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**VALUE PROPOSITION DEVELOPMENT AND COMMUNICATION:  
A CASE STUDY FROM MEASUREMENT INSTRUMENT INDUSTRY**

Master's Thesis

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## ABSTRACT

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<p>Customer value proposition has a critical role when companies communicate how their offering is generating value to potential customers. The objective of this research is to identify the key values of case company's new measurement device and study how customer references could be used to communicate the value proposition.</p> <p>The theoretical part of this study consists of a literature review about customer value, value proposition, value co-creation, value-based selling, value assessment and customer reference marketing. Empirical part presents a qualitative case study which applies these theories into practice and combines them with the results from 16 interviews conducted during the research.</p> <p>Results of the study introduce four key values that case company should use to communicate how their offering is creating value to the customer. These values are based on in-depth analysis of customers' business model and how case company's offering generates value in it. Customer reference marketing is identified as an effective way to communicate these values and best ways for case company to utilize references are proposed. The main finding is that the use of references needs to be systematical and based on clearly defined objectives that guide the reference selection and use.</p>	

## TIIVISTELMÄ

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<p>Arvolupauksella on kriittinen rooli, kun yritykset viestivät sitä, kuinka heidän tarjoomansa tuottaa arvoa potentiaalisille asiakkaille. Tämän tutkimuksen tavoitteena on tunnistaa case-yrityksen uuden tuotteen tärkeimmät asiakasarvot ja tutkia kuinka asiakasreferenssejä voidaan käyttää arvolupauksen viestimisessä. Työn teoreettinen osa koostuu kirjallisuuskatsauksesta, jossa käsitellään asiakasarvoa, arvolupausta, arvon luontia yhteistyössä, arvopohjaista myyntiä, arvojen määrittämistä sekä referenssimarkkinointia. Työn empiriaosa esittelee laadullisen case-tutkimuksen, jossa esitellään tulokset 16 haastattelusta sekä yhdistetään kirjallisuuskatsauksen tulokset case-yrityksen käytännön tarpeisiin.</p> <p>Työn tuloksissa esitellään neljä tärkeintä asiakasarvoa, joita case-yrityksen tulisi käyttää viestiessään siitä, kuinka tarjooma tuottaa hyötyjä asiakkaalle. Nämä arvot perustuvat syvälliseen analyysiin potentiaalisten asiakkaiden liiketoiminnasta sekä siitä, kuinka case-yrityksen tarjooma tuottaa arvoa asiakkaalle. Referenssimarkkinointi on todettu tehokkaaksi tavaksi välittää näitä arvoja asiakkaille. Tuloksissa ehdotetaan erilaisia tapoja, joilla case-yritys voi hyödyntää referenssimarkkinointia arvolupauksen viestimisessä. Tärkeimpänä nostetaan esiin tarve referenssien systemaattiselle käytölle, joka perustuu selkeästi määriteltyihin tavoitteisiin ja niitä tukevaan referenssien valintaan.</p>	

## **Forewords**

Almost six years ago I started my journey in Lappeenranta. These years have given me a lot, both academically and outside of the classrooms. This thesis marks the final and most demanding chapter in my adventures at this academic world. These adventures have brought me an education, great moments, new friends and most importantly many lessons that will be valuable in the next chapters of my life. At this point I want to express my gratitude to the people who have been part of this journey and shared these adventures with me.

First, I would like to thank Vaisala for giving me the opportunity to work in a very interesting project that enabled me to see what it really takes to be the leading company in the industry. Especially I want to thank Jutta and other co-workers for all the support and lessons you have given me. I would also like to thank my supervisor on university's side, Asta Salmi, for guidance and support during the thesis project.

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# **1 INTRODUCTION**

This is the introduction part of the master's thesis conducted for Vaisala Oyj. The aim of the next chapters is to explain the reasoning for conducting this thesis and to give some background information about the objectives and structure of this study. The first part focuses on giving background information about the subject and reasoning for this study, and then the research questions, objectives, theoretical background and the scope of the study is introduced.

## **1.1 Background**

This master's thesis is conducted as a part of Vaisala Oyj's product development project, that aims to produce a disruptive product innovation to the biogas quality measurement markets. Biogas quality measurement is a completely new market area for Vaisala, and therefore there is a need to study the value generation process in this market area. This knowledge is used as a basis for drafting the value proposition for the new product. In addition to defining the value proposition, there is also a need to find out the best possible ways to communicate it to potential customers. The aim of this study is to provide an overview of the value generation process in biogas measurement markets, use this information to develop the value proposition and also study how this value can be communicated using customer reference marketing.

Customer value proposition has been identified to have a critical role when companies communicate how their offering provides value to customers. However, the scientific research on value propositions is still quite fragmented and the definition of a value proposition is loosely defined. (Payne et al. 2017) Majority of the companies use the term value proposition but they are not often able to successfully develop and communicate their value propositions. There are multiple reasons for this kind of a failure in defining and communicating the values. Traditionally value has been considered to be directly linked to actual functions and

performance of the product itself. However, the current idea about value and how it is created is shifting towards the direction where the actual value is only realized and generated in the customer's process. (Lindgreen et al. 2012) This shift also means that companies drafting their value propositions have to understand that instead of proposing values related to the physical product, they need to have a value proposition that communicates how the product generates value in customers' process. (Grönroos 2008) In order to succeed in this kind of value proposition creation companies need to have a good understanding of their customers' business model and how value is generated in it.

Customer reference marketing used in the B2B environment has similarities with the value proposition in terms of research and successful use. Research conducted on customer reference marketing is quite fragmented and companies are often not able to gain the full potential of their reference use. (Jalkala & Salminen 2010; Terho & Jalkala 2017) Customer references are still seen as one of the most effective ways to communicate the value proposition to potential customers. They enable companies to demonstrate how their offering is actually generating value in customers' process and reduce the uncertainty and risk that customers' face. (Jalkala 2009) This is especially important when a company is entering a new market area or is introducing a new product. By being able to demonstrate the true value of their products and services to customers, companies are able to differentiate themselves from their competitors that offer a more generic value proposition and lack the knowledge of how the value is actually generated in customers' process. (Anderson et al. 2006)

## 1.2 Objective of this study and research questions

In order to reach the goals, the following objective was set out for this study:

**Develop a value proposition for Vaisala's new measurement device and study how references can be used to communicate this value proposition.**

This objective was then divided into three research questions that aim to provide the information needed to fulfill the main objective of this study. These questions and the main objectives are presented in the following table.

**Table 1.** Research questions and objectives

	<b>Research question</b>	<b>Objective</b>
1.	What are the key value generation activities in biogas quality measurements?	Find out the activities that generate value in biogas quality measurement. Create a value proposition based on these activities.
2.	How to successfully communicate the value proposition with references?	Identify the best ways to use references for value proposition communication. Identify the challenges and benefits of communicating the value proposition using references.
3.	What are the key challenges of developing and communicating the value proposition in a new market entry and how to overcome these challenges?	Identify key challenges in developing and communicating the value proposition when entering a new market. Give recommendations on how to overcome these challenges

The first research question aims to find out how different operators in biogas industry generate value in their processes and how to use this information in developing a value proposition for Vaisala's new product. This question is

answered by conducting interviews with different operators in the biogas industry ranging from end-users to biogas plant manufacturers. In addition to interviews, the literature review and information gathered previously in Vaisala about biogas industry and economics of it, is also providing a valuable source of information about the biogas process and value proposition development.

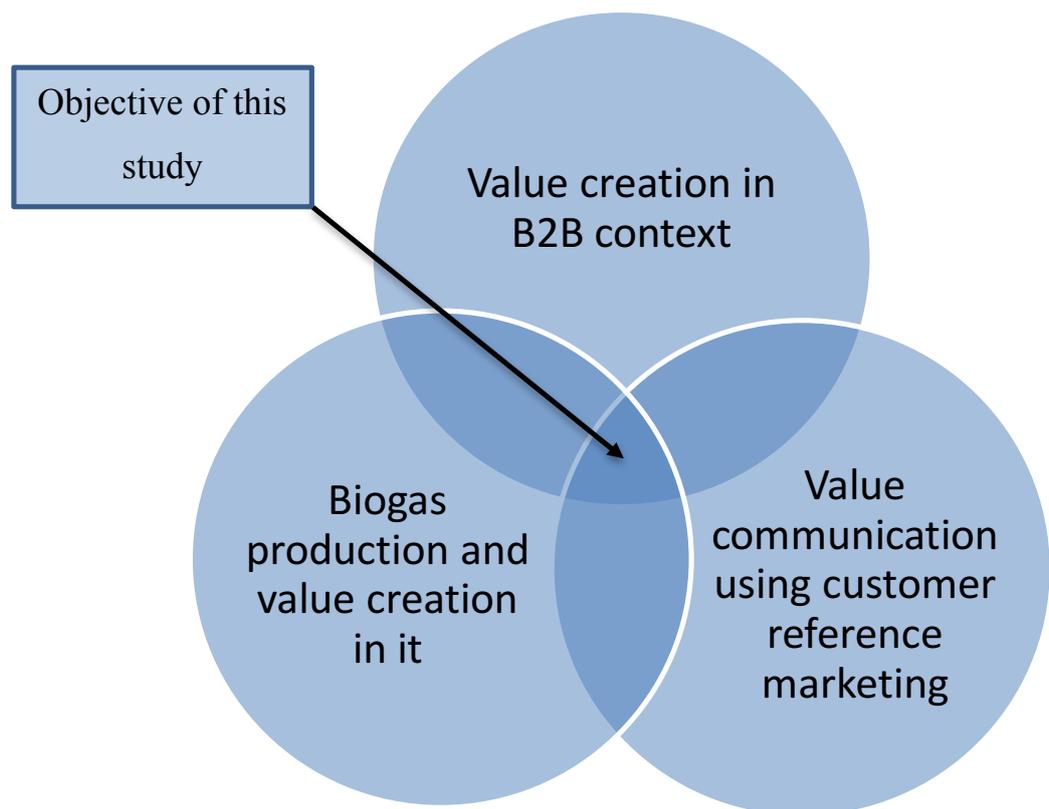
The second research question aims to find out how to successfully communicate the value proposition by using references in a situation where a company is going into a new market area with a new product. This question is answered through comprehensive literature review on customer reference marketing in a B2B context. The aim of this literature review is to identify the different factors that define the successful use of references. This knowledge is used to give recommendations on how Vaisala could utilize references when communicating the value proposition of their new product.

The third research question aims to identify the key challenges related to value proposition development and communication in order to avoid problems that these challenges might cause. Challenges related to the use of references concern Vaisala more in the future and therefore identified challenges are used to give suggestions on how to overcome possible problems related to the use of references going forward.

### **1.3 Theoretical background and scope of this study**

The theoretical framework of this thesis is built around the theories on value-based selling, value proposition development in B2B markets and the use of customer reference marketing in communicating these values. In order to gain an understanding of value generation in biogas quality measurement, information about biogas industry and gas quality measurement needs in it is also included in this study.

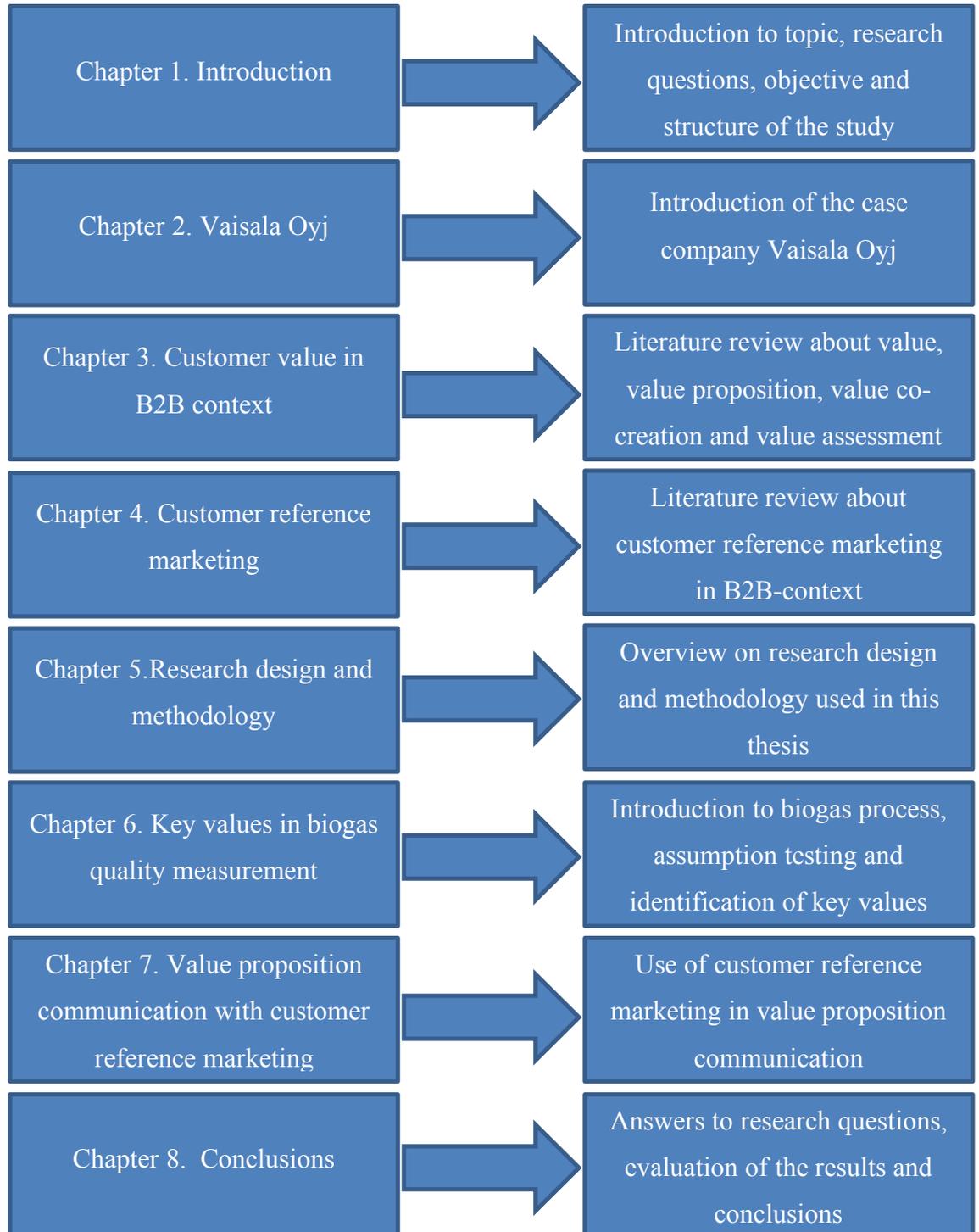
Theoretical framework about value in B2B context is used to gain an understanding of different aspects of value proposition and its development. Customer reference marketing forms the basis for the value communication part. The goal of this study is to gain a deeper understanding of these two concepts and to propose ways to combine these in a way that leads to effective communication of the created value proposition for Vaisala's new product. Vaisala is entering into a new market area with a new product that can be seen as disruptive technology. Current products in the market do not have the same features and therefore there is a clear need to study how these features create value to customers and how Vaisala should communicate this value. Figure 1. illustrates how the theoretical framework is connected to the objective of the study.



**Figure 1.** Research objective

## 1.4 Structure of the report

This report is divided into eight chapters. The following figure presents the structure of this thesis with short descriptions about the content of each chapter.



**Figure 2.** Research report structure

## 2 VAISALA OYJ

This thesis is conducted as a part of a product development project in the case company Vaisala Oyj. The purpose of this chapter is to provide background information on Vaisala, its current business, and the product development project.

### 2.1 Introduction

Vaisala Oyj is a Finnish high-tech company that produces a wide range of measurement devices for environmental and industrial measurements worldwide. Currently, Vaisala has around 1600 employees at 30 offices in 16 countries. It is serving customers in over 150 countries. Vaisala's net sales in 2016 were 319.1 million euros. Vaisala has been operating for over 80 years and it is considered as one of the oldest high-tech companies in Finland.

During Vaisala's 80-year-long history the company has evolved from meteorological observation devices manufacturer to a global company with wide product portfolio in environmental and industrial measurements. First 30 years Vaisala focused on the radiosonde development and production. From early 70's until the late 90's Vaisala took big steps forward and developed a foundation for the current product portfolio. This includes automated weather observation systems, revolutionary sensor technology in humidity and pressure, and its own microsensor production capability. This era was also the start of the industrial measurements business. This diversified Vaisala's portfolio from meteorological observations to a wider range of applications and end-users. Currently, Vaisala has two business areas that are being built upon the core competencies in the measurement technology and the production of sensors. These business areas are Weather and Environment and Industrial Measurements. (Vaisala 2017)

#### *Weather and Environment*

Weather and Environment business area serves customers in weather-dependent markets when there is a need for accurate, real-time, uninterrupted and reliable

weather data that is used to support customers' decision making under any weather condition. Weather and Environment is divided into two business lines. Products and systems unit provides physical products such as weather radars and sounding systems. Digital solutions unit provides hosted services, decision support and consulting. Typical customers are meteorological institutes, road and rail authorities, airport organizations, and defense forces. Vaisala is also serving private sector customers in the energy and maritime industries.

### *Industrial Measurements*

Industrial Measurements business area aims to improve quality, productivity, and energy efficiency by offering customers high-quality measurement devices that are able to offer reliable real-time measurement data. Customers in this area vary from semiconductor factories and greenhouses to high-rise buildings and hospitals. Vaisala's products are typically used to monitor temperature, humidity, dew point, pressure, carbon dioxide, moisture in oil, and dissolved gases in oil.

## **2.2 Strategy**

Vaisala's current growth strategy is based on three strategic themes: the creation of customer value, reliability, and simplification. In Weather and Environment additional customer value is created by building new businesses around decision support services that are offered to renewable energy, aviation, and roads customers in addition to the traditional products. Industrial Measurements focuses on creating added customer value by enhancing its offering and developing sales channels in a way that Vaisala is able to create more value for customers' operations. Reliability is achieved by producing high-quality products, well-functioning customer service, and on-time actions. This will lead to a higher customer satisfaction and loyalty, with current and future customers. Vaisala has a high-mix low-volume product portfolio in all business areas and simplification creates value through increased operational efficiency in Vaisala's operations. This is achieved with optimized

global networks, streamlined supply chains, common capabilities, and continual improvement. (Vaisala 2017)

### 2.3 Key numbers and the role of product development in Vaisala

In the year 2016, Vaisala generated 319.1 million euros in net sales with 22.3 million EUR in operating result. Weather and Environment account currently approximately two-thirds of this with sales of 215.4 million EUR and Industrial measurements the rest with 103.7 million EUR sales. However, in recent years Industrial Measurement area has been able to grow faster than the market and it is projected to keep on this path also in the future. Weather and Environment also has a higher yearly fluctuation in sales because of the nature of the project based business. Vaisala targets an average annual growth of 5%, and Industrial Measurements plays a key role in achieving this goal. In 2016 Vaisala spent 38.0 million EUR in research and development representing 11.9% of net sales. Weather and Environment share of this was 26.5 million EUR which was 1% less than in 2015, Industrial Measurements invested 11.5 million EUR with a 22% growth from the year 2015. (Vaisala 2017)

**Table 2.** Vaisala key financial figures 2015 and 2016 (Vaisala 2017)

	2015	2016	Change
Net sales (MEUR)	318.5	319.1	0,2%
Weather and Environment	225.5	215.4	-4.5%
Industrial measurements	93.0	103.7	11.5%
Operating result (MEUR)	29.6	22.3	-24.7%
Weather and Environment	15.2	3.4	-77.6%
Industrial measurements	18.3	21.6	18.0%
Other	-4.0	-2.7	-32.0%
R&D (MEUR)	36.1	38.0	5.3%
Weather and Environment	26.7	26.5	-0.7%
Industrial measurements	9.4	11.5	22.3%

As we can see from the Table 2, R&D spending in Vaisala is on a high level. Investments in product development are seen as an important source for Vaisala's competitive edge. Vaisala is constantly looking for new market areas and developing its current offering. This thesis is a part of Industrial Measurement business area's product development project that aims to develop Vaisala's first measurement device that can be used to measure the quality of biogas. This a completely new market area for Vaisala and therefore, there is a need to gain a deeper knowledge about customers' value generation process that can then be used as a basis for developing the value proposition of this product. There is also a need to gain a better understanding of how to successfully communicate these values by using customer reference marketing.

