisenaan, millaisia palveluita pitää räätälöidä?  
What kinds of logistics services do you buy standardised and which ones need to be tailored?

21. Miten kuvailisitte Palveluntuottajan kykyä tuottaa palveluita sairaalan tarpeita vastaaviksi?  
How would you evaluate the service provider’s ability to produce services that suit needs at the hospital?

22. Uskotko yhteistyön Palveluntuottajan ja organisaationne välillä jatkuvan myös tulevaisuudessa? Miksi, miksi ei?  
Do you think collaboration between the service provider and the hospital will continue in the future? Why? Why not?
Appendix 3. Interview Logistics Service Provider, Strategy Level

I) Yleistiedot/ General information
a. Nimi/ Name
b. Toimenkuva organisaatiossa/ Position in the organisation
c. Työtehtävät/vastuualueet organisaatiossa/ Tasks and areas of responsibility
d. Työkokemus/ Work experience

II) Yleistiedot, logistinen palveluntuottaja, julkinen sektori/ General information, log. Serv. Provider, public sector
1. Mitä palveluita logistinen palveluntuottaja tuottaa?
What services does your organisation produce?
2. Millaisia ovat Palveluntuottajan vahvuudet?
What kinds of strengths do you possess as a service provider?
3. Mitkä ovat Palveluntuottajan toiminta-alueet ja miten ne jakautuvat?
What are your main business areas?
4. Millaisia asiakkaita palveluntuottajalla on?
What kinds of customers do you have?
5. Millaisia asiakkaita palveluntuottajalla on?
What kinds of customers do you have?
6. Mitkä ovat Palveluntuottajan merkittävimmät kilpailijat?
Who are your main competitors? a) How do you differ from your competitors?
7. Millainen merkitys julkisen sektorin asiakkaiden pyynnötteille on?
What kind of meaning do public sector customers have to your business?
8. Miten julkinen sektorin asiakkaiden pyynnötteille on?
What kinds of differences are there in serving a public and private sector customers? If necessary, ask about differences, challenges and opportunities
9. Palveluntuottaja ilmoittaa tavoittelevansa toiminnassaan kustannustehokkuutta, miten tämä näkyy palvelujen suunnittelussa?
Your organisation announces it aims for cost efficiency, how does this goal impact your service development activities?
10. Millä tavoin palveluntuottaja rakentaa palvelunsa, jotta se pystyy vastaamaan julkisen sektorin tarpeisiin?
How do you design your services to be able to respond to public sector needs?

III) Terveydenhuollon asiakkuudet/ Healthcare customers
12. Kuinka suuri osa Palveluntuottaja asiantuntijoiden asiakkaita kuuluu julkisen terveydenhuollon piiriin?
What percentage of your customers belongs to the public healthcare sector?
13. Mitkä terveydenhuollon asiakkaat ovat merkittävimpiä?
Which actors in the public healthcare sector are you most significant customers?
14. Millä tavoin terveydenhuollon asiakkuudet eroavat muista julkisen sektorin asiakkaita?
How do the public healthcare customers differ from other public sector customers?
15. Millaisia haasteita julkisen sektorin terveydenhuollon palvelumisessa on?
What kinds of challenges do you face serving public healthcare customers?
16. Miten palveluntuottaja on hyötyä julkisen sektorin tarpeisiin?
How have you tried to respond to these challenges?
17. Millaisia erilaisia palveluntuottajien tarpeita on kuuluneet?
What kinds of services solutions have you developed for a public healthcare sector? Please exemplify, (domestically, locally)
18. Millaisissa tilanteissa julk. terveys palveluhenkinnat....
In what situations do public healthcare customers look for a) Untailored services b) Tailored services?

19. Millä tavoin palveluntuottaja pyrkii vastaamaan terveydenhuollon asiakkaiden räätälöintitarpeisiin?
   a. Millä tavoin mahdolliset räätälöintitärkeet on otettu huomioon Palveluntuottajan palveluiden suunnittelussa?
   How do you aim to respond to services needs in the public healthcare sector that require tailoring?