The focus in the following two chapters is on gaining a better understanding of the theoretical framework considering value-based selling, value proposition development in B2B markets, and the use of customer reference marketing in communicating these values. This knowledge is then used in the empirical part of this thesis to develop a value proposition for Vaisala's new product and to propose best practices for successful customer reference marketing.

### **3 CUSTOMER VALUE IN B2B CONTEXT**

This chapter introduces a literature review of the value-based selling, customer value and value propositions, value co-creation, and value assessment. Literature review begins with an introduction to three dimensions of value-based selling framework that is later on used as a basis for the structure of the empirical part of this thesis. After reviewing the concept of value-based selling, the actual concept of value and value proposition is reviewed in order to gain an understanding of what value means in B2B context. Then the focus is shifted in different ways that value can be created and assessed.

#### **3.1 Three dimensions of value-based selling**

Value-based selling is seen as an approach that enables companies to differentiate from their competitors. By actively identifying how supplier's offering generates value to customers, the supplier is able to differentiate from competitors that offer more generalized value propositions to their customers. Terho et al. (2011) have identified three dimensions that companies should take into account when they enter the markets with value-based selling approach. By doing this, companies are able to understand customer needs, create a value proposition that is based on these needs, and also communicate this value proposition in the most effective way. The three dimensions of value-based selling are:

1. Understand the customers' business model
2. Draft a value proposition based on customers' business model
3. Communicate the value proposition

The first dimension focuses on understanding how customers' process operates and what their business goals are. The supplier needs to gain an understanding of customer's earning logic, what are the resources needed and key processes that generate value for the customer. (Johnson et al. 2008) This enables the supplier to

proactively approach the customer and offer solutions that are aimed to improve their ability to create value. It allows the supplier to differentiate from the competitors that are not focused on identifying the most important value drivers in customers' business, and instead try to offer more generic values. This kind of understanding about customers' business creates a basis for compelling value propositions. (Terho et al. 2011)

The second dimension focuses on crafting the actual value proposition. This should be done based on the understanding gained on customer's process and how the value is generated in it. Effective value proposition should always be co-created with the customer(s) in order to make sure that it reflects the actual values to them. (Vargo et al. 2008) Instead of a supplier delivering certain values to the customer, the value proposition should be based on the customer specific data and understanding of the benefits that a suppliers offering can create to the customer. It is important to remember that the supplier is only able to propose these values, and the actual value is generated in customer's own processes. (Ballantyne et al. 2010) The supplier should focus on bringing the value opportunity of its offering visible to the customer by using methods such as value calculators and lifecycle cost analysis, which enable the customer to see quantified figures of the benefits. Quantification of the value proposition is seen as an important factor even if the quantification is only able to produce simulations and estimates rather than exact figures. (Anderson and Narus 1998)

The third dimension is the actual communication of the value proposition built in the first and second dimension. The communication should focus on presenting credible evidence on how the offering is able to contribute to the customer's business profits. (Terho et al. 2011) Credible evidence on the offering's ability to create superior value to the customer is seen as the most powerful mechanism for reducing the risk that the customer faces towards offerings capability to generate proposed value. (Jalkala 2009) Value communication needs to be transparent and based on trust, and it also has to emphasize long-term commitment and credibility of the supplier. Two widely used strategies for a transparent and risk reductive value

communication are references and guarantees. References act as an evidence of the past success and the capabilities to deliver the proposed value (Salminen & Möller, 2006). Guarantees send a signal that the supplier trusts the offering so much that they are willing to bear some of the risk that customers face. The most important part in creating and communicating the value proposition should always be the identification of the key activities that generate value for the customer and the communication of these values in a way that is credible and reduces customers' risks. (Terho et al. 2011)

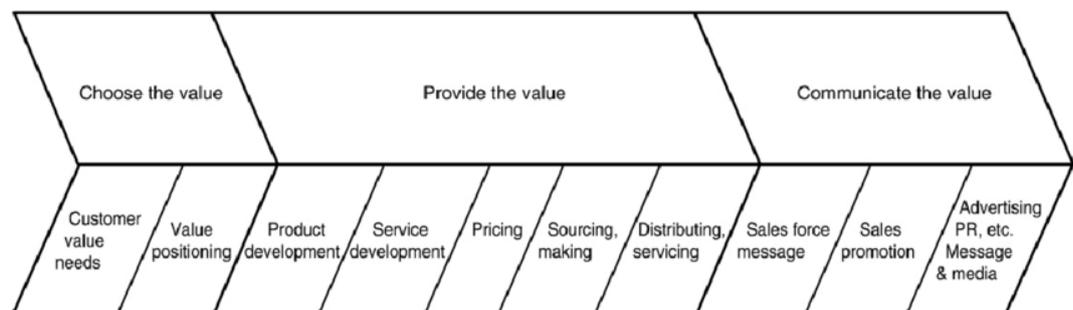
### **3.2 Customer value and value proposition**

Customer value and value propositions are identified as the key themes in B2B marketing and selling research and practice. However, research about the value that businesses create and deliver is quite fragmented, and the academics and practitioners are still exploring what value means and how to define it. (Lindgreen et al. 2012) Ulaga and Eggert (2006) define that value in B2B context is the trade-off between the benefits and sacrifices that the customer perceives in supplier's offering. Perceived benefits and sacrifices are typically diverse and they can be monetary or non-monetary. Monetary benefits and sacrifices can, for example, be increased revenues and profits or costs of acquiring the offering. Non-monetary benefits and sacrifices are harder to define but they can include such things as improved reputation or decreased risks. (Grönroos 2011)

The simplest way to illustrate the created value is to use markets where companies sell physical goods. In an example like this, the value is created almost solely through the physical product and it does not have any added value creation mechanisms. This makes it relatively easy for the customer to compare the value of this product to the price that it is being sold at. Modern markets are moving towards the direction of more complex solutions where physical products and services are combined and the value is only realized as value-in-use in customers' own process. This makes it a lot harder for the customer to evaluate the value of a particular

offering and to make the decision between different offerings. (Grönroos 2008, 2011)

The value proposition is an essential part of value creation and communication. It is a proposition about the values that the company aims to deliver to its customers through its offering. (Skålen et al. 2015) Value proposition thinking originates from Lanning and Michaels (1988) that stated that value proposition is a combination of the value that the offering of the company is able to provide to the customer and the price that the customer pays for that offering. Value proposition aims to indicate how well the offering is able to fulfill the customer's needs in comparison to the costs that the customer experiences with the offering during its lifetime. The value proposition is originally seen to be built around three separate parts: choosing the value, providing the value, and communicating the value. Core activities of a business are usually also placed around these three parts as can be seen from the Figure 3.



**Figure 3.** Value delivery system (Lanning and Michaels, 1988)

This kind of traditional model of value proposition and value creation is not very well suited for defining complex value proposition of modern-day B2B marketing. This has led to a situation where a more suitable model for value proposition and value creation is needed. One of these theories on value is service-dominant logic, later referred to as S-D logic. S-D logic aims to combine the traditional product-based value proposition with the value that services are able to add to the offering. (Vargo and Lusch, 2004) Service-dominant logic is, therefore, an extended version of the traditional value proposition model that only considers the value of physical goods.

This makes S-D logic much more suitable for a modern B2B business environment where an increasing amount of offerings are a combination of product and service, and value is generated in customers' own processes as a value-in-use. (Skålen et al. 2015; Grönroos 2011)

### 3.3 From selling goods to selling services

Service-dominant logic is a framework that aims to explain the value creation in a business that is based on services and exchange between different actors. It is based on the model that Vargo and Lusch (2004) created for explaining this kind of modern business activities that are being built around the service-for-service exchange. S-D logic contains all the key differences that a service business has when compared to traditional product centered goods-dominant logic. S-D logic is also able to expand goods-dominant logic by adding in the service perspective. According to S-D logic, services are complex solutions that involve both tangible and intangible goods. The following table illustrates the differences between G-D and S-D-logic.

**Table 3.** Characteristics of S-D and G-D logic (According to Vargo and Lusch, 2004 and Vargo et al. 2008)

	<b>Goods-Dominant logic</b>	<b>Service-Dominant Logic</b>
<b>Unit of exchange</b>	People exchange for goods. These good serve as operand resources	People exchange to acquire the benefits of specialized competencies (knowledge and skills) or services.
<b>Role of goods</b>	Goods are units of output and operand resources that are embedded with value.	Goods are transmitters that enable access to benefits of company's competencies and operate as an enabler of value-creation process.
<b>Role of customer</b>	The customer is the recipient of goods and operand resource. Customers "use up" or	The customer is co-creator of value through the integration of company's provided resources with other resources.

	“destroy” the value created by the firms.	
<b>Determination and meaning of value.</b>	Value is determined by the producer. It is embedded in the operand resource (goods) and is defined in terms of “exchange-value”.	Value is perceived and determined by the consumer on the basis of the “value in use”. Firms can only make value propositions.
<b>Firm-customer interaction</b>	The customer is an operand resource. Customers are acted on to create transactions with resources	The customer is primarily an operant resource. Customers are active participants in relational exchanges and co-creation.
<b>Source of economic growth</b>	Wealth is obtained from surplus tangible resources and goods. Wealth consists of owning, controlling and producing operand resources.	Wealth is obtained through the application and exchange of specialized knowledge and skills. It represents the right to the future use of operant resources.

Service-dominant logic and its foundational premises have been updated several times during the past ten years. In their latest article Vargo and Lusch (2016) propose that there are 11 foundational premises that define S-D logic:

1. Service is the fundamental basis of exchange.
2. Indirect exchange masks the fundamental basis of exchange.
3. Goods are distribution mechanisms for service provision.
4. Operant resources are the fundamental source of strategic benefit.
5. All economies are service economies.
6. Value is co-created by multiple actors, always including the beneficiary.
7. Actors cannot deliver value but can participate in the creation and offering of the value proposition.
8. A service-centered view is inherently beneficiary oriented and relational
9. All social and economic actors are resource integrators.
10. Value is always uniquely and phenomenologically determined by the beneficiary

11. Value co-creation is coordinated through actor-generated institutions and institutional arrangements.

These 11 foundational premises provide a clear overview on the idea that services are the basis of all the business in S-D logic. Physical goods are seen as a part of a service that is being exchanged. A transaction of a product is actually a transaction of the underlying capability of the supplier to produce this product. These capabilities are “hidden” under the tangible product. The role of the product is to act as an intermediary for services and capabilities of the firm and product is a part of the larger offering. This offering usually consists of support- and additional services that form the whole complex offering with the physical product. Know-how is seen as a basic unit of transaction. It is also seen as one of the most important assets for a firm since it operates as a source of strategic competitive advantage. (Vargo and Lusch, 2004; Vargo and Lusch 2016)

The role of the customer is also different in service-dominant logic from what it is in traditional goods-dominant logic. As stated in the eleven foundational premises of S-D logic, the value is always co-created with the beneficiary. In goods-dominant logic, the customer is seen as a receiver of a product whereas in service-dominant logic customer is receiving and co-creating value with the supplier. This foundational difference emphasizes the importance of customer’s role in value creation process. Value is always co-created, and in order to get the best possible result, the supplier needs to work in cooperation with the customer. This kind of approach to value creation ensures that customers’ needs are fulfilled at the highest possible level. Value co-creation approach also enables companies to form longer lasting and deeper relationships with customers instead of single transactions. These relationships are highly valued in S-D logic, and they make the co-creation of value possible. (Vargo and Lusch, 2004; Vargo and Lusch, 2016)

### 3.4 Value proposition types

Anderson et al. (2006) note that even if the offering is actually able to provide superior value to the customer but it is communicated in a wrong way the customer will likely interpret it as a marketing puffery and fails to see the full value creation potential. In order to overcome some of the issues with value communication, Anderson et al (2006) have divided value propositions into three types: all benefits, favorable points, and resonating focus. This categorization helps companies to identify the differences between value proposition types and their benefits regarding successful value proposition communication. The following table presents the main differences between these value proposition types.

**Table 4.** Three value proposition types (Anderson et al. 2006)

<b>Value proposition:</b>	<b>All benefits</b>	<b>Favorable points of difference</b>	<b>Resonating focus</b>
<b>Consists of</b>	All benefits customer receives from a market offering	All favorable points of difference a market offering has relative to the next best alternative	The one or two points of whose improvement will deliver the greatest value to the customer
<b>Answers the customer question:</b>	“Why should our firm purchase your offering?”	“Why should our firm purchase your offering instead of your competitor’s?”	“What is <i>most</i> worthwhile for our firm to keep in mind about your offering?”
<b>Requires</b>	Knowledge of market offering	Knowledge of own market offering and next best alternative	Knowledge of how own market offering delivers superior value to customers, compared with next best alternative
<b>Potential pitfalls:</b>	Benefit assertion	Value presumption	Requires customer value research

*All benefits*

It is common for a supplier to simply list all of the benefits that their offering might deliver to the customer and think that more is always better. However, this kind of approach to the value proposition may have a major drawback. It might claim advantages that do not benefit the customer and therefore are not appealing to the customer. Listing all of the benefits also usually results in similar value proposition with competitors. Because of this, customers might feel that all of the offerings are almost similar and make the decision based on the price. (Anderson et al. 2006) In the previous study of Anderson et al. (2000) researchers also found proof that supports this claim. Customers were willing to buy offerings that produce less value if they were priced lower than other products. This is mostly explained by the lack of proper value communication that would enable the customer to realize all the benefits of the offering.

*Favorable points of difference*

The second level of value propositions focuses on comparing the benefits of the supplier's own value proposition to the key competitors. The aim is to identify the benefits that competitors can not offer and to use these as a factor of differentiation. This requires more knowledge about the competitors' offering and how to assess the value it creates to the customer. At this level, firms are able to stand out from their competitors in some benefits they offer. They are now answering the question of why the customer should buy their offering instead of competitors but they are still not taking consideration the actual customer needs. This can lead to a situation where an offering has multiple points of differences but the customer is not able to assess how these differences bring value to them. It is also possible that firms assume that these points of difference must be valuable for the customer, but in reality, customers do not find actual value in these benefits. This is usually caused by the lack of knowledge about customer's needs and how the offering generates value in customers' process. (Anderson et al. 2006; Grönroos 2008, 2011)

*Resonating focus*

Resonating focus aims to combine all aspects discussed before with knowledge about customer needs. This approach focuses on a smaller group of customers that have the highest potential for the firm. This enables a more detailed gathering of information about customer needs and value creation process, which leads to a customized value proposition for specific customers or customer groups. Competitors offering is also taken into consideration in order to understand what the key benefits that differentiate supplier from the competitors are. Resonating focus demands more from the supplier because deeper knowledge about the customers and competitors is needed. Anderson et al. (2006) suggest that the effort put in to gain this knowledge still pays off. B2B marketing and selling are moving in the direction of customer oriented approach and companies that are not able to understand customer needs will fall behind the ones that are able to do so.

**3.5 Customer value co-creation**

Value co-creation plays a pivotal role in S-D logic as stated in the previous chapter. This process of value co-creation involves multiple stakeholders and interest groups. The customer is usually seen as the most important stakeholder but often there are also other parties involved in the value creation process. S-D logic is based on the assumption that stakeholders work together and combine their resources in value creation process. (Vargo 2011; Vargo et al. 2008) In order to be able to create value in this network of different parties, companies need to identify the key stakeholders and create value propositions together with them. Frow and Payne (2011) have developed an iterative framework for co-creation of the value proposition. It is constructed out of following five steps:

1. Identify stakeholders
2. Determine core values
3. Facilitate dialogue and knowledge sharing
4. Identify value co-creation opportunities
5. Co-create stakeholder value propositions

All of the steps are iterative and recursive with the possibility that results achieved in one step might have an impact on the results of other steps. Knowledge sharing and communication are also not restricted to the third step, these factors have implicit effects in each step. The whole process of going through these five steps involves sensing, monitoring, feedback and integration of knowledge with other resources available. By following these steps supplier should be able to achieve improved value alignment and opportunities to co-create value within the stakeholder network. (Frow and Payne, 2011)

#### *Identify stakeholders*

The first step of this process is to identify all the stakeholder involved in value co-creation process. This might be challenging since the networks can be quite large and some of the stakeholders are more involved in the network than others. Some stakeholders also might not be aware that they are part of the network or the firm might not identify these stakeholders as someone who has an effect on the value creation process. (Frow and Payne, 2011) It also possible that individual entities might be involved in more than one stakeholder group. This should also be taken into consideration when identifying stakeholders. Mitchell et al. (1997) suggest that executives should base the importance of different stakeholders into their perceptions of stakeholder's power to influence the company, legitimacy or appropriateness of their claims about the company and the urgency in which these factors need to be addressed.

#### *Determine core values*

Next step is to determine core values in a way that highest possible value increase for the customer is achieved. This should not be mixed up with profit maximization which in many cases is in contradiction with S-D logic. Core values should be determined in a way that they align with the objectives and goals of key stakeholders. This kind of approach reduces tensions between interest groups and enables parties to reach their common goals. (Abela and Murphy 2008) This is also in line with S-D logic. It increases collaboration, reduces tension between

stakeholders and potentially facilitates better value alignment between stakeholders. (Frow and Payne, 2011)

*Facilitate dialogue and knowledge sharing between stakeholders*

It is important that communication and knowledge sharing among stakeholders is organized, open and based on trust. The main goal is to share valuable information, establish trust and make sure that all the parties are able to adapt to continuously changing market environment. Simultaneously this kind of cooperation is able to minimize doubts about different stakeholder's integrity and motives in reaching common goals. All of this creates the basis for value co-creation. (Frow and Payne 2011)

*Identify value co-creation opportunities*

This step is an important part of the whole S-D logic. According to Lusch (2006), the shift from the value-in-exchange perspective of G-D logic to the value-in-use perspective of S-D logic offers a new perspective to value co-creation. Value cannot anymore be created in isolation from stakeholders. Customers are turning from "passive audience" to "active players" that co-create the value. Companies need to identify all the stakeholders that could be involved in the value co-creation process and involve them in the process. In some cases, this might also mean non-customer stakeholders. For example, environmental organizations are often not direct customers but their involvement in the value creation process might have an impact on other stakeholders. They might also be able to bring in new forms of value that would have been left out in the traditional G-D logic based value proposition. (Frow and Payne, 2011)

*Co-create stakeholder value propositions*

With help of the previous four steps, the most important stakeholders are now being moved from "passive audience" to "active players" capable of co-creating value propositions. At this point is essential that all parties involved will participate in active knowledge sharing and dialogue. Stakeholders might have different views about what is valuable to them based on their own goals, context, and existing

knowledge. The open dialog enables stakeholders to identify conflicting interests and focus on creating value propositions that are tailored and refined based on the relationships between stakeholders. At this point, it is also important to note that there will always be conflicts between different stakeholders and that the role of the company is to recognize and manage these differences. Companies should also always remember that S-D logic is based on the idea that value propositions can only be offered to markets and value itself is created during the in-use experience in customer's own processes. (Frow and Payne, 2011; Payne et al. 2008; Grönroos 2008)

### **3.6 Value assessment**

Value co-creation framework is a good starting point in understanding how value can be co-created, who are the parties involved and the kind of communication needed to succeed in this process. However, the framework is composed out of theoretical level explanations about value co-creation and it is not offering practical level tools for the actual value assessment. In order to understand how the actions suggested in the framework can be implemented to a value proposition development in practical context this chapter introduces nine methods/practices that can be used for this. According to Anderson et al. (1992) research, these methods are widely used in large industrial firms and they are found to be useful when used in right situation. Firms also often use multiple methods at the same time to ensure the best possible results. (Anderson and Narus 1998)

#### *1. Internal engineering assessment*

The first method is internal engineering assessment. This method is based on internal testing performed in supplier's laboratory or in some other test environment by suppliers own researchers. This method is usually conducted with supplier's own resources and it doesn't require customer input or the input is minimal. It still requires detailed knowledge about customer's production process and product usage in order to understand the value of the product to the customer. Values

derived from this method are still based solely on the assumptions of the supplier which can cause misconceptions. (Anderson et al. 1992)

### *2. Field value-in-use assessments*

The second method is based on field studies conducted in customer firms. This method requires cooperation and input also from customer firm's side in order to gain knowledge about real value-in-use. Value assessment is usually conducted by interviewing personnel of customer firm. The goal is to find out how supplier's offering is able to generate value in customer's process (e.g. cost savings, life-cycle costs, higher yield). This kind of method usually produces monetary values. These can, for example, be cost savings that supplier's product is able to generate. The outcome is dependent on the way that interviews are constructed. If the aim is to find out non-monetary values, then the interviews should be constructed in a way that support this goal. (Anderson et al. 1992; Anderson and Narus 2008)

### *3. Indirect survey questions*

In this method, the supplier is using questionnaires to gather knowledge about how changes in the offering would affect the perceived value. It is a good method to evaluate how the customer sees the importance of certain attributes of the existing products and what would be the result if these attributes were being changed or removed. These results are then usually combined with results gathered from other test methods. In product development this information is then used to evaluate how certain decisions about attributes would affect the possible value of the offering. It is a good method for filling gaps in knowledge on how the customer uses suppliers offering. It can also be used to test assumptions made about the usage and see if they are reasonable. (Anderson et al. 1992)

### *4. Direct survey questions*

The direct survey has the same basic idea that the indirect survey. Potential customers or other relevant parties such as industry consultants are selected to answer questionnaires about supplier's offering. In a direct survey supplier's offering or offering concept is presented and the aim is to find out what the value

of offering would be for respondents. It is also possible to use a series of follow-up questions to find out how certain components or parts of offering effect to its overall value. (Anderson et al. 1992)

#### *5. Focus group value assessment*

Focus group assessment is used to gain knowledge about how certain focus group perceives the actual or potential offering from the supplier. Focus groups use qualitative phenomenological approach to gain an understanding of perceptions and reactions of participants. This approach should generate estimates about the value of suppliers offering. Participants of the focus group are exposed to potential offerings and then asked to give their estimates about the value of this offering. Adequate focus group selection is essential for this method. Participants are usually individuals who work in customer firms or in industry. For example, industry consultants or pundits can be selected in to focus groups as an individual who is not working in customer firm. (Anderson et al. 1992; Anderson and Narus 1998)

#### *6. Conjoint or tradeoff analysis*

The conjoint analysis aims to figure out the value of offering in more detailed level. In the conjoint analysis, the offering is separated into different attributes which are then valued by respondents. Another possibility is to use offerings with different attributes in order to find out how respondents see the value difference between them. This enables statistical analysis between different versions of the offering. This way supplier can easily see which attributes generate the highest value and therefore should be included in the offering. (Anderson et al. 1992; Anderson and Narus 1998)

#### *7. Benchmarks*

In benchmark method, respondents receive information about suppliers offering and are then asked to compare it to other offerings in the market. These other offerings are usually produced by key competitors or are seen as an industry standard. Respondents are typically asked to evaluate how much more value they would receive if suppliers offering would have selected additions, attributes or

features that the benchmark offering does not have. It is also possible to use reversed approach and ask how much the value of supplier's offering would decline if it would lack certain attributes or features that benchmark offering has. (Anderson et al. 1992)

#### *8. Compositional approach*

The compositional approach combines some of the previous methods. It aims to find out how single attributes are able to generate value "inside" the suppliers offering. Researchers give respondents different version of supplier's offering and ask them to value these offerings. For example, researchers might use offering that has three different levels of the certain attribute in it and then asks respondents to estimate the value of each offering. These value estimations can then be used to evaluate differences between offerings and their capability to generate value to the customer. The final offering can then be built upon this information in a way that it generates the highest possible overall value. (Anderson et al. 1992; Anderson and Narus 1998)

#### *9. Importance ratings*

Importance ratings is a method that intends to find out the importance of different attributes instead of trying to find the exact value of attributes. Researchers give respondents a given set of different attributes or features of supplier's offering and ask the respondents to rate these. Usually, the rating is based on the attributes importance to the respondent's firm. It is also common to ask respondents to rate similar attributes that can be found from competing offerings in order to gain information on how suppliers offering is performing when compared to competitors. Importance ratings is a good method to find out the importance of certain attributes but it fails to provide information about the value. (Anderson et al. 1992)

As we can see from the preceding chapter the concept of value has multiple dimensions and ways to assess it. Shift from simple physical goods to combinations of product and service has also had a big impact on the way that value is addressed at the recent literature. S-D logic and co-creation of value are not the only possible ways to approach this subject but considering the goal of this research they provide a good framework for approaching value in B2B context. Also, the case company has a desire to move away from the G-D logic and broaden their thinking about value more towards S-D logic and co-creation. As we can see from the literature review this is not an easy task and requires much more from the supplier than the use of traditional G-D logic and supplier initiated values. On the other hand, it is also an effective way to differentiate from competitors and gain competitive advantage. By understanding their customers and how value is generated in their processes suppliers have higher chances of success. It enables them to differentiate from their competitors that use more generic value propositions and fail to understand that value is co-created and highly dependent on the customer's own process. Effective communication of values is essential part of three dimensions of value based selling and success of the company. In the following chapter the focus is shifted to the ways that value of suppliers offering can be communicated to potential customers.

## **4 CUSTOMER REFERENCE MARKETING**

Communication of values is seen as a part of the value delivery system that includes marketing, advertising and customer relationship development (Lanning and Michaels, 1988). Value communication is also an important part of Terho et al. (2011) three dimensions' model of value-based selling. Potential benefits of supplier's offering are often hard to assess from the customer point of view and firms should emphasize the importance of value proposition communication. (Ballantyne et al., 2011) In many occasions, it is hard for a customer to assess the real value of supplier's offering. Offering might be complex and involve multiple tangible and intangible elements that generate value in customer's process. In order to ensure that customer receives the value proposition and finds it credible companies need to find the best possible ways to communicate their value propositions and differentiate from competitors.

### **4.1 Customer references as a way to communicate value proposition**

The following chapters will provide a comprehensive review of customer reference marketing and its applications in value proposition communication. These chapters are divided in the following way: references in general level, how references can be used to communicate chosen values and what should be taken into account when references are being used. Because this thesis is being carried out as a part of product development project, which aims to open a new market area for Vaisala to enter, special attention towards reference use in a new market entry is adopted.

#### **4.1.1 Definition and role of customer references as an intangible strategic asset**

Current literature and research about customer references and their use in communicating value propositions is quite scarce and fragmented. Even though the research conducted about reference use is relatively scarce it is still seen as highly relevant and widely used method in customer-based marketing (Jalkala & Salminen

2010; Terho & Jalkala 2017). There are no clearly defined description of what customer reference marketing is. Jalkala and Salminen (2010) define the concept in the following way:

*A customer relationship and the related value-creation activities that a firm leverage externally and internally in its marketing efforts.*

References are therefore seen as customer relationships that are being deployed to marketing activities by supplier firm. This definition also provides a clear distinction between references and other similar communication methods such as word-of-mouth. Use of references is always seen as a supplier-initiated activity that requires active management (Jalkala 2009). Jalkala (2009) has developed the definition of references further in order to express this difference by defining the use of references in the following way:

*Reference use is a cross-functional process that involves building, managing and leveraging a portfolio of customer references that can be used externally or internally as marketing assets in targeting organic growth and firm performance*

This definition of references as something that can be managed and leveraged is rooted in the idea that references are an asset and part of company strategy. Salminen and Möller (2006) discovered in their study that references played a significant role in all major growth strategies of the firms that participated in their study. Reference marketing is widely used when companies are operating in their current markets as well as in a new market entry. When entering into new markets references play a key role in facilitating the introduction of the new offering to markets by decreasing the uncertainty and risk experienced by the buyers (Salminen & Möller 2006).

Due to this importance of reference use as a part of firm's strategy, many studies suggest that references should be treated as an important intangible marketing asset that should be utilized and managed in a systematic way (Jalkala 2009; Jalkala & Salminen 2010; Terho & Jalkala 2017). Jalkala (2009) also emphasizes the role of

references in building other marketing assets such as reputation, status and brand image. Interconnected nature and unclear boundaries between these marketing assets highlight the importance of systematic management and utilization of references. References should be seen as an important asset that can be utilized broadly in a wide range of functions instead of seeing them only as a sales tool for customer acquisition (Terho & Jalkala, 2017).

Origin and reasoning for reference use can be traced back to procurement practices and rules that different customers in B2B markets utilize in buying situations (Aarikka-Stenroos & Makkonen 2014; Salminen & Möller 2006). Even though this thesis focuses on the reference marketing from supplier's perspective it is important to understand how buyers use references in their decision-making process. Need for references is often related to the complexity of the offering. Complex offers demand more evidence to support the buying decision and reduce the perceived uncertainties and risks. According to Aarikka-Stenroos and Makkonen (2014), companies use references to seek experience-based information that is not based on any monetary reward from supplier firm. This kind of information is seen as a critical input to buyers' decision-making process. It provides unbiased information regarding the offering and capabilities of supplier firm. It is also common that there are multiple persons involved in the buying process. References are seen as good way to ensure that everyone involved in the process will receive the same information about the supplier and their offering (Jalkala 2009; Terho & Jalkala 2017)

## **4.2 External reference use**

In the following chapters, customer reference marketing is divided into external and internal use. This allows more profound examination of different mechanisms and desired outcomes. In this context, external use refers to situations where references are used to communicate the value proposition to external actors. Internal use refers to situations where references are used for internal purposes in supplier firm.

Terho and Jalkala (2017) have defined the external use of reference in the following way:

*External leveraging of references refers to activities that communicate customer references to potential customers through demonstrating delivered customer value in previous and existing customer relationships.*

As we can see from this definition the main reason for using references is their capability to communicate the delivered customer values to potential customers. This chapter aims to identify and explore different practices and proposed functions of external reference marketing when communicating these values. These functions are divided into three broad categories that reflect the desired effects and ways that companies can achieve these effects.

*Indirect evidence about supplier's experience through status transfer and signal passing.*

Jalkala & Salminen (2010) and Stuart et al. (1999) propose that status transfer can take place through three different social mechanisms. Firstly, they suggest that high-status reference customer(s) send a strong message that they are only doing business with suppliers that have the same appreciation towards high-quality. This, in turn, sends a positive message about supplier's quality. The supplier would not be doing business with high-status reference customers unless its own offering is high-quality. This reputation can then be used as a "seal of approval" to establish new customer relationships that are based on the reputation transferred through these high-status reference customers (Helm & Salminen, 2010)

Secondly, well-known companies are perceived to have good capabilities for evaluating their suppliers and doing due diligence. This, in turn, sends a strong signal that supplier has passed this process and it is considered trustworthy by these customers. Helm and Salminen (2010) propose that this message of passing the strict selection criteria of the high-status customer is able to make new market entry and customer relationship establishment substantially easier in the future.

Thirdly, established relationships with the current reference customers are seen as an endorsement of supplier's reliability, credibility, and ability to maintain good customer relationships. This is especially important for young companies or in a new market entry situation. (Jalkala & Salminen 2010; Ruokolainen & Aarikka-Stenroos, 2016)

*Demonstration and concretization of suppliers offering.*

References are seen as one of the most effective ways for reducing the perceived risk and concretizing suppliers offering to potential customers (Salminen 1997; Terho & Jalkala, 2017). Value creation potential of supplier's offering is often uncertain and therefore needs to be demonstrated by providing concrete evidence of how current customers applying this offering in their own process have been able to generate value with it. Salminen and Möller (2006) found that by using references supplier is also able to combine the technical aspects of the offering to value proposition and demonstrate the benefits of their offering in a way that is easier to interpret and has more credibility.

This aspect is seen as an important reason for using references also by Terho & Jalkala (2017) and Salminen & Jalkala (2010) who suggest that risk reduction by demonstration and concretization is one of the main reasons behind the effectiveness of reference use. By demonstrating previous installations and value that these have generated in customers' processes supplier is able to reduce the risk that potential customer perceives. This, for example, can be done by showing quantified savings or higher revenues that customers have been able to achieve with suppliers offering. (Jalkala and Salminen 2009)

*References providing proof of supplier's capabilities*

One source of risk for the customer is supplier's capability to deliver the proposed values. As mentioned before, high-status customers are seen as an important reference since they promote that supplier has passed their strict criteria. This also signals that supplier is capable of delivering the values they propose. Long-lasting customer relationships also add more credibility to supplier's capabilities of providing offering repeatedly (Salminen & Möller 2006; Jalkala & Salminen 2010).

Helm and Salminen (2010) suggest that country-of-origin effect also play a key role in providing proof of capabilities. Reputation transfer and credibility building are more effective if the supplier and customer are originating from countries that are perceived generally positive. Ruokolainen and Aarikka-Stenroos (2016) also highlight the importance of having reputable reference customers that can provide proof of supplier's capabilities in delivering the value proposition through status transfer effect and by providing reliable data on how the offering has benefitted them.

### **4.3 Internal reference use**

Most of the studies conducted on reference use focus on the external use and importance of references in external applications. In their most recent article Terho and Jalkala (2017) highlight this imbalance of studies focusing on external use even though there are several ways that references can be used also internally. In this chapter, these functions are divided into three categories that reflect the expected benefits and desired effects of internal reference use.

#### *Facilitate learning and advance offering development*

Jalkala (2009) points out that references should be leveraged internally to facilitate learning in organizations. Especially in product development projects first references often provide great opportunities also for internal learning. Feedback gathered from reference customers can be used to improve the offering and internal processes in a way that company has a higher success rate in the future. This kind of recombination by using the knowledge gathered earlier in the project and through reference customers is seen as an effective way of speeding up the learning processes. (Gomez and Monterroso, 2007) However, it requires careful documentation and reviewing of gathered knowledge. In the best case scenario, this knowledge from the individual offering is transferred into an organization-wide opportunity to improve current practices and offering with the customer-focused approach (Salminen & Jalkala, 2010; Terho & Jalkala 2017). Learning from

references offers companies a great way to ensure that the work they do is based on the real customer needs and adds value to customer's process (Ruokolainen & Aarikka-Stenroos, 2016). Salminen and Möller (2006) also suggest that in addition to own references companies should leverage competitor's references in the learning process. Competitor's references offer a window for evaluating own capabilities compared to competitors. Especially in new market entry, these references can be used to learn about market needs, required capabilities and potential problems that might evolve.

#### *Motivate personnel*

One important part of the internal use of references is to motivate personnel by providing information on how the customer has been able to generate value with supplier's offering. Jalkala and Salminen (2010) bring up the important aspect of how references can shape attitudes and organizational culture. When references are used internally they bring the whole company together and showcase how different parts of the company have contributed to the offering. This is seen especially important from the viewpoint of technical personnel who often see just their part of the offering and are usually not that close to the customer. References help the personnel not operating in customer interface to understand customer needs and offers a chance to see how their work has benefitted the customer. This can happen through deliberate communication like success stories and "solution of month" awards or as an unplanned word-of-mouth inside the company.

#### *Develop understanding of customers' value creation process*

A profound understanding of the customer's value creation process is seen as one of the most important success factors in the modern business environment. In order to gain this kind of understanding companies need to do close cooperation with customers and learn from their past deliveries. Terho and Jalkala (2017) point out that internal reference use is a good way to gain a deeper understanding of customers' value generation processes. All the benefits that customer receives from the offering are often realized only when the customer actually uses it in their own process. This value-in-use is also often customer specific and varies among

different customers. References can be used to raise awareness about these direct and indirect benefits of the offering. This, in turn, creates a positive circle where the supplier has a better understanding of the customer's value creation process and is able to use this information to improve the offering and their responsiveness to customer needs. (Ruokolainen & Aarikka-Stenroos, 2016) This kind of understanding also helps companies in creating and communicating their value proposition to customers. With an in-depth understanding of customers' value creation process companies are able to build more attractive value propositions. In the best case scenario companies are able to identify hidden customer needs and values, and use these to build value propositions that differentiate them from their competitors (Jalkala & Salminen, 2010; Ruokolainen & Aarikka-Stenroos, 2016)

#### **4.4 Reference use in a market entry**

According to Jalkala and Salminen (2009), systematical reference use plays a key role in successful new market entry and it is seen as one of the most beneficial situations for customer reference marketing. References support market entry by providing proof of supplier's capabilities in delivering their value proposition which in turn reduces the risk that customers perceive. (Helm & Salminen, 2010; Jalkala & Salminen 2010; Ruokolainen & Aarikka-Stenroos 2016).

References help to reduce the uncertainty that first customers face with a new supplier. Especially companies in project business, information technology, and process technology are seen to benefit greatly from the use of references in a situation like that. Gomez-Arias and Montermoso (2007) propose that initial reference customers in a new market entry should be seen as intangible marketing assets that have high strategical importance when considering the success of the entry. These reference customers are also usually able to bring in more than just an external reference that can be used in marketing.

*Role of first reference customer*

Role of first reference customer(s) is highlighted in many articles regarding reference use in a market entry. Initial reference customer is an intangible strategical asset that can and should be leveraged in many ways during the market entry (Helm & Salminen, 2010; Gomez-Arias & Montermoso, 2007; Ruokolainen & Aarikka-Stenroos 2016). When references are treated as a strategical asset the value of first reference customer(s) is seen to extend beyond the value of the possible revenue they generate to the supplier. First reference(s) should be selected based on their suitability to act as a reference instead of trying to find first customers that are able to generate highest revenues. Gomez-Arias and Montermoso (2007) point out that especially in the case of start-ups this is not always possible since the revenue generated from the first customer might be crucial for firm's future survival but in most cases references should be chosen based on their suitability.

In addition to acting as an important marketing asset and possible source of revenue first reference(s) also offer opportunities for internal use in such aspects as technology and business development and help to understand industry-specific features. Need for continuous improvement and development during the first stages of market entry is common and reference customer(s) are usually able to offer an opportunity for the supplier to learn more about these needs. First reference customer(s) are often able to add substantial value to offering by putting it into actual use and providing supplier feedback based on their experience with it. First references also offer an opportunity to learn more about customers' needs regarding expected customer service, possible selling points and effectiveness of value proposition (Gomez-Arias & Montermoso, 2007; Ruokolainen & Aarikka-Stenroos, 2016).