20. Millainen merkitys Palveluntuottajan ja asiakkaan välisellä yhteistyöllä on seurauvissa vaiheissa?
   a. Tarpeiden kartoitus
   b. Palvelun suunnittelu
   c. Palvelun tuottaminen ja kuluttaminen
   What is the meaning of collaboration in the following phases? a. Need identification b. Service development c. Service production and use?

IV) Alueelliset terveydenhuollon asiakkaat/ Local public healthcare customers

21. Millainen merkitys sairaanhoitopiirin asiakkaiden palveluntuottajalle?
   What kind of a meaning does the hospital district have to your organisation?

22. Millaisia palveluita palveluntuottaja tuottaa sairaanhoitopiirille?
   What kinds of services do you produce to the hospital district?

23. Miten sairaanhoitopiirin palvelutarpeet eroavat alueen muitten julkisten asiakkaiden tarpeista?
   How do the needs differ between the district hospital and other local public healthcare customers?

24. Millaisia palveluita palveluntarjoaja tuottaa tällä hetkellä alueelliselle yliopistosairaalalle?
   What kinds of services do you produce to the regional university hospital?

25. Miten yliopistosairaalan palvelutarpeet eroavat alueen muitten julkisen sektorin asiakkaiden tarpeista?
   How do these needs differ from those of other local public sector customer needs?

26. Millaisia haasteita yliopistosairaalan palvelumiseen liittyy?
   What kinds of challenges are there in serving the university hospital?

27. Millaisia logistisia ongelmakohtia yliopistosairaalassa on palvelutuottajan näkökulmasta?
   What kinds of logistical challenges do you think there exists in the university hospital?

28. Millainen merkitys yhteistyöllä on yliopistosairaalan asiakkaiden näkökulmasta?
   a. Millaisissa tilanteissa yhteistyön merkitys korostuu?
   What kind of a meaning does collaboration have considering the university hospital? a. In what kinds of situations is the need for collaboration emphasised?
Appendix 4. Interview Logistics Service Provider, Operational Level

I) Haastateltavan Yleistiedot/ General information
1. Nimi/ Name
2. Toimenkuva organisaatiossa/ Position in the organisation
3. Työtehtävät/vastuualueet organisaatiossa/ Tasks and areas of responsibility
4. Osaamisalueet/ Area of specialisation

II) Yleistiedot, palveluntuottaja, liiketoiminta-alueet ja asiakkuudet
General information, service provider, business areas and customers

5. Kertoisitteko vapaamuotoisesti Palveluntuottajan liiketoiminta-alueittain?
   a. Millaisia palveluita liiketoiminta-alueet tuottavat?
   b. Mitkä ovat Palveluntuottajan kannalta tärkeimmät liiketoiminta-alueet?
   Tell freely about services in your main areas of business. a. What kinds of services are produced and what are the most important business areas in your organisation?

6. Millainen merkitys kullakin eri palvelualueilla on Palveluntuottajan toiminnalle?
   Discuss the meaning of each one of your business areas to your business.

7. Millä tavoin asiakkaanne ovat jakautuneet julkisen ja yksityisen sektorin välillä? How many customers do you have in the public/private sector

8. Kertoisitteko vapaamuotoisesti julkisen sektorin liiketoiminta-alueittain?
   Freely discuss public sector customers in each one of your business areas

9. Kertoisitteko vapaamuotoisesti, millaisia palveluita toimitatte julkisen sektorin asiakkaille
   a. Millaisia palveluita toimitatte julkiselle terveydenhuollolle (kysy erikseen, jos ei oteta esille)
   Freely discuss what kinds of services you deliver to public sector customers? A) And the public healthcare customers.

10. Millaisia tekijöitä julkisen sektorin asiakkaat arvostavat eri liiketoiminta-alueen palveluissa? Kysy esim. millaisia erilaisia tarpeita heillä on, mitä edellyttävät, vaativat jne. What kinds of things do the public sector customers value in your services?

11. Miten olette pyrkineet ottamaan edellä mainitut tekijät huomioon palvelujen suunnittelussa?
    How have you taken these experiences into account in your services development?