*Credibility-building and proof of capabilities with references*

As stated earlier the importance and usefulness of reference customer(s) is emphasized in a new market entry situation. Especially companies introducing disruptive innovations need the support that references can offer. The new supplier needs to build credibility on their ability to deliver the offering and also provide evidence on how it is actually generating value in customer's process (Gomez-Arias

& Montermoso, 2007; Jalkala & Salminen, 2010). The main reason for this kind of need to provide proof of supplier's capabilities is connected to customer's desire to reduce risks associated with offering that has not yet been "tested" by a wide range of market participants. By concretizing the realized benefits and value creation potential supplier is able to reduce the risk perceived by new customers that are not yet aware of the supplier's capabilities (Salminen & Möller 2006; Helm & Salminen, 2010). Larger companies often have better opportunities to overcome this problem related to the market entry. They can utilize earlier references from similar industries or deliveries to provide proof of capabilities in the new market. Small companies are more dependent on the first reference(s) and their role in providing credibility and proof of capabilities (Ruokolainen & Aarikka-Stenroos, 2016; Hada 2011)

#### **4.5 How to choose right references**

In the preceding chapters, reference use has been explored from the viewpoint of the benefits that companies are able to gain by using them in a systematical way as a part of their strategy. Here, point of view is shifted towards actions that need to be done in order to succeed in reference use. First, the focus is on different factors that should guide companies when choosing the reference customer(s). Then, introduce possible challenges that companies might face with reference use and introduce different ways to overcome these challenges. Finally, reference marketing practices and their desired functions are also introduced in the last chapter.

Kumar et al. (2013) have studied the reference use in B2B companies with the aim of developing a method for calculating each reference customer's business reference value to a certain company. Calculation method and actual calculations are out of the scope of this thesis but this study still provides a suitable basis for evaluating reference customers' value to the company and uncovering the most important attributes to consider when choosing reference customers. These

attributes are suitability and willingness of reference customer, length of relationship and similarity with the customer.

*Suitability and willingness of the reference customer*

There are no generalized criteria that could be applied to reference customers when concerning their suitability to act as a reference. Kumar et. al. (2013) suggest that reference customer selection should be a strategic decision based on reference customer's capability to have an impact on potential new customers.

The first factor that is suggested as a criteria for this decision is the size and reputation of the customer. Large firms are generally seen as a more attractive choice. Large firms face more pressure from outside and their decisions are considered to be more transparent and deliberate than smaller companies. This acts as a clear signal of trust towards supplier and its capability in delivering the proposed values. Large firms also usually have better reach within their networks. This reach then turns into a better ability for the supplier to reach a larger number of potential customers through this actor. Companies with large networks have high reference value and should be given special attention when choosing reference customers. (Jalkala & Salminen 2009; Möller & Halinen, 1999; Gomez and Montermoso 2007).

Gomez-Arias & Montermoso (2007) caution about risks of focusing too much on the company size by raising attention to mid-sized customers' ability for faster adoption and closer cooperation during the initial implementation. Innovativeness of the customer is also seen as an important factor. Innovative companies as first adopters of the new offering will courage others to adapt it and are also often able to provide valuable feedback for the supplier.

In addition to these factors concerning customer's suitability from the capability viewpoint, customer's willingness to act as a reference should also always be taken into consideration. Willingness to act as a reference is seen as an important factor since it usually signals customer's satisfaction towards supplier's offering and mutual relationship (Helm & Salminen, 2010).

*Length of relationship and commitment*

Length of the relationship between supplier and reference customer is seen as an important factor affecting the success of reference marketing. It signals trust and commitment towards the supplier's capability of delivering their offering and maintaining a good relationship with customers (Jalkala & Salminen, 2009). Ruokolainen and Aarikka-Stenroos (2016) discovered that especially in start-up and market entry phase reference customer's commitment is seen as an important signal about future-orientation and customers' confidence that supplier is able to deliver the promised offering in the future. This, in turn, encourages potential customers to take this new supplier into consideration when making a buying decision. For this reason, commitment should also be included in customer reference information that is communicated forward. Helm and Salminen (2010) also suggest that reference portfolio should include customers that have made repeated orders with the supplier if that is possible. This further increases the supplier's credibility as a trusted partner that is able to repeatedly fulfill customers' needs.

*Similarity*

Multiple studies have identified that similarity between reference customer and potential customer plays a key role in the power and credibility that reference marketing has. Also, the similarity between reference customer and supplier is an important factor (Terho & Jalkala, 2017; Ruokolainen & Aarikka-Stenroos, 2016; Jalkala 2009). Reference customer(s) should be similar to potential customers in terms of how they are able to generate value with the offering in their own processes. This provides potential customers an opportunity to evaluate how suppliers offering is generating value in a similar process that the customer has and therefore reduce the risk that customer faces with this new offering. It also signals that supplier is able to do business with this kind of customers and understands their needs.

In their study Kumar et. al. (2013) identified that highest effect comes from reference customers that use the same offering, second highest from references that operate in the same industry and third highest when potential customer and reference customer have same role or position in their firm. These factors are also

noticed by Terho and Jalkala (2017) who propose that reference portfolio should be assembled in a way that it is able to address different customer types and segments, application areas and geographic regions.

#### **4.6 Challenges in customer reference marketing**

So far only the positive sides of reference marketing and the effects that it has on performance in different stages of business have been presented. In this chapter possible problems related to reference use are evaluated from the external and internal viewpoint. In this context, external and internal do not mean the same than in previous chapters were these terms referred to the external and internal use of references. In this context internal refers to problems that arise in internal processes related to reference use. External problems are related to external factors such as customers' willingness to be used as a reference.

##### **4.6.1 External**

External problems in reference use are mostly caused by customers' willingness to act as a reference and share information. Also, the process of finding right companies to be used as reference can cause problems, especially when the supplier is entering into new markets (Salminen 1997; Ruokolainen & Aarikka-Stenroos, 2016, Terho & Jalkala, 2017).

The customer might not be willing to act as a reference for multiple reasons. Competitive pressure and risk of revealing sensitive information are seen as the main reasons for customers not wanting to be used as references. Customer's willingness to share information also creates a problem when concerning the credibility of reference. Too scarce information might raise questions about why supplier is only sharing a small amount of information and if there is something that supplier doesn't want to bring out to the public. (Jalkala and Salminen 2010; Ruokolainen and Aarikka-Stenroos 2016)

Studies about reference use also suggest that customers might see this kind of cooperation taking their scarce resources away from more important things, especially if the relationship between customer and supplier is not close. Reference marketing practices like site visits or reference calls take time and resources, and customers do not usually benefit from this in monetary terms (Jalkala & Salminen 2010; Salminen, 1997). If the customer is not willing to share information about their process or doesn't want to be publicly used as a reference one solution could be a reference case without disclosing who the actual customer is. Formal contracts about what information is shared and how much reference customer is devoting resources are also seen as a good way to increase customer's willingness. This ensures that only information that customer is willing to share is shared and also help to prevent situations where the customer would be overburdened. Guarantees and price reductions are also seen as a good way to increase customer's willingness and decrease their risks. (Terho and Jalkala 2017)

Finding the right reference can also cause problems, especially when entering into new markets. Customers might not want to act as a reference before they can be certain that supplier is reliable and that they can put their own reputation at risk by backing up this new supplier. The supplier might be able to overcome this problem by providing discounts and extra guarantees, make formal contracts about reference use and allocating extra effort in deepening the relationship. (Terho and Jalkala 2017) It is also important to notice that not all customers are suitable to be used as a reference. Helm and Salminen (2010) point out important factor regarding the risk associated with the status transfer effect. Usually, this effect is only viewed from the perspective of how low-quality supplier causes risk for a high-quality customer when using their reputation to aid supplier in marketing. It is important to notice that this effect works also other way around. A low-quality customer can also cause negative status transfer effect to a high-quality supplier if it used as a reference.

One common problem that companies also face is having wide enough reference portfolio. The supplier might not be able to accumulate a portfolio that has references from all customer groups that they are trying to influence. Therefore,

supplier is not always able to use reference that would be suitable to address a specific customer group or need (Terho & Jalkala, 2017).

#### 4.6.2 Internal

Internal problems with references are mostly caused by lack of systematic use that would treat references as a strategical intangible asset instead of a tool that can only be used to support sales. Lack of systematic use and collection of references leads to a situation where the supplier is not able to reap all the possible benefits of its reference portfolio (Jalkala 2009; Salminen & Möller, 2006).

Lack of management and responsibility of references might lead to situations where salesperson “protect” their own references. This, in turn, leads to situations where references are not used as efficiently as they could be and supplier might lose a potential customer because they are not able to use right reference for certain kind of customer. This can also be caused by a lack of a system that would allow salespersons to evaluate supplier’s reference portfolio and choose the best references for certain customers. It is also possible that some references might be overused if there are no system controlling that certain customers are not overburdened with site visit and other activities that require resources from the reference customer. (Jalkala 2009)

Lack of systematic use and salesperson protecting their references can also lead to a situation where knowledge gathered from the customer is not spread throughout the whole organization and opportunity to facilitate learning and motivation of personnel is not realized. A deeper understanding of customer needs is not gained when references are seen only as a tool for sales and are not systematically analyzed and documented for further use. This might also lead into a situation where customers are rated only based on their ability to generate revenue instead of viewing them as an asset that can be utilized in growth strategy. Some customers might have an important role as a reference even if they are not the best customer

in terms of their ability to generate revenue for the supplier. (Salminen & Möller, 2006; Jalkala 2009; Kumar et. al. 2013; Terho & Jalkala, 2017)

#### **4.7 Marketing practices for customer references**

Proposed functions for external and internal reference use have been examined in the preceding chapters and the focus in this chapter is now shifted in connecting the proposed functions to appropriate marketing practice.

##### **4.7.1 External**

As we can see from the Table 5 external reference use has multiple functions and desired effects. Reference customers' role and the amount of effort being put into process also varies quite a lot when we move from the top of the table to bottom. On the top of the table, reference customer is only providing their brand and reputation to be used in reference material but they do not participate in the actual process. At the bottom, reference customer is actively involved in the process by providing their resources to be used for activities such as reference calls and site visits. It is also important to notice that suppliers control over the reference(s) decreases when customer's role in the process increases and vice versa. This, in turn, can cause some problems and inconveniences especially in situations where reference customer's role is high. (Jalkala & Salminen, 2010, Terho & Jalkala, 2017)

**Table 5.** Practices and proposed functions of external customer reference marketing (According to Jalkala & Salminen, 2010)

<b>The proposed function of reference marketing activity</b>	<b>The supplier's reference marketing practices</b>	<b>The reference customer's role</b>
-Provide indirect evidence of experience -Enhance credibility through status-transfer effects	-Reference lists	Allowing company name and logo usage
-Demonstrate and concretize the solution -Provide indirect evidence of previous performance -Demonstrate the value of the solution	-Success stories, customer cases, case studies, ROI-studies -Sales presentation reference slides -Audio/video testimonial (webcast/podcast) -Recorded reference interviews/podcasts	Participating in producing marketing/sales material
-Serve as a certificate of passing through a selection process -Signal an enhanced market position	-Press releases -Articles in trade journals -Promotional material -Customer presentations at seminars and conferences	Participating in media activities
-Provide indirect evidence about the functionality of the technology -Generate positive word-of-mouth	-Reference calls (one-to-one/one-to-many) -On-site reference visits -Customer events and meetings -Social media	Participating personal interaction with potential customer(s)

Available marketing practices vary quite a lot from simple reference lists to customer presentations and site visits. In the table, proposed functions and marketing practices are tied together to give an example of how certain function relates to different marketing practices. In reality, these functions and marketing practices are not this tightly connected and tend to create a mix that is based on their suitability for supplier's needs. It is also good to notice that when the customer's

role increases these functions and practices tend to accumulate meaning that when the customer is willing to host site visits it is likely that the customer is also participating in other reference marketing practices. (Jalkala & Salminen, 2010)

Reference lists and other marketing material based on one-way communication are seen as the easiest form of customer reference marketing. They are relatively easy to create, require a small contribution from the customer and still provide valuable status transfer effects, especially if the material contains large and prestigious customers with a good reputation (Jalkala & Salminen, 2007). Press releases and other material signaling that supplier has passed through customer's selection process are also an important part of reference marketing. Especially in a situation where supplier is entering into a new market this kind of material acts as a strong signal that early adopters are trusting this new supplier (Jalkala & Salminen, 2010).

Different kind of success stories and materials where the customer is telling about the value they have been able to generate in their own process by using the suppliers offering are identified as a good way to demonstrate and concretize supplier's value proposition. At this, point the importance of similarity between the reference and a potential new customer is also emphasized. The potential customer should be able to use the material to evaluate how the offering is going to create value in its own process and decrease the perceived risk. Ruokolainen and Aarikka-Stenroos (2016) propose that this kind of reference material should contain at least the following aspects:

1. Basic data about reference customer

Basic data includes information such as company name, size, industry and other relevant characteristics that can enhance credibility and support supplier in using the reference.

2. Long-term orientation

Long-term orientation acts as a signal that supplier is committed to customer and is ready to learn about customers' needs and provide the offering suited for these needs.

### 3. Direct benefits

Provide proof of verified benefits that customer has received from suppliers offering. These can be easily quantified benefits such as cost savings and quality improvements or more abstract and harder to define such as improved reputation or brand image.

### 4. Competencies and indirect benefits

New competencies that customer was able to achieve with the help of supplier's offering. These are competencies that supplier has not taken into account when designing the offering and can be seen as an "extra" benefits for the customer.

### 5. Demonstrated and improved competencies of supplier

This aspect is seen as more new market entry specific and it is intended for showing that supplier is capable and ready to learn from its customers in order to improve its offering in the future. It can also be used to demonstrate supplier's competence, experience, and problem-solving capabilities.

### 6. Contemporary and future-oriented commitment to reference customer

Customer's commitment, especially in new market entry, sends a signal about the trustworthiness and credibility of the supplier. In the case of more mature supplier commitment is telling more about the quality of the relationship and supplier's capability to maintain a long-term relationship with the customer.

Reference calls, site visits and other activities that require reference customers' involvement are also an important part of the reference portfolio. These practices require more effort from the supplier and the control over reference quality is lower but they offer potential customers a chance to have indirect evidence on how the offering is actually performing in real life context. Especially in process technology and in more complex offerings this is an important aspect in assuring the potential customer on supplier's ability to provide real value to the customer. The new market entry has also been identified as a situation where the value of reference visits is high because of their ability to reduce perceived risks. (Salminen & Möller, 2006; Jalkala & Salminen, 2010; Helm & Salminen, 2010; Ruokolainen & Aarikka-Stenroos, 2016)

#### 4.7.2 Internal

Internal reference use is more limited to learning and motivating purposes and customer's role is not that significant. Most of the internal marketing practices focus on delivering the gathered knowledge about the customer(s) to the entire organization through systematical analysis, documentation, and communication of references. Table 6 combines the desired functions of internal reference use to marketing practices that can be used to achieve the desired benefits of internal reference use.

**Table 6.** Practices and proposed functions of internal customer reference marketing (According to Jalkala & Salminen, 2010)

<b>The role of customer references as marketing assets</b>	<b>The function of reference-marketing activity</b>	<b>The supplier's reference-marketing practices</b>
Template for organizational learning	Enhance organizational experiential learning and reduce redundancy	Best-practice and lessons-learned exercises
Knowledge base for customer-need and market sensing, and for understanding internal competencies	Enhance understanding of customer needs and internal competencies	Systematic analysis of a well-documented portfolio of customer references
Basis for building credible value propositions	Develop credible value propositions	Measuring delivered customer value from reference cases
Schema for offering and new-product development	Help in offering development	Selecting and documenting "iconic cases"
Source of internal motivation	Motivate personnel	Internal success stories and "solution of the month" types of announcements
Schema for training and educating personnel	Educate and train personnel	Internal reference case descriptions and "reference black books"

Internal use of references can be divided into two categories based on the marketing practices used. The first category uses written material and announcements to

communicate successful references throughout the organization. The second category demands more involvement from the personnel and includes different kind of exercises and analysis that utilize the gathered reference data.

The first category focuses on delivering the information about successful references to the whole organization in the form of success stories, a solution of the month announcements and other material that is easily communicated to the entire organization. The aim of this is to motivate personnel and share information that would otherwise stay within the sales department. The second category demands more work and involvement from the different parts of the organization. These are usually systematic processes that aim to utilize references for learning and development purposes. For example, the supplier can use success stories and other reference material to train salespeople in gaining a better understanding of their customers' processes and needs. (Jalkala & Salminen, 2010; Terho & Jalkala, 2017)

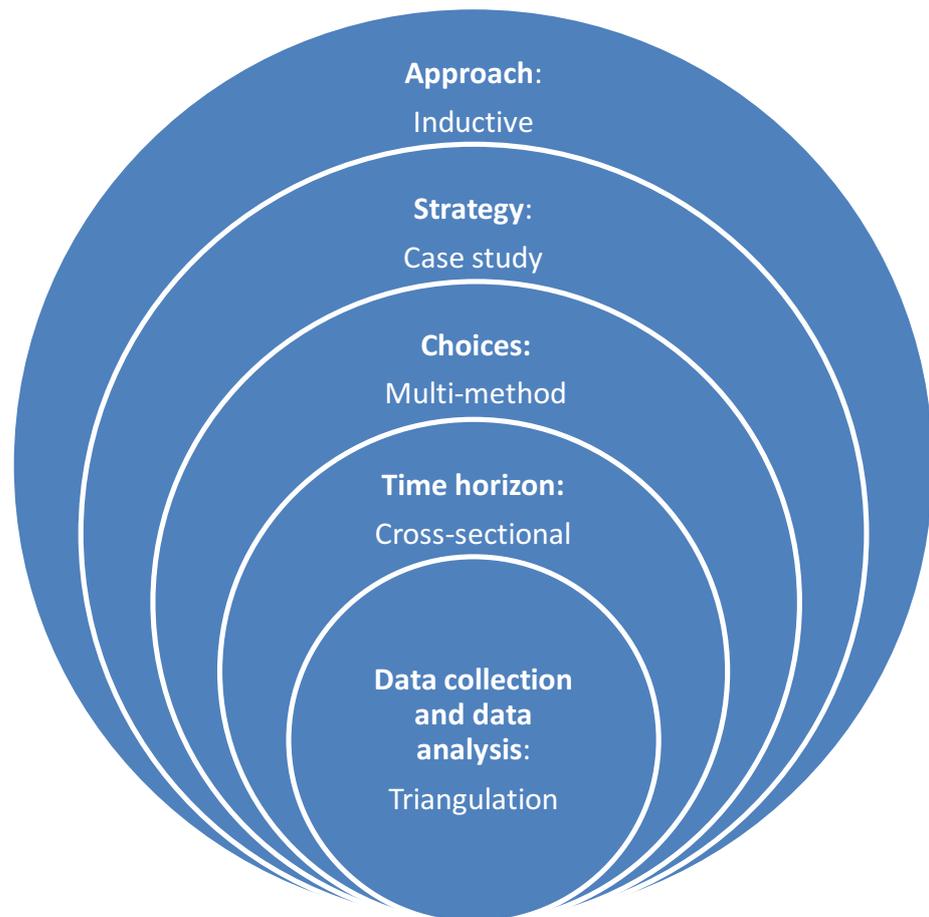
## **5 RESEARCH DESIGN AND METHODOLOGY**

The research design is the overall plan that guides the process and ways that research questions are answered. It should contain clear objectives, data collection and analysis methods and sources of data and to also consider the constraints and limitations that the research has. (Saunders 2009, pp. 136-137) In this chapter, the research design and methodology for this thesis is introduced and the reasoning for the selected design and methodology is also provided.