III) Palveluitten rakenne, palveluprosessit/ Service structures and processes
    Freely describe one typical services process (or multiple). (How are services developed, what kinds of phases exist). After this, ask for a description of a possible special process

   How are your services formed in terms of individual steps? Concretically exemplify.

14. Millä tavoin pystytte vastaamaan sekä julkisen että yksityisen sektorin tarpeisiin? (esimerkiksi budjettiiroinhin, erityistoiveisiin?)
   a. Miten palvelut on rakennettu
      What makes it possible to serve both public and private sector customers’ needs (for example budget differences, special requirements) a. How are these services developed?

15. Palveluntuottaja ilmoittaa tavoittelevansa toiminnassaan kustannustehokkuutta, kuinka tämä näkyy
   a. Palvelujen,
   b. Prosessien suunnittelussa,
   c. Resurssien suunnittelussa?
You aim for cost efficiency, how does this goal affect the planning of a. Services b. Processes c. Resources?

IV) Organisaation rakenne/ Organisational structure
16. Kertoisitteko vapaamuotoisesti Palveluntuottaja-organisaatiosta (jos ei tule ilmi, kysy esim, rakenne, resurssisuunnittelu, hierarkiat, maantieteellinen sijoittautuminen)..<?
   Freely discuss your organisation. If not discussed, ask about structure, resource planning, hierarchies, geographical distribution..<
17. Miten Palveluntuottaja-organisaation rakenne edesauttaa palvelujen tuotantoa?
   How do you think your organisational structure contributes to your service planning?
Appendix 5. Guiding Questions for Group Discussion

Healthcare professional questions marked with red, Logistics service provider questions with blue.

1. What would you define as the most crucial logistical challenges in your unit or hospital?
2. Why are these most central? How do they influence you and your colleagues work?
3. How could you respond to these problems?
4. What kinds of solutions have you developed for other hospitals?
5. Based on your expertise and the report, what do you reckon are the most central logistics issues?
6. How could these be solved utilising your services? How would you produce these services?
7. How would you and your colleagues benefit from these services in your work?
Appendix 6. Analysis Nodes

Diagnosing Needs
*Customer
*Service Provider

Solution
*Customer
*Service Provider

Implementation
*Customer
*Service Provider

Value-in-Use
*Customer
*Service Provider

Other
Appendix 7. Observations on Possible Logistical Challenges at the University Hospital Central Surgery Ward

Report: Observations on possible logistical challenges
Data collected in 2015 in weeks 2-3

I conducted interviews at the central surgery ward and additionally I did a guided tour in the ward facilities together with the nurses. Based on the interviews and the tour, I formed my own simplified process description where possible logistical challenges are discussed as objectively as possible all the way from the order placement to the operation and post-operative procedures with emphasis on medical staff, i.e. nursing staff point-of-view.

Needs----Order---Delivery---Pre-Operation---Operation---Post Operation

Needs

At the surgery ward in the university hospital order requests in the theatre are placed by the medical staff who inform the staff nurse about their needs who further informs the central warehouse placing the final order.

Orders

Order requests placed the previous day are manually checked the following morning. The person responsible for the procedure additionally modified the orders as well as cost centres if necessary. In unclear situations the nurse verifying the orders contacts the procurement department. During the weekend order requests pile up as a result of which the beginning of the week is usually reserved for order placement tasks. A nurse responsible for placing orders describes her own process in the following way:

“I take care of possible instrumentations and that they are taken downstairs for instrument care.. I inform the operative staff that we have this kind of a care and then I sometimes have a representative with me and then I place orders till 2:15 PM after which I sign deliveries and verify we have received the correct orders. We encounter delivery failures rather often as we have our own things and Avohoitotalo has its own then we send them there and back.” (Staff Nurse, Surgery 2015.)

Incorrectly fed order numbers cause delays at times as reference numbers are kept in folders. Some of the orders are taken care of by an internally produced actor called shelving services utilising an inventory system, Pyxis. During the process of adopting this system some challenges have been faced by the staff as all the products stored in the system do not have an inventory button meaning the inventory and monitoring of lower limits is not up-to-date

Deliveries

In discussing deliveries the medical staff emphasises reliability and safety. One nurse expresses her concern for commitment of logistics professionals in the university hospital. She finds it important that availability of certain items is guaranteed.

“[I]t isn’t always understood how important it is that we have access to certain items. We can’t wait for a year until the next batch is ready […] [R]eaction to changes in availability must to be extremely
fast be it a fluid, goof or clothing, or whatever. We can’t function without them.” (Staff Nurse, Anaesthesiology 2015.)

Additionally delivery delays may cause operation delays and create up to 500-1000 euros of staff costs every hour.

The tasks belonging to the nursing staff are classified as direct or indirect. Direct tasks are related to patient care and indirect to all other activities. For instance, in the absence of the ward pharmacist the nurses unload medical deliveries and feed the information to Pyxis inventory system. However, these tasks have decreased due to staff training and hiring of new staff. In the case of urgent deliveries the medical staff representative is in contact with the central warehouse requesting them to contact the medical staff immediately after the goods have arrived. Having received this information a member of the medical staff rushed in the warehouse to pick up the delivery. The central warehouse and internal deliveries run until 3PM after which, in cases of emergency, an external logistics service provider has been used and requested to deliver the order sometimes all the way to the theatre. An external service provider creates value by guaranteeing service deliveries and delivery assurance.

In most cases, the external service provider delivers the orders to the goods reception from where the orders are further delivered to wards. Delivery failures occur relatively often. Tracking is difficult. In the university, internal delivery failures are regarded to be in correlation with the change of staff.

Accurate delivery times are especially important as in order to guarantee operational functionality, access to certain goods are needed. On the other hand, orders delivered too early congest activities carried in the central warehouse.

In the ward, postal orders are delivered by an internal courier. Mail is delivered to the ward in a bunch that is further organised by the ward secretary or a member of the medical staff.

Pre-Operative Procedures

If a lack of certain medication is observed during the pre-operative phase, the nurse responsible for preparing the theatre refills the medication cabin by collecting needed products from the pharmacist where inventory is kept up-to-date with Pyxis. All large-sized equipment has its own place due to their low number. Thus, returning the equipment to its own place is especially important. Due to lack of space in the ward, items such as trolleys, cabinets and boxes are stored in the corridors. According to a nurse, this makes patient logistics difficult at times. There is not enough storage space in the ward. Some of the stuff is stored in theatres or somewhere close. Below a comment related to shelving services responsible for storage arrangements at the ward:

“Some of the shelves are too deep, they could be of divergent depths. Additionally, the packages may sometimes be too large. Previously our equipment specialists unloaded the package in five different theatres.” Staff Nurse, Anaesthesiology 2015.)

Operation (Surgery)

During the operation the medical staff may have to leave the theatre to pick up items that have run out or that do not exist in the theatre. In the medical ward, restocking is organised by in-house shelving services (3-5 members of staff responsible for the whole hospital) utilising the Pyxis system. According to the medical staff the shelving services representatives do not unload deliveries but shift this task to the medical staff. All the deliveries look the same and in urgent situations finding the correct item may be rather challenging. Additionally, some of the items are stored in a locked cabinet. In order to gain access to these, the medical staff first need to sign in to the Pyxis system. Sometimes
the system fails to respond. In these situations the medical staff member reaches for the lock with a key to the cabinet placed on top of it using a chair, for instance. On top of the cabinet there are unloaded boxes that may sometimes fall on the nurse.

The automatic inventory system is not finished. Some of the products are delivered unloaded automatically after the lower limit has been reached. Deliveries are not unloaded to different storage rooms. Instead, even if there was a need for a delivery of 40 items, the delivery may contain 100 items. This leads to clogs in the storage room. Some of the orders are taken care of by the medical staff as the adoption of the Pyxis system is in progress. Everyone follows the inventory. Shelving services deliver goods once a week although there is a need for more deliveries. Additionally, the deliveries are made only during daytime and during the night the medical staff picks up needed items themselves from the central warehouse. Placing items correctly both in the central warehouse and ward storage rooms is especially important. Below are some comments related to shelving services:

“It has been really tough for our staff as sometimes the needed item has not been found. This Pyxis system is kept updated by pressing buttons meaning when you take a piece of equipment, you press the button and the machine knows that one of the then items has been taken. But currently, there are no buttons to press. As a result, we are doing all sorts of things in parallel where the equipment care specialists restock the shelves which is a task belonging to the Pyxis system and shelving services.” (Staff Nurse, Anaesthesiology 2015.)