The research design of this thesis is built around research onion introduced by Saunders et al. (2009). In this chapter, these choices regarding research design and tactics are introduced starting from the outer circle of the research onion.

### **5.1 Research design**

This study uses an inductive approach to derive results from the data collected and analyzed during the research. In order to be able to use inductive approach researcher needs to first build a profound understanding of the research context without building a hypothesis. This knowledge is then used for analyzing the collected qualitative data with the goal of making generalizations from the broad data. The inductive approach allows a flexible research structure that can be changed during the research if it seen necessary. The inductive approach also sees the researcher as a part of the research project and emphasizes the importance of an in-depth understanding of the research context instead of creating generalized results. (Saunders 2009, pp 124-129) The literature for this research was studied before the empirical work and used as a basis for the data collection phase. The theoretical section of this study was modified after initial empirical research to provide better support for the data collection.



**Figure 4.** Research design (Sanders et al. 2009 pp. 108)

A qualitative case study is presented in the empirical part of this thesis. According to Hirsjärvi et al. (2004, pp 125) case study is a strategy that is used in studies that aim to provide detailed and intensive information about a single case or small group cases that are linked to each other. It involves an empirical investigation of phenomena in its real life context using multiple sources of evidence (Saunders et al. 2009, pp. 144-146) Aim of case studies is to investigate literature about a particular phenomenon and combine it with empirical information in order to gain a rich understanding about the topic. The case study in this thesis can also be defined as an embedded case since it involves more than one unit of analysis. (Saunders 2009, pp 147)

Qualitative research is used in empirical part, meaning that the research aims to create a comprehensive understanding of the phenomenon in real life contexts using people as a main source of information. Methods used in qualitative research can, for example, be structured interviews, detective participation, group interviews, and analysis of multiple documents and texts. This information is analyzed inductively in a way that researcher is able to have a complex and detailed view of the studied phenomenon. (Hirsjärvi 2004, pp 155)

Time horizon selection in this research is cross-sectional. This research aims to study a particular phenomenon at a particular time and create a “snapshot” of the situation at this particular moment in time. The chosen time in cross-sectional research can be the present moment or some period in the history (Saunders et al. 2009, pp. 155; Bryman & Bell 2011, pp. 68-69)

Data for this thesis is collected and analyzed using triangulation. Saunders et al (2009, 145-147) define triangulation as an analysis method that uses multiple data sources and collection techniques in one study to ensure that data is reliable and telling the right things to researcher. A multi-method qualitative study is adopted as a data collection method for this study. Multi-method allows the use of multiple qualitative sources and methods such as semi-structured interviews, meetings, benchmarking and database analysis using non-numerical procedures. (Saunders 2009, pp. 151-153)

## **5.2 Data collection and analysis**

Interviews are used as the main source of empirical information in this research. Hirsjärvi et al. (2004, pp 193-196) suggest that interviews should be used as the main method for data collection in qualitative research because of the unique qualities they have. Interviews offer a chance have a direct interaction with respondents. This increases the flexibility of information collection and also allows more in-depth questions with the possibility to ask further questions. Main

weaknesses associated with interviews are its time-consuming nature and possible misunderstandings and biases between participants (Hirsjärvi et al. 2004, pp 193-197)

All interviews for this thesis were conducted as semi-structured interviews. Semi-structured interviews are a combination of structured and open interviews. They enable flexible interviews that take the expertise of the respondent into consideration. Semi-structured interviews are based on a list fairly specific questions and/or themes that act as a guideline for the interview but also allow additional questions if they are seen necessary. Guidelines used in the interviews during this research can be found from the appendix. It is also possible to leave out some of the questions or themes if they are not seen necessary. The interviewer needs to also have a basic understanding of the topic in order to be able to steer the interview and generate additional questions. (Saunders et al. 2009, pp. 320-322; Bryman and Bell 2011, pp. 466-470)

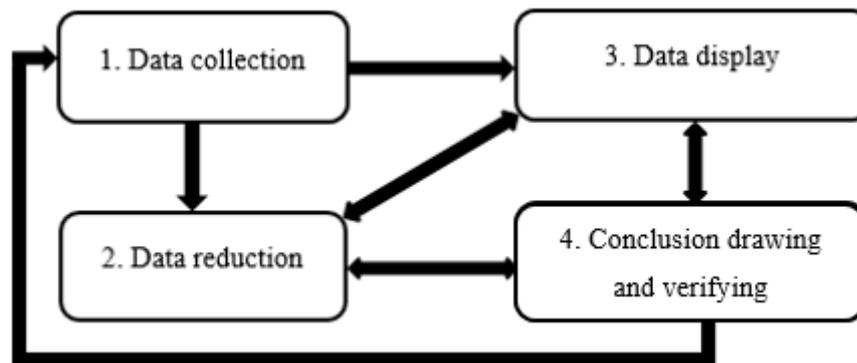
According to Hirsjärvi et al (2004, pp. 155) respondents for interviews should be selected based on their ability to provide information about the phenomenon instead of using a random sample. Respondents for this research were selected with purposive sampling (Patton 2002, pp. 131-140) Respondents selected for the interviews presented a wide range of actors operating in the biogas industry. Main criteria for the selection of respondents was that they had good understanding about the measurement and maintenance needs concerning AD plant and/or landfill. Other important criteria was that respondents should operate with different business models and in multiple countries to ensure that the responses represent global markets. The sample size was not determined prior the research and interviews were ceased when saturation was reached. Interviews were conducted between September 2017 and January 2018. More detailed list of respondents can be found from the appendix.

In addition to interviews, data was also collected by analyzing material gathered in Vaisala before this research. This data was mainly gathered from end-user and plant manufacturer visits and interviews, presentations, and other information sources about biogas production process such as market analysis and guides for plant owners. The data that was gathered prior to this research formed a basis for the interview guidelines and assumptions that are introduced in the chapter 6. During the research, project Vaisala also had meetings with distributors and engineering companies that operate in biogas industry. These meetings offered an additional source of information that could be used in this thesis. These meetings were not constructed around the themes of this thesis but they still provided fruitful information regarding the research objectives. Summary of the data sources can be found from the following table.

**Table 7.** Summary of data sources outside the case company

<b>Interviews during the study</b>	Amount of interviews/meetings
End-user	9
Plant manufacturer	2
Industry expert	2
CHP-distributor	3
<b>Interviews and visits prior study</b>	
End-user	17
Plant manufacturer	4
<b>Additional information sources</b>	
Distributor meetings	3
Engineering company meetings	8
<b>Total</b>	48

Collected data was analyzed using the data analysis framework introduced by Miles and Huberman (1994). This analytical framework is built around three major phases of data analysis: data reduction, data display, and conclusion drawing and verification.



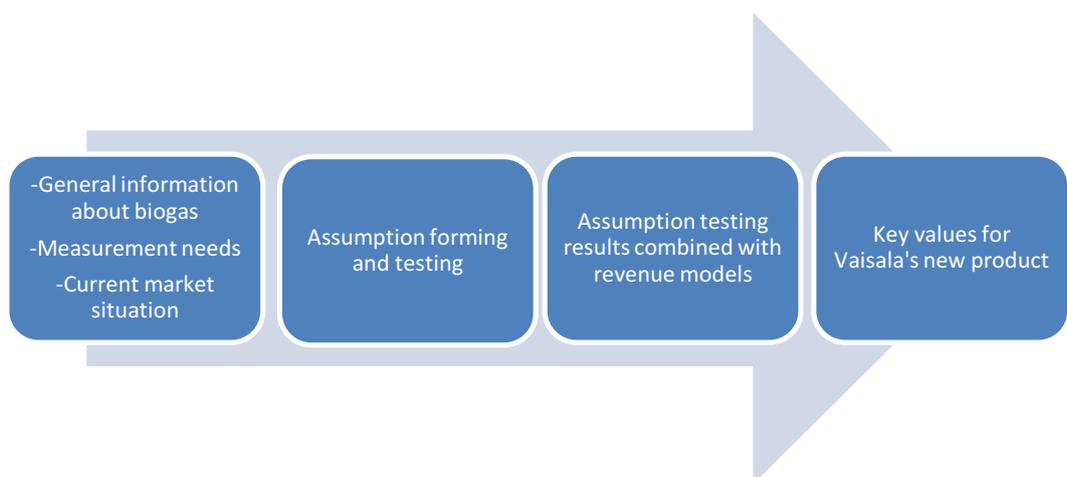
**Figure 5.** Data analysis model and phases (According to Miles and Huberman 1994)

Data reduction phase aims to clarify and condense the data into a form where it can be displayed and analyzed. In practice, this happens throughout the research as the researcher gains a better understanding of the topic and is able to filter out insignificant data. Next phase is the data display where the collected data is brought into a form where it can be displayed and analyzed. Data can be displayed in multiple ways and basically, any way that helps the research move forward is appropriate. The last phase is to use the data and draw conclusions/verifications from it. All of these phases take place somewhat concurrently and affect each other in an iterative process that can be seen in Figure 5.

## 6 KEY VALUES IN BIOGAS QUALITY MEASUREMENT

This chapter is the beginning of the empirical part of this thesis. As stated in the three dimensions of value-based selling by Terho et al. 2011 in chapter three, development of value proposition should be started by gaining a profound understanding of the customers' business model. This enables the supplier to proactively approach customers and offer solutions that improve customers' capability to generate value in their own process. It also allows the supplier to differentiate from competitors that are not identifying the specific value drivers of their customers and are instead offering a more generic value proposition.

The first chapter offers general information about biogas process and gas quality measurement needs in it. This information is then used as a basis for creating assumptions about measurement needs in the customers' processes. The second chapter introduces these assumptions and the results of testing these assumptions. The third chapter focuses on understanding different revenue models in biogas industry and how they effect on the need and value of biogas quality measurement. The last chapter introduces key values of biogas quality measurement based on the understanding gained on customers' process and how the gas quality measurement generates value in it.

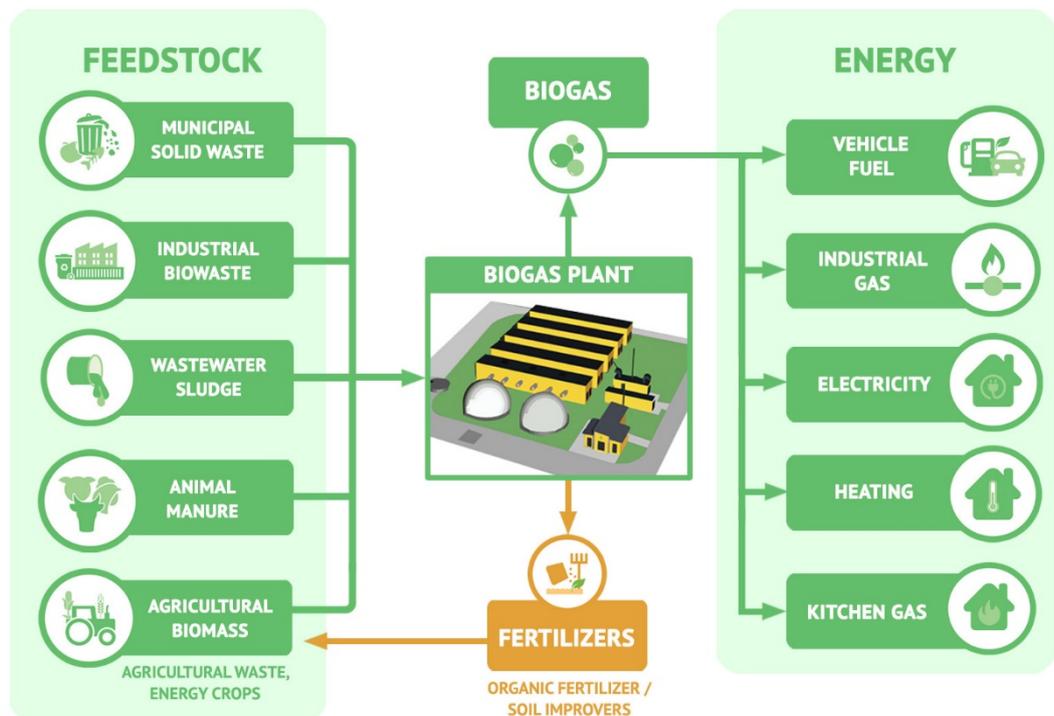


**Figure 6.** Framework for value analysis

## 6.1 Biogas process and gas quality measurement needs

### *Biogas*

Biogas is a mixture of different gases that have been created by breaking down organic matter in the absence of oxygen. In this kind of environment organic material is being broken down by microorganisms through fermentation. This process creates a gas mixture that is primarily methane (50-70%) and carbon dioxide (25-45%) but also typically contains small amounts of hydrogen sulfide, moisture, siloxanes and many other gases depending on the process environment and feedstock used. Biogas is a renewable energy source that can be utilized in multiple ways. It is mainly used as a fuel for generating electricity and heat in CHP-units but is worth to notice that during the recent years upgrading biogas to biomethane that can be used as a substitute for natural gas has also increased substantially. (Motiva 2017)(Biokaasuyhdistys 2017) (Biogas as a renewable energy source)



**Figure 7.** Feedstock sources and end use of biogas in AD-plant (Bio-GTS 2017)

### *Production methods*

Biogas production can be divided into two different categories based on the used production method. The most common way is anaerobic digestion inside controlled anaerobic digester, later referred as AD or AD-plants. Size of AD operation can range from small household-scale digesters to large industrial plants with multiple digesters and complex infrastructure around them.

Another way is to collect the biogas that is produced when organic material is naturally decomposing in landfills. This requires that landfill is equipped with infrastructure that allows the gas to be captured instead of letting it evaporate into the atmosphere. Landfill gas can be used in similar ways than the gas from AD plants and it has also the benefit of capturing the methane instead of letting it get into the atmosphere like in open landfills. Methane is 20-70 times more powerful greenhouse gas than carbon dioxide and therefore it is important to capture it with AD-plants or in landfills. This environmental aspect of biogas production is also one of the reasons that many governments encourage the use and capture of biogas with incentives and other support mechanisms. (Biokaasuyhdistys 2017; Motiva 2017; QYResearch 2016)

### *Raw material used for biogas production*

Raw materials used for biogas generation in AD-plants vary a lot between different plant types and it is quite common that one plant uses multiple feedstock sources simultaneously. Most common feedstock material is biodegradable waste streams produced by human activities. This approach uses biogas plants as an effective and environmentally friendly way to handle these waste streams. However, use of these waste streams as a raw material causes challenges for process control because feedstock quality and composition might vary a lot. Different raw materials have a big difference in their potential biogas yields. This increases the importance of continuous biogas quality measurement that can be used to control the feeding of digesters. Another common feedstock material is energy crops. These crops are grown to be used as a fuel for AD-plants. With energy crops, the raw material is more homogenous and it is usually easier to control and optimize the process because of lower variation in raw materials gas yield potential. (QYResearch 2016)

Landfill gas is also produced during the process of handling solid waste streams. Landfills differ from AD-plants in a sense that once the landfill is prepared for gas production purposes there is not a possibility to add more raw material into the process. Landfills are also not limited to biodegradable waste streams and can contain all kinds of municipal solid waste. This also adds challenges to the end-use and quality measurement of produced biogas because it typically has a higher amount of impurities and lower methane content. (Motiva 2017) (Balat & Balat 2009)

#### *Gas quality measurement needs in biogas process*

Gas quality measurement needs in biogas process depend on the type and size of the AD-plant or landfill. Some simpler farm scale-plants might operate with one handheld measurement device that is used once a day for control whereas in some industrial plants continuous measurement in multiple locations throughout the process is needed. Measurement need is usually also connected to the degree of automation and complexity of the AD-plant or landfill. Common parameters in continuous biogas quality measurement are methane, carbon dioxide, oxygen and hydrogen sulfide (Guide to Biogas 2010). Composition and quality of biogas are important parameters for monitoring and optimizing the process. Data received from these measurements can be used to control the process, to monitor the health of digester(s), energy balance calculation, plant performance optimization, controlling and adjusting CHP-unit(s), protecting CHP-unit(s) and other sensitive parts from harmful contents in gas, pricing the sold biogas or biomethane and in some cases also for compliance reporting purposes. Without continuous monitoring of the gas quality, AD-plants and landfills are not able to optimize the process and achieve the highest possible gas yields. In recent years growing need to optimize the performance and minimize the costs has increased the need for high-quality gas measurement devices in AD-plants and landfills that want to increase their gas yields and revenues through better process control and lower costs. (Boe 2006; Knobelspies et al. 2016; Guide to biogas 2010)

## 6.2 Current situation in the market

This chapter provides a brief overview of the current market situation in biogas quality measurement markets and also introduces key features of Vaisala's new measurement device. It is not a comprehensive review of competitors and it should be seen only as an introduction that is needed for understanding the differences between current devices and Vaisala's new device.

### *Competitors*

The current market for biogas quality measurement devices is dominated by analyzer systems that extract the gas from biogas pipeline and analyze it ex-situ. These devices have a complex structure which includes multiple sensors, sampling lines, a sampling pump, gas dryer and other components needed for performing the measurements. Current analyzers typically use infrared sensors for methane and carbon dioxide and electrochemical cells or paramagnetic sensors for hydrogen sulfide, oxygen, and hydrogen measurements. Especially electro-chemical cells suffer from long-term drift and they need to be replaced in a relatively short time interval. Measurement drift is also a problem with current infrared based sensors and there is a need to calibrate the devices in a regular interval with calibration gases. Calibration intervals are different for every device but typically it needs to be done at least every 3-6 months. Other typical problems are condensation accumulating in sampling lines and unexpected failures with pumps and other components.

Because of the complex structure, the price of these devices can reach over 20 000€ which is seen to prevent the use of proper gas analysis, especially in the small scale plants even though it might be a crucial part in improving efficiency and reducing the costs of the plant. There is clearly a need for a device that has a simpler structure and is capable of measuring the gas quality directly from the pipeline without sampling systems and condensation removal. (Knobelspies et al. 2016; QYResearch 2016)

*Vaisala's new product*

The product that Vaisala is bringing into markets is clearly disruptive when compared to the analyzer system currently sold. Vaisala's product is intended to be used directly in the gas line as an in-situ measurement device that eliminates the need for sampling system and drying of the sample. Because of Vaisala's proprietary infrared measurement technology calibration and maintenance interval is also increased from 3-6 months to once in a year. Vaisala device doesn't have hydrogen sulfide and oxygen measurements because there is not suitable technology for doing this in-situ but it is capable of measuring H<sub>2</sub>O content. Current analyzers in the markets are not capable of measuring H<sub>2</sub>O content because of their need to dry the gas sample. Simpler design and in-situ measurement also make it less susceptible to electrical and mechanical malfunctions caused by the harsh environment in biogas plants and landfills.

**6.3 Assumption forming on values in biogas quality measurement**

This chapter introduces nine assumptions that have been used as a basis for gathering and analyzing the data needed for identifying the key values of gas quality measurements in biogas industry. Assumptions and their categories also formed the basis for the semi-structured interviews conducted during this research. In addition to interviews, other data sources introduced in chapter five were also used to form and test these assumptions. Assumptions are divided into four categories based on their ability to generate value for the customer. These categories are process control and optimization, upgrading, and selling, use in CHP-unit(s) and general values. The findings of the data analysis related to each assumption are presented in the chapter 6.4.

**6.3.1 Process control and optimization**

In order to be able to control the process, plant personnel need reliable data about the quality of the biogas coming out of digester(s). This data can be used to control the amount of raw material fed into digester(s) and in some cases also for preparing

right kind of raw material mix. The amount of measurement points in the process is usually related to the number of digesters

Data about gas quality is also used for preventing problems in digesters. Methane and carbon dioxide content of the gas acts as a warning sign about possible problems in the process. Digester stability is constantly monitored with the aim that plant personnel is able to react to abnormal behavior as soon as possible. The need for measurement data is typically on the hourly level since the changes in the process are slow and possible adjustments made are usually visible only after hours or even days from the time of adjustment. (Boe, 2006; Guide to biogas, 2010)

Landfills have similar measurement needs but the difference is that their ability to control the process is more limited than in the AD-plants. Landfills are not able to control the fermentation process and the raw material used is also predetermined because the gas collection starts after the landfill stops taking new waste in. In landfills, gas quality measurement is used to control the valves that control gas flows from different parts of the landfill and to adjust blowers that suck the gas from the gas wells and pipelines. Landfills also use the measurement data for preventing problems and observing the state of the process in similar ways than what AD-plants do.

*Assumptions:*

1. Customers are able to achieve the full potential of their process with more reliable and accurate gas quality measurement
2. Customers are able to prevent potential problems in process with more reliable gas quality measurement

### 6.3.2 CHP-use

The most common use for biogas is heat and electricity generation in plants own CHP-units that use the produced biogas as a fuel. This is an efficient way to use the biogas and it also provides heat and electricity for plants own use. Biogas coming out of digester or landfill is saturated with water vapors and in addition to methane

and carbon dioxide also contain gases such as hydrogen sulfide, that can be harmful to the engine. Gas quality and especially methane content might also vary substantially and there is a need to adjust the CHP-unit accordingly.

Customers also need to measure the gas quality and send this information to CHP-units control system in order to achieve the highest possible efficiency. It also enables corrective actions if biogas quality starts to change in a way that it could cause damage to the CHP-unit or decrease the efficiency of it. Data on gas quality and especially methane content is also commonly used to count energy balances and controlling that CHP-unit is achieving the desired efficiency ratio when turning the biogas to heat and electricity. (Guide to biogas, 2010; Teodorita et al. 2008)

Assumptions:

3. Customers are able to achieve higher efficiency in their CHP units with continuous methane content measurement
4. Customers are able to protect their CHP-units from possible damages with better gas quality control
5. Customers need more reliable and accurate measurements for controlling the energy balances and monitoring the quality of the gas used in their CHP-units

### 6.3.3 Upgrading and selling biogas

In addition to using biogas in plants or at landfills own CHP unit gas can be sold forward as a raw biogas or as a biogas upgraded to biomethane that has the same qualities than natural gas and can be injected into gas grid or sold as a vehicle fuel. If biogas is sold forward as a raw biogas or biomethane there is a need to measure the methane content because it is often used as a basis for pricing the sold biogas. Raw biogas has fewer quality requirements than biogas upgraded to biomethane. Usually, gas is sold without any upgrading and is only dried and possibly desulfurized after it leaves AD-plants or landfill.

If biogas is upgraded to biomethane to replace natural gas the producer of biomethane is responsible that the gas quality meets the requirements that are set

for gas that is fed into the gas grid or sold as a vehicle fuel. CO<sub>2</sub> and other unnecessary components need to be removed and CH<sub>4</sub> content is typically raised above 90% in the process. There is also a need to measure the gas quality during the upgrading process in order to be able to control the upgrading process. (Guide to biogas 2010; Teodorita et al. 2008)

Assumptions:

6. There is a need for more reliable and accurate gas quality measurement device for pricing the sold raw biogas and biomethane
7. There is a need for more accurate and reliable gas quality measurement device to be used in biogas upgrading process

#### 6.3.4 General values

Based on the competitor comparison and initial interviews with end-users there is clearly a need for a measurement device that is able to conduct measurements in-situ without sampling system, has a simpler structure and withstands harsh external conditions better. Another clear pain point with current devices in the market is their short calibration and maintenance intervals that cause too much work and expenses to the end-users. These costs are also often unpredictable and hard to estimate at the moment when the device is being bought. Initial costs of buying these complex analyzer systems are also seen to be too high especially for small-scale customers.

Assumptions:

8. There is a need for an in-situ measurement device with simple and robust structure
9. Current devices in the market have too short calibration and maintenance intervals that cause unnecessary and unpredictable costs over the lifetime of the device

## 6.4 Results of assumption testing

This chapter introduces results of the assumption testing. These results were derived from multiple sources of information. Interviews conducted during the research can be seen as a main source of information. In addition to interviews data was also collected by analyzing material gathered in Vaisala before this research. This data consists of end-user and plant manufacturer visits and interviews, meetings with engineering companies and distributors during the research, presentations, and other information sources about biogas production process such as market analysis and guides for plant owners.

### 6.4.1 Process control and optimization

Assumption 1. Customers are able to achieve the full potential of their process with more reliable and accurate gas quality measurement

Assumption 2. Customers are able to prevent potential problems in process with more reliable gas quality measurement

#### *Findings*

Data analysis gives clear support for the assumptions. Almost all interviewed persons mentioned that reliable and stable gas quality measurement is a key factor in their effort to control the process and achieve the full potential of their AD-plant or landfill. The accuracy of the measurement was also seen important, but because of the nature of the process accuracy does not play that big role in the successful process control as the long-term stability and reliability. Many of the respondents mentioned that most important thing is that they can trust the long-term methane concentration trends and to be sure that they are making the process adjustments based on the correct information. Changes in the process are slow and if the decision to make an adjustment is based on incorrect reading this can lead to a situation where the process is not operating in its full potential for a longer period of time. Most common problem related to this with current devices on the markets is the measurement drift which causes the devices to show a reading that has drifted away

from the actual reading and could be interpreted as a change in the process even though it is actually just a measurement error.

AD-plants are also typically not highly automatized and the information about gas quality is not used to automatically adjust the process. Every plant has a different kind of bacterial flora inside the digester(s) and process control is based on the typical biogas process defined by the plant manufacturer that is mixed with plant personnel own knowledge and “gut feeling” of their digester(s) typical performance. If the plant has multiple digesters even different digesters in the same plant might have a different kind of performance. Ability to measure each digester individually was therefore also seen as an important factor for the successful plant operation.

The ability to prevent problems and perform troubleshooting was also associated with a reliable measurement that enables the user to trust the long-term trends and make corrections to the process based on that information. In the worst case scenario bacteria inside digester dies which leads to digester shutdown that can last multiple months and cause substantial financial losses in terms of lost revenue and digester reboot costs.

Responses from landfill users have the same demands for stability and accuracy of the measurement. The only notable difference is that the adjustments made to the process take a longer time on landfills which emphasizes the importance of long-term stability and reliability of the measurement device.

**Table 8.** Quotes from the responses regarding assumptions 1 and 2.

“Each digester behaves differently and therefore must also be controlled separately. Most important thing is to avoid problems. Optimization often hard because feedstock is not homogenous and control is based more on the operators “gut-feeling” than automated process that would always work in the same way.”
“All measures ultimately attempt to improve the process and yield. CH <sub>4</sub> measurement doesn’t automatically adjust the process, operators have to use their own “touch” and trends they get from measurements.”
“Drift becomes a problem when data is used for longer-term control and process health evaluation. Data must be reliable in long-term. Causes problems when

there is a need to do calculations based on the methane content. Drift might cause device to show smaller/higher readings even if the quality has stayed same”
“The true methane concentration is 61% but it shows 44.9% in the measurement instrument, it shows what it wants to show”
“Drift and too short calibration intervals cause problems. Reliability and repeatability much more important than accurate measurement data. Have to be able to trust long-term trends that are used for adjustments. Not important if the device is able to tell the exact content or not, reliability more important.”
“Operator is able to prevent the problems by using longer-term trends and monitor them daily. Other measures also used to prevent problems and to evaluate the health of the process. If it gets bad it might take many weeks to get the process back into the normal state with normal gas yield.”
“CH <sub>4</sub> very important in process control. It tells a lot about the health of bacteria inside the digester. Problems in bacteria health can be observed quite quickly from it”
"I fear that the process will be ruined due to the incorrect and cheap measurement"

#### 6.4.2 CHP-use

##### Assumption 3.

Customers are able to achieve higher efficiency in their CHP units with continuous methane content measurement

The third assumption was based on the idea that customers are able to achieve higher efficiency in their CHP-units by providing real-time gas concentration data to the control unit of their CHP. This would then result in better efficiency because control unit is able to adjust the air-fuel ratio in the best possible way. Assumption testing gave mixed results to this assumption. Based on the responses it seems that especially some older CHP-units need continuous information about the methane content of the gas in order to operate as efficiently as possible, but most of the modern CHP-units are able to adjust their air-fuel ratios without continuous methane content information. Even though these units are able to do the adjustments without the continuous data many respondents believed that there is a possibility

that engines could achieve higher efficiency with real-time CH<sub>4</sub> data, especially in situations where gas quality fluctuates often and the amount of fluctuation is high. Respondents also pointed out that the gas quality might not affect the efficiency directly in the form of reduced fuel consumption but by reducing the downtime of the CHP. Downtime is often caused by engine shutdowns and alarms related to fluctuations in methane content that in turn triggers the CHP-units automated protection systems.

**Table 9.** Quotes from the responses regarding assumption 3.

“By knowing the CH <sub>4</sub> value, CHP can make itself more efficient, a fixed value can be also given to CHP”
“Methane content is being fed into the engines because it results in higher efficiency because the engine can be controlled better. Used to control the air-fuel mixture. If CH <sub>4</sub> content known this mixture can be optimized and burning process runs better”
CHP efficiency not impacted by the methane concentration, engines controlled and run by using a suitable combustion chamber temperature setting, controlled by the temperature
“CHP systems control themselves based on gas flow and gas level at a storage tank”
“Customer measures gas quality because wants to avoid alarms and shutdowns, also better efficiency with real-time CH <sub>4</sub> content data, also believes that lifecycle longer if gas content measured and controlled”

Assumption 4.

Customers are able to protect their CHP-units from possible damages with better gas quality control

CHP-unit maintenance and repair expenses can be a big part of the cost structure in AD-plants and landfills. The fourth assumption is based on the idea that customers would be able to decrease their maintenance and repair expenses by having a better control over the quality of the gas used in their CHP-unit(s).

Almost all of the respondents raised gas humidity and hydrogen sulfide content as most potential ones to cause damage to the CHP-unit. Combination of humidity and H<sub>2</sub>S was seen especially harmful because it forms corrosive sulfur that damages

the CHP-unit. In order to avoid this AD-plants and landfills typically have some kind of process that aims to remove the hydrogen sulfide and humidity from the gas. This process is usually not able to remove all of these harmful components and there seems to be a clear need for controlling the amount of hydrogen sulfide and humidity left in the biogas when it enters the CHP-unit. This measurement would provide users information about their gas quality which in turn could be used to prevent possible problems with the CHP-unit. This would lead to a longer lifetime of the engine and decrease the amount of unplanned maintenance and repair downtime in electricity and heat production. The customer would save money by decreasing the need for costly repairs and would also be able to generate more revenue through a higher amount of sold electricity and heat.

**Table 10.** Quotes from the responses regarding assumption 4.

<p>“Humidity would be interesting at this point because of a combination of water and hydrogen sulfide form a corrosive combination that damages the engine in long run. We could use humidity alarms for motors and maybe stop them if humidity is too high.”</p>
<p>“Humidity itself not that big of an issue for the engines but becomes an issue when mixed with impurities in the gas. The biggest problem is with hydrogen sulfide that causes corrosion when mixed with water.”</p>
<p>“Combination of water and hydrogen sulfide has probably caused multiple cooler breakdowns in our plants. In some cases, it happened after just 10 000 hours of engine use. Replacing the cooler is not that easy and takes at least couple of days. Cost of new cooler and installation normally tens of thousands of euros plus the additional cost of not being able to produce electricity. “</p>

#### Assumption 5.

Customers need more reliable and accurate biogas quality measurements for controlling the energy balances and monitoring the quality of the gas used in their CHP-units

Most of the respondents that had a gas quality measurement in their CHP-unit used the data for this purpose and had a control system that allowed them to monitor their CHP-unit performance. Usually, this kind of monitoring is done by counting energy

balances and efficiency ratios based on the energy content of the input biogas and output electricity and heat. These calculations are then being compared to values that manufacturer of the CHP-unit has given about the performance of their units to see if there are problems and/or possibilities for improvements.

Many of the respondents also emphasized the importance of reliable gas quality data in the situation where CHP-unit is not operating the way it should be or it breaks down. In these situations, the user needs to be able to provide evidence about their gas quality to the CHP manufacturer in order to prove that the problems were not caused by their gas quality. Ability to measure the humidity of the gas was also raised as an interesting point in the responses to this assumption. Because the quality of the biogas might vary substantially CHP manufacturers have set minimum requirements concerning the gas quality. These are set to prevent damages for the CHP and to ensure that they run with highest possible efficiency. The humidity of the gas is included in these requirements. However, current devices in the markets are not able to measure the humidity of the gas and currently AD-plants and landfills have to simply trust that their humidity removal process is operating correctly.

**Table 11.** Quotes from the responses regarding assumption 5.

“You have to have something to put on the table if there are problems with the engine, we need to be able to show engine suppliers numbers on what we put in and what we get out. Our gas quality is good, there is something wrong with engines mechanical quality”
“Control that you get the highest possible amount of electricity out of your plant, otherwise you lose money. If you don’t get the full amount of electricity you are losing money on your big investment to this kind of plant”
“We also use it to control that CHP is working in a way it should work by measuring the quality and amount of gas that goes in and comparing it to electricity and heat coming out, efficiency ratio”
“In this kind of cases, it could be valuable to have reliable data about the gas quality so that plants can prove to the engine manufacturer that their gas has had good quality and is not the reason for the engine to break down.”
“Also good to have if there are some problems with the engine. Problem shooting and also to prove that engine is fed with gas that fulfills engine manufacturers requirements concerning gas quality.”

### 6.4.3 Upgrading and selling biogas

#### Assumption 6.

There is a need for more reliable and accurate gas quality measurement device for pricing the sold raw biogas and biomethane

#### Assumption 7.

There is a need for more accurate and reliable gas quality measurement device to be used in biogas upgrading process

According to responses, there is clearly a need for gas quality measurement when biogas is sold either as a raw biogas or upgraded to biomethane. However, the requirements concerning measurement accuracy and pressure in upgrading process are too high for Vaisala's new product and therefore this device cannot be used in upgrading or selling the biomethane. Information gathered for assumption seven should be used in the following product development projects to ensure that Vaisala is able to offer a solution also for growing biogas upgrading markets.

Assumption six is based on the idea that current devices on the market have problems with accuracy and measurement drift. If this kind of device is used to determine the gas quality of the sold biogas there is a possibility that customer is paying too much or too little and the quality of the gas is not what customer expects. Respondents acknowledged that there might be some problems in gas quality measurement when raw biogas is being sold forward but they did not see it as a big problem at the moment. Selling raw biogas is not that common and if it is being sold there is usually only one buyer. Respondents felt that possible problems caused by inaccuracies in the measurement can be dealt with proper contracts between parties and by having gas quality measurement device from a supplier that both parties trust.

**Table 12.** Quotes from the responses regarding assumptions 6 and 7.

“Problems/differences in gas quality measurement have caused some problems when billing the sold gas”
“We have to be sure that the upgrading is working as intended and that customers are getting what they are paying for”
We haven’t had problems with this. Selling raw biogas is not that common in our plants. In some cases, CHP is owned by other company and then gas is being sold to CHP unit but there have not been problems with measurement accuracy.
“Gas chromatograph used when gas injected to grid if there is a problem with the quality, the plant is not allowed to put the gas into the grid. Grid operator shuts down your valve and you are not able to put gas into grid, it is a big problem if revenues come mainly from sold gas”

#### 6.4.4 General values

##### Assumption 8.

-There is a need for an in-situ measurement device with simple and robust structure

Responses support the assumption that current devices face problems because of their complex structure and harsh operating environment. Majority of the measurement devices currently sold are complex analyzers that are based on extractive measurement with sampling system. Many respondents saw this problematic because these analyzers are susceptible to failures. The most common problem that respondents were having is sampling lines getting stuck because of the dirt in the biogas. Also, the low quality of some of the devices is a factor that raised up from the responses. Measuring sensors and other components used in these devices were seen to be low quality and not designed for the harsh biogas environment. This leads to some of the problems mentioned already in the first assumptions. Measurement sensors start to drift and lose their accuracy which in turn leads to a situation where the user is not able to trust the data and starts to look for other ways to control the process.

**Table 13.** Quotes from the responses regarding assumption 8.

“The simpler the product the better, Siemens analyzers are huge!”
“We have 3 methane sensors currently in the plant but only one of them works moderately”
“If the instrument requires continuous maintenance, you might have the energy to do it in the start-up phase. If it continues, you start looking at other parameters for process control, that’s not good”
Plant manufacturers integrate analyzer systems of poor quality due to tight budget control, current systems are "legos", quality of the systems is low, margins are low

## Assumption 9.

-Current devices in the market have too short calibration and maintenance intervals that cause unnecessary and unpredictable costs over the lifetime of the device

The last assumption focuses on the costs that customers have with the current devices in the market. As we can see from findings of the eight assumption customers are not satisfied with the quality and durability of their analyzers. This causes problems when the customer is using the measurement data and it also creates unnecessary costs to customers. Low-quality sensors and other components force users to do maintenance and calibration too frequently. According to the responses, this is a problem because of unnecessary work that is required but most importantly because of the costs that frequent maintenance and calibration causes. Current devices are seen as relatively cheap to buy but maintenance heavy which can lead to substantially higher lifetime costs than what respondents had anticipated. In many cases, customers also haven’t thought about the lifetime costs when they bought the measurement device and costs related to too short maintenance and calibration intervals came as an unpleasant surprise for the customer.

These responses clearly indicate that there is a need for a measurement device that has substantially longer maintenance and calibration intervals. Also, a service

contract with fixed yearly or monthly price was seen as a good solution by many respondents. This would enable customers to anticipate their costs more accurately in advance and avoid unplanned costs caused by maintenance, calibration or the device breaking down.

**Table 14.** Quotes from the responses regarding assumption 9.

“I would be ready to pay more if the device has longer calibration interval and is more reliable in the long run. Longer intervals with more predictable costs would be a good improvement and something we would be ready to pay for.”
“Sensor replacement today in every 6-9 months”
“Service contract with fixed price sounds like a good idea. It would eliminate unexpected costs and make our operational costs more predictable”
“A lot of instrumentation in the market but "cheap" and maintenance heavy”
“User has to be able to do the basic maintenance and the use of calibration gases etc. needs to be minimized. Thousand euros to that and another thousand to that results in costs running out of hands quickly.”

## 6.5 Revenue models in biogas industry

Last part of understanding customers’ business model and how the offering actually generates value to customers is to understand their revenue generation model. Based on the data analysis biogas producers usually have multiple possible revenue streams and revenue model of AD-plant or landfill is usually based on a combination of these streams. Plants can earn money by charging tipping fees, selling generated heat and electricity or by selling the produced biogas. In many countries producers also receive some governmental incentives such as carbon credits. Some AD-plants are also able to sell their digestate to be used as a fertilizer in agriculture but this doesn’t offer any significant revenue streams and is generally seen as an effective way to get rid of unnecessary digester sludge. The following quote is taken from the interview of an AD-plant manufacturer and gives a good example of how the revenue models might vary substantially.