“After the xray had been introduced to shelving services, I went to prepare the space. I had a male patient and no delivery point had breathing masks for men in store. That itself is a horrible deficiency. We can’t oxidise a male with a large face with a mask too small. Then I phoned xx and you phoned shelving services and they said they would deliver masks tomorrow. That was not good enough because we had patient at the time and they may have had an urgent need. The xray is locate only one floor below us, and we have those masks in our unit but it is not a good idea to leave the patient alone. That was an example of a problematic situation. Deficiencies are not allowed, the [shelves] must be full.” (Nurse, Anaesthesiology 2015.)

In case items needed during the operation are not available in storages located outside the theatres, a member of staff is sent to the central warehouse to collect the missing item. According to the interviewed nurse in the anaesthesiology unit, picking up items is part of her job. Sometimes the nurses also collect large-sized equipment needed during the operation.

Post-Operative Procedures

After an operation has finished, the medical staff re-organises the theatre for the upcoming operation. Operations create plenty waste: largest operations up to five refuse sacks of litter. Additionally, some of the equipment used during the operation need to be cleaned directly after use due to the low number of items and/ or to maintain of operational efficiency. However, not all the nurses remember to send the expensive equipment for cleaning. As a result, patient care processes may be delayed. All nurses are expected to be responsible:

"Everyone should know what they need to take care of. You can’t leave stuff behind because it is a disaster for the next person who can’t find it. Or if it hasn’t been cleaned or something similar.” (Staff Nurse, Anaesthesiology 2015.)

Additionally, the operating staff takes care of needs identification in the theatre and delivers order requests to the staff nurse.
### Appendix 8. Value Co-Creation Process and Shared Resources

<table>
<thead>
<tr>
<th>Healthcare Customer Resources</th>
<th>Logistics Service Provider Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information on Needs (Collaboration)</td>
<td>Diagnosing Skills (Internal Logistics Issues)</td>
</tr>
<tr>
<td>Information on Experiences (Challenges and Current Solutions)</td>
<td>Expert Knowledge (Lack of Customer Orientation)</td>
</tr>
<tr>
<td>Information on Context (In-House Traditions, Training)</td>
<td>(Lack of Communication)</td>
</tr>
<tr>
<td>(Lack of Flexibility)</td>
<td>Relational Capital (Empathy, Understanding the Customer)</td>
</tr>
</tbody>
</table>

| Solution |
|-------------------------------|--------------------------------------|
| Information on Needs (Collaboration) | Expert Knowledge (Co-Development, Communication) |
| Information on Experiences (Challenges and Current Solutions) | Modular Service Structure) |
| Information on Context (In-House Traditions, Training) | Diagnosing Skills (Flexible & Tailorable Services Needed) |

| Modular Service Delivery |
|-------------------------------|--------------------------------------|
| Information on Context | Expert Knowledge: |
| Information on Needs | **Modularity in Services** (Customer Need, Automatisation) |
| Industry Expertise | **Modularity in Organisation** (Contracts and Agreements) |
| Production Material | (Facilities, Equipment and Resources) |
| Effort and Times | **Modularity in Processes** (Efficiency, Tailoring) |
| Financial Resources | |
| Information on Experience | |

| Customer Value-in-Use |
|-------------------------------|--------------------------------------|
| Information on Context | Expert Knowledge (Value-in-Use through Modularity): |
| Information on Needs | **Indirect Monetary Value** |
| Industry Expertise | Space and Process Efficiency |
| Production Material | **Non-Monetary Value** |
| Effort and Times | Well-Being & Trust, Decreased Stress |
| Financial Resources | |
| Information on Experience | |

Resources

Interactions

Service Delivery integrates to Customer Processes