*“Revenue model depends a lot on the plant type and feedstock. In some of our plants/countries tipping fees are the most important source of revenue and sold heat and electricity is just an additional benefit. In some plants situation is opposite. Need for good process control and optimization grows if more revenue is coming in based on the sold electricity or heat. Hard to say any exact figures to this”*

#### *Gate/tipping fees*

Gate fees or tipping fees are the revenue that AD plant or landfill receive when they take in waste from actors such as municipal waste management company or grocery store that needs to get rid of their biowaste. This fee is usually based on the quantity of the waste received and pricing is done by individual operators based on their costs of handling the waste.

#### *Sold electricity and heat*

Most of the AD plants and landfills have CHP-unit for turning the produced biogas into heat and electricity. Plants are able to generate heat and electricity for their own use but most importantly this is an important source of revenue. Most biogas producers are relying on sold electricity as the main revenue source. The monetary output of CHP-unit is determined by its capability of turning the biogas to electricity and heat that can be sold forward. Biogas producers are typically not able to increase the efficiency of CHP-units and therefore any increase in revenue comes from higher gas yields and quality improvement of the gas. In many countries, some kind of feed-in tariff is also paid for the electricity and heat produced with biogas. These tariffs vary from country to country and size of the plant and used raw material also often effects on the amount of feed-in tariff.

#### *Sold biogas or biomethane*

Biogas producers can also sell the produced gas as raw biogas or as an upgraded biomethane that can be used as a substitute for natural gas. Upgrading has been gaining popularity in recent years and its role as a revenue source for producers is estimated to rise more in the future. Upgraded gas can be injected directly into

natural gas grid and producer is paid by the amount of gas injected into the grid. Many countries also have feed-in tariffs for upgraded biogas that is used to replace natural gas. Other possibility is to sell the upgraded gas as a vehicle fuel for gas cars directly or through a third-party operator. Producers can also sell the raw biogas without upgrading it. This option is easier for the producer because it eliminates the need to build upgrading capacity but the price of gas is also lower due to its lower quality and energy content. Usually, the buyer also needs to be relatively close to the producer because there is not similar infrastructure for raw biogas as there is for natural gas. The typical buyer is an industrial user that has their facilities nearby and uses the gas in their own process to generate heat or electricity. Pricing of raw biogas is also based on the quality and quantity of the gas but there are not feed-in tariffs for raw biogas.

#### *Additional revenue streams*

Some producers might also receive additional revenue streams such as carbon credits and other incentives that are aimed to support clean energy production. These are usually based on the amount of methane and carbon dioxide producer is able to capture in their process and therefore prevent it being released into the atmosphere. Carbon credits and other incentives are seen as complementary to the revenue sources discussed above and do not act as a main source of revenue for the producers.

#### *Differences in revenue models and the effect to gas quality measurement need*

Revenue models vary widely between plants and there is not any universal or best possible model to be used. For example, plants in Finland typically get over 70% of their revenues from tipping fees paid by waste handling companies and electricity generation plays only a small role whereas in Germany some plants have to pay for their raw material and their revenue model is based solely on sold electricity and heat or sold biogas. This also effects the producers need to control and optimize the process. In plants where most of the revenues come from tipping fees, biogas process is only seen as an effective way of getting rid of the waste and capture methane that would otherwise be released into the atmosphere. On the other

end of the spectrum are plants that pay for their raw material, usually energy crops, and use the biogas process in turning this raw material into fuel that can be used in CHP-units to generate revenue in the form of sold energy. These producers need to optimize their process in order to generate the highest possible amount of revenue from the raw material. This is also important from the viewpoint of the gas quality measurement device supplier. Biogas producer's need to monitor and control the process depends on the value that better process control is able to add to their revenue generation potential. In the case of a producer that is mainly generating revenue through tipping fees, process control might be only used to prevent possible problems in the process whereas producer relying solely on revenues from sold biogas has much higher need to optimize the quality and quantity of the produced biogas.

## **6.6 Key values in biogas quality measurement**

According to Terho et al. (2011), value-based selling model value proposition should be based on the understanding gained from customers' processes and how value is generated in these processes. Preceding chapter has introduced the information gathered about biogas production, measurement needs in it and revenue generation models that producers can use. Also, results of assumption testing regarding different values were introduced and analyzed. By combining the results of assumption testing and knowledge gained about the process and value generation in it the following values were identified as resonating values for Vaisala's new measurement device:

1. Superior long-term stability and reliability that enables customers to reach better performance on their AD-plant or landfill

Long-term stability and reliability enable customers to reach the full potential of their AD-plant or landfill. By eliminating measurement drift and other similar problems customers are able to trust their measurement and make correct decisions

regarding the process control. Customers are also able to measure digester specific gas quality. This results in better control over the process which in turn leads to potentially higher gas yields and revenues through process optimization. It also increases customers' capability to prevent possible problems in the process.

## 2. Better protection of CHP-unit with continuous gas quality measurement

With Vaisala's device customers are able to protect their CHP-units by continuously measuring the quality of biogas that goes into it. By reducing the possible damages caused by biogas that is not suitable to be used in CHP-unit customers are able to reduce their maintenance and repair costs. This should also result in reduced CHP downtime which in turn leads to higher revenues through higher production of electricity and heat. Capability to measure the humidity of the gas is a clear differentiator for Vaisala and should be emphasized when communicating this value to customers. With humidity measurement customer is able to protect the engine and also has the possibility to control their water separation process.

## 3. Better control over CHP-unit with reliable gas quality measurement

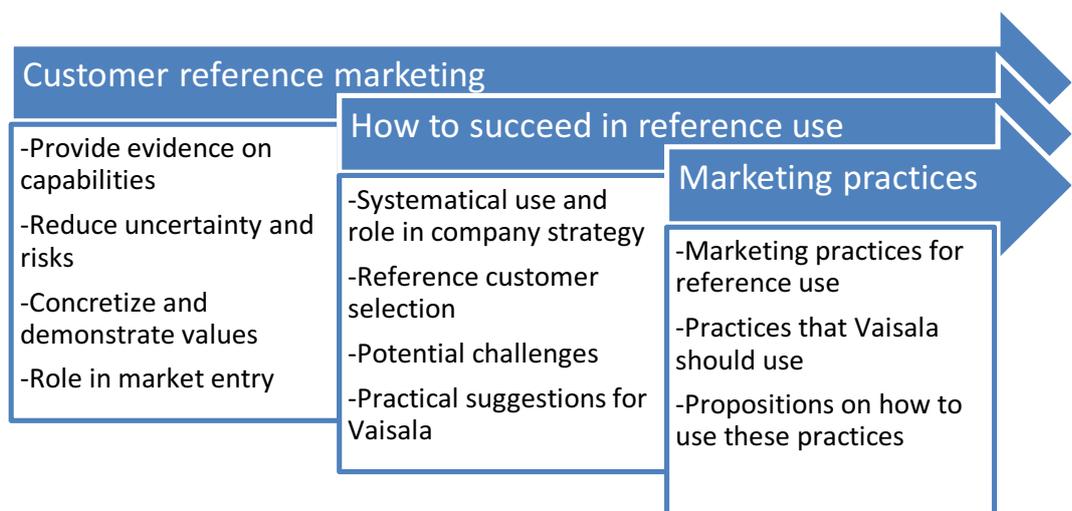
Continuous in-situ measurement of biogas quality enables the customer to count reliable energy balances for their CHP-units and monitor that their gas quality meets all requirements. With this information, customers are able to control that their CHP-unit is operating the way it should be and as a result is generating the highest possible amount of revenue. If there is some kind of problem in the CHP-unit customer is also able to use this measurement data as an evidence that they have met the gas quality requirements set out for CHP-units. In some CHP-units, this measurement could also be used to improve the efficiency by providing real-time methane content information to CHP-units control system. Capability to measure humidity is a differentiator also with this value.

#### 4. Simple and robust build with low and predictable life-cycle costs.

Capability to measure in-situ and in each digester without complex analyzer system is a clear differentiator for Vaisala. Vaisala's device is designed to withstand the harsh biogas environment with its simple and robust design that enables in-situ measurements. By being able to increase maintenance and calibration intervals customers should reach lower life-cycle costs when compared to current devices on the markets. Vaisala's device is also more affordable option regarding the initial price of the device. Customers are also able to predict their costs better with Vaisala's fixed-price maintenance and calibration service.

## 7 VALUE PROPOSITION COMMUNICATION USING CUSTOMER REFERENCE MARKETING

The preceding chapter focused on the first and second dimension of the three dimensions of value-based selling. This chapter focuses on the third dimension which is the communication of the value proposition to potential customers. According to Terho et al. (2011) and Salminen & Möller (2006) communication should focus on presenting how supplier's offering is able to generate value in customer's process. In order to be successful in this, the communication needs to be based on credible evidence about supplier's capabilities of delivering the solution and also emphasize long-term commitment, trust, and transparency. A widely used method in achieving this is the use of customer reference marketing. References act as an evidence of past success and supplier's capabilities in delivering the proposed values. Most importantly they are seen as a credible way to communicate and demonstrate these values and reduce the risks that customer faces. The importance of credibility and risk reduction aspect of references is also emphasized in a situation where the company is going into new markets or is introducing a new product.



**Figure 8.** Framework for customer reference marketing

Use of references as a communication method helps to overcome many of the challenges that companies face when they enter into new market area or introduce new products. With the use of references, it is possible to ensure that all desired customer groups are being reached and values are being communicated effectively to them. This requires that reference use is systematical and reference portfolio is large enough to address different customer groups and measurement needs. With this kind of reference portfolio, Vaisala is able to communicate the right values to all customer groups by utilizing references that are similar with the potential customer in terms of process type, measurement need and value generation model.

As we can see from the preceding chapter revenue models and needs for gas quality measurement are relatively fragmented in biogas industry. It is difficult to categorize potential customers into clear groups because of the variations between different needs and value generation models. However, it is clear that value communication should address this issue on some level. Identifying different customer groups and types is important for successful reference use. Vaisala needs to be able to build reference portfolio in a way that all customer groups are presented in it. Based on the interviews and other data customers seem to identify themselves to a certain category that is based on their production method and feedstock being used as a raw material. It is logical to use these categories also for value communication because it gives a higher probability that customer is being reached out with suitable reference and value proposition. These customer groups are waste water-plants, municipal waste plants, industrial plants, agricultural plants, and landfills.

Basic measurement need is still pretty similar in all customer groups and same values apply to all customer groups. What differentiates these groups from each other is the amount of value that the gas quality measurement generates in customer's process. For example, small agricultural plant or landfill might be able to adjust the process only on a weekly basis whereas industrial plant might be able to optimize the process on hourly basis and has much higher control over the process. Stable and reliable measurement is still bringing value to these customers

but the industrial plant is likely to benefit more from the measurement. It is also important to notice that different revenue models have a high impact on the measurement need and therefore also to value generation potential. For example, municipal waste-plant might receive 90% of its revenue from the gate fees and measurement need is only in controlling that the process is operating the way it should be but there is no need to optimize the process since the revenue is not based on the gas yield.

References are one of the most widely used ways to communicate the value proposition to potential customers but as we can see from the chapter 4. studies about successful reference use and best practices are relatively scarce and fragmented. The following chapters aim to combine the literature review about references to practical needs of Vaisala. The focus is in external reference use since it is more relevant from the viewpoint of value proposition communication but the potential for internal use is also taken into consideration in order to give insights into possibilities it has in facilitating learning and development.

## **7.1 External reference use**

Terho and Jalkala (2017) defined that external leveraging of references refers to *activities that communicate customer references to potential customers through demonstrating delivered customer value in previous and existing customer relationships.*

In order to successfully do this kind of external leveraging of references in the communication of Vaisala's value proposition, there is a need to review different aspects that should be taken into account during the reference use. Following chapter introduces things that need to be taken into account when choosing the reference customers, possible problems that might arise, how to overcome these and gives suggestions on how to utilize different reference marketing practices.

### 7.1.1 How to choose the right customer references

Systematical reference use starts from reference customer selection that is based on specific criteria set on the attributes of reference customers and desired outcome. This ensures that reference customers are able to form a basis for successful communication of the chosen value proposition. This can be hard especially when entering into new markets where the supplier is not able to choose which companies it uses as a reference and instead has to use the ones that it is able to get. This is often the case also for the companies operating in more mature markets, especially if reference management is not systematical.

In these situations, companies often end-up choosing the customers that have the highest value in terms of profits or revenue it generates instead of focusing on the value that customer would have as an intangible marketing asset. Reference customers should be always selected based on their strategical value as marketing asset instead of focusing on their ability to generate revenue as a customer. It is not easy to assess the strategical value of a reference customer at least in the beginning of relationship and selection should, therefore, be based on the following attributes.

Customer's ability to generate status transfer effect can be utilized to communicate supplier's value proposition effectively to potential new customers is one important attribute to take into consideration. This kind of customer is typically relatively large player in the markets, has a good reputation and is able to use the networks it has to influence potential customers. In order to achieve these effects, Vaisala should have reference customers that enable it to build credibility in the markets and signal that it has passed through their selection process. In the biogas industry this kind of companies would be big AD-plant manufacturers or engineering companies that have large impact and networks on the market, large CHP-unit manufacturers or distributors, AD-plants or landfills that have a reputation of being a leading actors in terms of process technology and innovativeness. Preferably these companies would also be from the countries that are known to be frontrunners in biogas technology. This kind of customers would send a clear signal that leaders in

the market have accepted Vaisala's new device and are ready to use their reputation and credibility to provide evidence that this new solution in the markets is generating value to them.

The second attribute is customer's willingness to be used as a reference. Customer needs to be ready to share the value it has been able to generate with supplier's solution to potential customers. In practice, this means that reference customer has to be ready to share data about their process and be prepared to allocate resources to work with the supplier. The customer also has to be ready to accept the risks that are associated with a new solution and be ready to work with the supplier in improving it. Ideally, this kind of customer would be an innovative company that wants to try out new technologies and help the industry to develop by sharing the results with other companies. Vaisala has established relationships with customers that have been working with Vaisala already in the product development phase in the form of pilot testing and technology development. These companies should be transformed into reference customers when the product is being launched. Vaisala has already established a relationship with these customers, they have shown that they are ready to devote their resources and there is already data available on the performance of Vaisala's new device. This would also send a clear signal that Vaisala has developed this solution with actual customers and that these customers are satisfied with the results and Vaisala's ability to handle customer relationships.

Length of the customer relationship is closely associated with customer's willingness to be used as a reference but it also affects the credibility of the reference. It is a clear indication of supplier's capabilities in delivering the value proposition and maintaining good relationships with customers. Repeated orders and long-term commitment increase the credibility of the supplier and reduce the risk that potential customers perceive. At this point, Vaisala does not have this kind of customer but this attribute should be kept in mind when choosing references after the product has been in the markets for some time.

The third attribute is reference customer's similarity to potential customers. The similarity of the reference customer is emphasized by many researchers. Kumar et al. (2013) and Terho & Jalkala (2017) propose that references using the same offering, operating in similar industry or segment and using the offering for similar applications have the highest impact on potential customers. This enables the supplier to concretize the value of their offering in a way that customer can easily assess the value that offering would be able to generate also in their own process. This, in turn, helps the customer to reduce the perceived risks related to offering and increase its attractiveness. In the context of biogas quality measurement, this would mean that reference customer has similar measurement needs, uses process technology that is relatively similar and is also operating with a similar revenue model. In order to ensure this Vaisala should have at least one reference customer from each customer group. For example, higher stability is generating value for all customer groups but the way that the value is generated in the customer's process is different in industrial AD-plant and landfill. Also, process conditions and measurement environment might vary a lot between different customer groups. This kind of references would also signal that Vaisala has experience in working with different kinds of customer needs and process environments in biogas industry.

#### 7.1.2 Challenges in the use of references

##### *Lack of reference management and systematic use*

Lack of systematic reference use has been raised as the main source of possible problems in many studies. If references are seen only as a tool that sales can use to boost their performance instead of treating them as an intangible strategic asset that can be managed, company is likely missing out many of the benefits and also facing multiple problems that could be avoided. One of the main problems is that company is not able to create a reference portfolio that would fulfill the needs of effective value proposition communication. Reference portfolio that is constructed only from the customers that generate the highest revenue or have a good relationship with the sales personnel is often not able to address all potential customers and their needs.

Another possible problem related to this kind of reference selection that is not based on predefined criteria are negative status transfer effects.

In order to avoid these problems in the use of references, Vaisala should clearly define what it is trying to achieve with reference use and who is responsible for managing references. At this point, the product manager is the most suitable person for this. References should also be selected based on the attributes presented earlier with emphasizes on the capability of the reference to communicate the value proposition. Reference portfolio should also be well documented and organized in a way that everyone has access to it and the best possible reference is always available. This process should also be started already in the product development phase and continued after the product is launched. This will also enable the internal use of references already in the product development process and it will support the product launch.

Customer's willingness to be used as a reference is closely related to problems presented in the previous paragraph. Often companies are not able to gather the best possible reference portfolio because they do not have suitable customers that would be willing to act as a reference. Both Jalkala & Salminen (2010) and Ruokolainen & Aarikka-Stenroos (2016) have identified that this problem is mainly related to customers' willingness in sharing information and devoting their scarce resources to be used in helping the supplier without receiving any compensation. When entering into new markets customers are also often not certain about supplier's capabilities in delivering the value proposition and therefore they do not want to put their own reputation in risk by backing up this new supplier.

Vaisala is facing all of these challenges with the new product. It is entering into a new market area with a new product and has no established reputation or customer relationships. The biggest challenge is probably going to be the lack of evidence that Vaisala is able to fulfill its value proposition. In order to overcome this challenge, Vaisala could offer customers some kind of guarantees or price reductions that would lower the risk that customer is perceiving. In addition to this Vaisala should also utilize its already established reputation as a market leader in other markets to provide proof of its capabilities and past success.

If the customer is not willing to share information about their process or doesn't want to be publicly used as a reference one solution for Vaisala would be a reference case without disclosing who the actual customer is. Formal contracts about what information is shared and how much reference customer is devoting resources are also seen as a good way to increase customer's willingness. This ensures that only information that customer is willing to share is shared and also prevents the situation where the customer would be overburdened.

Length of customer relationships is a problem that especially companies entering into new markets face. It is often not possible to establish customer relationships and have repeated orders before new offering has been in the markets for some time. In order to overcome this problem, Vaisala should transform pilot customers that have been already cooperating with the company in product development phase into reference customers. These customers have already established a relationship with Vaisala and they have also been already using the new measurement device in their own process. They are also able to promote the efforts that Vaisala has put into developing the product with customers already during the first stages of the product development project.

### 7.1.3 Reference marketing practices

In addition to choosing the right references and avoiding possible problems in that successful reference use also requires that appropriate marketing practices are being used. All the reference marketing practices and the proposed functions of these marketing activities are presented in the Table 5 and Table 6 at Chapter 4. In the following chapter, these marketing practices are connected to possible ways that Vaisala could utilize them when communicating the value proposition with references. Different practices need a varying amount of involvement from the customer. The amount of involvement needed is used as a basis to organize these practices, starting from the practices that require the least involvement and also give the highest amount of control to Vaisala.

*Reference lists*

Reference lists are seen as the easiest way to utilize customer references. Reference customer does not have to devote any resources to it and supplier is also able to simply just list all of their past customers. They still provide indirect evidence about supplier's capabilities in past deliveries and also increase the credibility through status-transfer effects. Vaisala is entering into new markets with no established reputation. Reference list with customers from different customer groups would enhance Vaisala's credibility and provide evidence that it is able to serve different customer groups with varying needs.

*Success stories, customer cases, and audio/video testimonials*

Success stories and other similar practices are an effective way to concretize and demonstrate how suppliers offering has actually generated value in customer's process. This, in turn, decreases the perceived risk and makes it easier for potential customers to evaluate how offering would generate value in their own process. Revenue models and measurement needs vary greatly between biogas producers. By having this kind of reference material with customers from all of the customer groups Vaisala would be able to demonstrate different values and their effect on customer's revenue streams. Vaisala is also coming to markets with a disruptive measurement method. This kind of references would also be a great way to demonstrate that the new technology is functional and show how it differentiates from the current devices in the markets.

*Press releases, trade journal articles and other promotional material*

This kind of reference material is used to signal that supplier has passed through customer's selection process and is reckoned actor in the markets. Especially in new market entry press releases about successful deals with first customers are seen as a strong signal that these customers have accepted suppliers offering. Press releases, articles and other material also help to enhance supplier's market position. Vaisala should use these practices during the market entry to raise awareness amongst potential customers and signal that first customers have accepted the new device in the markets. Articles and other material could also be used to signal that Vaisala

has good knowledge about customer needs and customers process. This could, for example be an article about measurement needs in CHP-units, that would be produced in cooperation with a major CHP-unit manufacturer and published in some biogas industry magazine.

*On-site visits, reference calls, customer presentations in seminars, conferences and other events*

Last marketing practice that can be used to utilize reference customers involves direct interaction between reference customer and potential new customer. This kind of activities also requires that reference customer is ready to devote their resources to this kind of use. A method involving actual customers is seen to be an effective way to provide potential customers indirect evidence about the functionality of the offering and ability to maintain good customer relationships. The customer is able to get first-hand information about the offering directly from someone who is already using it and most importantly is ready to promote it at their own will without monetary compensation. Even though this method is effective it also demands resources from the supplier and reference customer. Vaisala should use site visits only if the potential customer is seen important since the visits take more effort from both sides than what the other reference marketing practices. Customer presentations in seminars and other events could also be utilized in some key events. Vaisala could, for example, share a fair booth with reference customer or have these customers come to Vaisala's booth.

#### 7.1.4 Attributes of a successful reference case

Success stories, customer cases and other similar material that has customers demonstrating how they have been able to generate value with suppliers offering are an effective way to demonstrate value potential and decrease the perceived risk. Vaisala is entering into new markets with a product that can be seen as a disruptive technology. Reference cases and success stories are a good method for Vaisala to demonstrate the values and decrease the risk that potential customers might face.

According to Ruokolainen and Aarikka-Stenroos (2016) this kind of reference material should contain at least the following six attributes.

#### 1. Basic data about reference customer

Basic data includes information such as company name, size, industry and other relevant characteristics that can enhance credibility and support supplier in using the reference.

#### 2. Long-term orientation

Long-term orientation acts as a signal that supplier is committed to customer and is ready to learn about customers' needs and provide the offering suited for these needs. Vaisala is entering a new market so at the beginning only option to show long-term orientation and understanding about customer needs is to use pilot customers as a reference. These customers have been part of the product development process and are able to demonstrate Vaisala's long-term orientation towards customers and developing the best possible product. Cooperation done in the product development phase acts also as a clear signal of Vaisala's customer orientation and understanding of customer needs.

#### 3. Direct benefits

Provide proof of verified benefits that customer has received from suppliers offering. These can be easily quantified benefits such as cost savings and quality improvements or more abstract and harder to define such as improved reputation or brand image. In the case of biogas quality measurement, these benefits should be linked to Vaisala's value proposition in a way that they provide quantified examples of achieved benefits to potential customers. In practice, this kind of quantified benefit that customer has achieved with Vaisala's device could, for example, be higher gas yield or lower life-cycle costs compared to competitors' device.

#### 4. Competencies and indirect benefits

New competencies that customer has been able to achieve with the help of suppliers offering refer to competencies that supplier has not taken into account during the

development of the offering and can be seen as an “extra” benefits for the customer. For example, the ability to measure the humidity of the gas can be seen as this kind of benefit. It was not recognized as a benefit in the beginning of the product development but during the testing phase with pilot customers, the possibility to measure humidity was seen beneficial. Current devices in the markets are not able to measure humidity and therefore the benefits of measuring it were only realized when pilot customers started using Vaisala’s device and more research on the subject was done.

#### 5. Demonstrated and improved competencies of supplier

This aspect is seen as more new market entry specific and it is intended for showing that supplier is capable and ready to learn from its customers in order to improve its offering in the future. It can also be used to demonstrate supplier’s competence, experience, and problem-solving capabilities. Vaisala should utilize pilot customer as a reference also for this reason. Cooperation done with pilot customers is a good way to demonstrate what Vaisala has learned from these customers and how important continuous improvement of the offering is. This would also show how Vaisala has improved its competencies and capabilities during the product development process by learning from pilot customers.

#### 6. Contemporary and future-oriented commitment to reference customer

Customer’s commitment, especially in new market entry, sends a signal about the trustworthiness and credibility of the supplier. In the case of more mature supplier commitment is telling more about the quality of the relationship and suppliers capability to maintain a long-term relationship with the customers. Pilot customers would be good references also from this viewpoint. They have already been showing commitment during the product development phase. If these customers continue to use the device after piloting it signals that customer is trusting Vaisala and is ready to continue as a customer also in the future.

## 7.2 Internal use of customer references

Terho and Jalkala (2017) highlight the imbalance between the external and internal use of references. Internal use of references is often neglected and because of that companies lose the benefits of it. There are multiple identified benefits that systematic internal use of references has regarding learning, development of customer understanding and motivation of personnel. In this chapter, these benefits are introduced in the context of Vaisala's product development project.

### *Facilitate learning and advance offering development*

In addition to communicating the value proposition to potential customers, references can also be used to facilitate learning and development inside the company. There are multiple ways that references can be used for this purpose. For example, success stories and customer cases can be used in best-practice and lessons-learned exercises or workshops to improve and gain a better understanding of internal competencies. This kind of exercises are also a good way to give personnel a better picture of customer needs and how the offering generates value in customer's process. It is hard for Vaisala to utilize this kind of internal learning at the product development phase because of the lack of reference customers. Internal use for learning and development should, therefore, be started after Vaisala has been able to create a reference portfolio that can be utilized for this purpose. At that point, internal learning can be used to improve the offering based on the lessons learned from first reference customers and to educate sales personnel about customers' process and needs.

One possible way to facilitate learning especially when entering into new markets is the use of references as a benchmark. References from the previous deliveries of supplier can be used to benchmark capabilities and opportunities that the supplier has. Competitor's references such as customer cases from this new market can also be used to learn more about the markets, required capabilities and customer needs in them.

*Motivate personnel*

References can also be used to motivate personnel by spreading the information of successful customer cases throughout the whole organization. This can, for example, be achieved with “solution of the month” types of announcements or success stories that are communicated to the whole company instead of leaving this information only to the sales department. It is common that personnel doing the product development are not in direct contact with the customer and therefore do not see how their work has affected customers and generated value for them. Vaisala could utilize this kind of reference use already in the product development phase by creating reference cases with pilot customers and communicating successful pilot test to whole product development team. After the product is launched press releases and other information about first orders should be used to signal that Vaisala has been able to create a product that is accepted by customers. These should be communicated to whole company for motivational purposes but also to demonstrate and raise awareness of Vaisala’s new capabilities in biogas quality measurements.

*Develop understanding of customers’ value generation process*

The importance of understanding your customer’s business and their value generation is an important success factor. Internal reference use offers a good opportunity to learn more about these matters. Actual benefits and values that customer receives are often realized only at the point when the customer is actually using the product in their own process. With the systematical evaluation of references, companies are able to discover these direct and indirect values that their offering brings to the customer. This information can then be used to improve current offering and value proposition based on the customer needs and how the offering is actually generating value to the customer. Vaisala is not able to use customer references for this purpose at this point of product development but should use this later on. After Vaisala has been in the markets for some time and created a big enough reference portfolio there is a chance to use these references for gaining a deeper understanding of customers processes and needs. This kind of evaluation and use of references might also reveal some hidden customer needs or ways that

customer is generating value with Vaisala's new product. Vaisala could then use this information to develop the value proposition in a way that helps them to differentiate from competitors that do not necessarily have this information. Another way to benefit from internal use would be the quantification of customer values. Vaisala could use references in quantifying the value proposition by, for example, measuring the monetary savings that customer has been able to achieve with Vaisala's device after one year of use. This information can then be used to build a more concretized value proposition and reference portfolio that enables Vaisala to communicate quantified values to potential customers.

## 8 CONCLUSIONS

The aim of this research project was to **develop a value proposition for Vaisala's new measurement device and study how references can be used to communicate this value proposition.** This chapter provides an overview of how this objective was met. First, all the findings are combined and answers to each research question is presented. Then possible sources of error and limitations of the study are examined and validity of the results is evaluated. The final part of this chapter summarizes the research process. In addition to this, some future actions for Vaisala are also proposed.

### 8.1 Answers to RQs

The research objective was divided into three research questions. Answers to these questions were derived from multiple sources. A comprehensive literature review about customer value in B2B markets and reference based value communication was conducted. In addition to this information about biogas industry and measurement needs in it were gathered through interviews, industry-specific literature and by analyzing the data that Vaisala has accumulated throughout the product development project. The answer to the first and third research question was derived from all of these information sources. The answer to the second question is mainly derived from the literature review.

#### *1. What are the key value generation activities in biogas quality measurements?*

The first research question was formed with the objective of founding out how value is generated in the biogas quality measurement and to use this information to draft a value proposition for Vaisala's new measurement device.

First, a comprehensive literature review of different aspects of customer value in B2B marketing context was conducted. This formed the basis for understanding

different kind of value proposition types, how companies are moving from Goods-Dominant logic to Service-Dominant logic and how customer value can be created and assessed with different methods.

Findings of this research show that biogas production process and measurement needs in the process are not easily generalizable and there are a lot of variations among customer groups. Based on analysis four key values were identified. Following table introduces these values and reasoning for each value.

**Table 15.** Key customer values in biogas quality measurement industry

Value	How it generates value for customer
1. Superior long-term stability and reliability that enables customers to reach better performance on their AD-plant or landfill.	-Customer is able to gain better control of their process and potentially achieve higher biogas yields -Customer is able to prevent problems in the process and avoid the costs associated with these problems
2. Better protection of CHP-unit with continuous gas quality measurement.	-Customers is able to protect the CHP-unit from harmful content in the biogas which potentially leads to lower maintenance costs and downtime -Customer is able to decrease their CHP-units downtime and increase their revenues from electricity and heat
3. Better control over CHP-unit with reliable gas quality measurement	-Customer is able to monitor that their CHP-unit is operating properly and achieving electricity and heat generation goals -In case of malfunction, customer is able to provide reliable evidence about their biogas quality meeting the requirements -Some customer are able to increase the efficiency of their CHP-unit with continuous methane content measurement
4. Simple and robust build with low and predictable life-cycle costs.	-Customer is able to avoid the problems that complex analyzer systems have -Customer is able to lower their life-cycle costs because of longer calibration and maintenance intervals -Customer is able to achieve better predictability of the life-cycle costs

*2. How to successfully communicate the value proposition with references?*

The second research question was formed with the objective of gaining a profound understanding of how customer references can be used to communicate the value proposition and what challenges might arise. The aim of the literature review was to combine the research done on the topic and to form a comprehensive overview of the different aspects of reference use. This overview was then used as a basis for the evaluation on how Vaisala could successfully use references when communicating the value proposition.

According to the literature review, successful value proposition communication with references is built around systematic use that sees references as a strategically important intangible asset that can and should be managed. This approach to the use of references ensures that Vaisala is able to construct a reference portfolio that is suitable for communicating the value proposition to different customer groups. Main things to consider when choosing the reference customers is their willingness to act as reference, suitability, length, and depth of customer relationship and the similarity between reference customer and potential customer. In order to be successful in the use of reference the most suitable reference marketing practices should also be utilized. These are reference lists, success stories and customer cases, press releases and articles, promotional material and site visits for important customers.

*3. What are the key challenges of developing and communicating the value proposition in a new market entry and how to overcome these challenges?*

The third research question was set out to gain a deeper understanding of possible challenges that might arise during the value proposition development and communication in Vaisala and at the general level. This knowledge was then used during the value assessment conducted during this research. Challenges that might

arise with use of references were also identified, and used to give recommendations on how to overcome these challenges and avoid possible problems in the future.

Key challenges in value assessment are related to subjective nature of the value. The supplier is only able to generate potential value and build value propositions but the actual value is generated in customer's own process. This is especially true when assessing the value of a product that is still under development and is seen as disruptive technology. The customer might not be able to value certain features of Vaisala's new product because they haven't had these with current offering and therefore do not have the experience needed to assess how they would generate value in their process. The perceived value of the offering also varies between different customer groups and their needs. Customers' own processes and needs impact the way they see the value generation potential of the offering. The same offering might have substantially different value generation potential in different customer groups.

Challenges in using references can be divided between external and internal. External challenges are mostly related to choosing the right references and being able to construct a wide enough reference portfolio. Customers might not be willing to act as a reference or they are not suitable to be used to communicate the value proposition to potential customers. The biggest internal challenge is the lack of systematical reference use that would see references as an intangible asset that can and should be managed. This might lead to a situation where the full potential of reference portfolio is not realized. Another common problem is that reference portfolio is constructed out of references that company has been able to gather instead of systematically building it in a way that it fits the needs of value communication.

By having a system for reference selection and reference use companies are able to overcome most of the problems. Systematical reference selection ensures that reference portfolio is built in a way that it fits the needs of value communication whereas active portfolio management ensures that references are used in the most effective way

## **8.2 Evaluation of the results and limitations**

The study successfully identified the key values in biogas quality measurements and also provided a comprehensive overview of the current literature about customer reference marketing and how to apply it in Vaisala. However, the decisions made during the research process sets some limitations to the credibility and usability of the results.

Case study as a research method generally provides results that are not fully generalizable outside Vaisala and biogas context. This study as a whole still provides an example of how companies can approach the value proposition development and use customer references as a communication method for the value proposition. Especially theoretical framework about customer reference marketing is also applicable to other products in Vaisala as well as other companies in B2B markets.

Qualitative approach and semi-structured interviews as a data collection method are the main sources of potential errors in this study. Collected data has been analyzed using researchers own discretion. Data analysis is therefore dependent on the individual performance of the researcher and also possible biases that researcher has can affect the results. The researcher is also fairly inexperienced in conducting data collection and analysis which might also affect the credibility of the results.

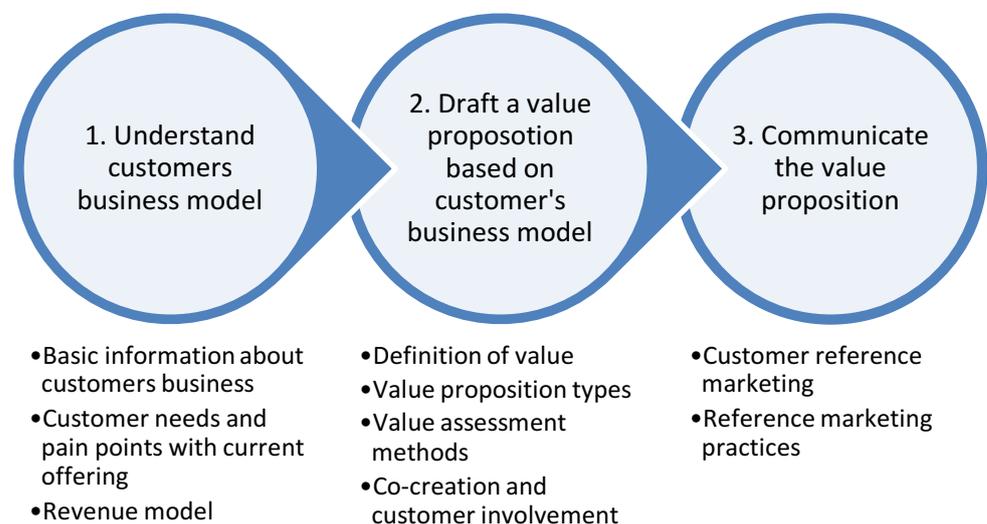
Interviewer and respondents might also have biases that affect the content and results of interviews. (Saunders et al. 326-335)

Researcher's previous experience in biogas industry and assumptions used to construct the interview frame might have caused this kind of bias when conducting the interviews and analyzing the data. Interviews were also mostly conducted without non-disclosure agreements which might restrict the respondents' capability to evaluate some of the values. Respondents were not fully aware of all the features and capabilities of Vaisala's new device and therefore some of the values might not have been fully realized in interviews. Majority of the interviews were also carried out with companies from Europe which is a potential source of error since Vaisala is targeting global markets with the new device. However, most of the biogas

production outside of Europe uses process technology that has been developed in Europe or is otherwise similar and therefore has similar measurement needs and revenue models than respondents in Europe has.

### 8.3 Conclusions and suggestions for further actions

The empirical part of this report presents a process of value proposition development in the case company and gives suggestions for the use of customer reference marketing with Vaisala's new product. Structure of this process is based on the three dimensions of value-based selling by Terho et al. (2011). Figure 9 illustrates different parts of this process and connects them to theoretical frameworks presented in chapters three and four. It is good to note that even though this process is presented going from step one to three the actual process is much more iterative in nature.



**Figure 9.** Process of value proposition development and communication

The first part of the process is to understand customer's business model. Companies can only propose values and the actual value is generated in customer's own process. Therefore, the value proposition should always be based on an

understanding of the customer's business model and how the offering is able to generate value in it. During this process, the company should gain basic knowledge about their customer, customer's needs, and pain points they have with the current offering, and most importantly understand customer's revenue model and how value is generated in their process.

The second part of the process focuses on drafting the actual value proposition that is based on the knowledge gained in the first part. At this point it is important to understand what value means, how value propositions can be developed and the differences between value proposition types. It is important to understand that value does not mean the price of the offering. Move from goods-dominant logic to service-dominant logic emphasizes the service aspect and sees physical products only as an intermediary used to deliver the underlying know-how of the supplier. Value is created in cooperation and supplier is only able to propose values. By understanding the customers' business model supplier is able to develop value propositions that address the real customer needs and value that offering generates in customer's own processes.

Third and final part of this process is the actual communication of the identified values. Communication of these values should focus on presenting credible evidence on how the offering is generating the proposed value in customer's process. Lack of proper communication might lead to a situation where the customer is not able to realize all the benefits of suppliers offering and ends up choosing a lower value offering that is priced cheaper. Here, focus has been on customer references as a communication method. Use of references is seen as one the most effective ways to demonstrate the supplier's capability to deliver proposed value and reduce the risk that customer perceives. Chapter 7 introduces a more detailed description of different ways that Vaisala could utilize references when communicating the value proposition of their new product.

As said in the beginning this process is iterative in nature and therefore should be continued in Vaisala after this research project. Key customer values presented in this study are based on the interviews and assumed capabilities of Vaisala's new product. It would be fruitful to re-evaluate these values after the product is launched and first customers have used in their own processes. Vaisala is bringing disruptive technology into the markets and some values might have been under- or overestimated during this research project because respondents were not able to fully understand all the features of the product. Especially values related to humidity measurement are something that respondents were not able to fully evaluate at the moment because current measurement devices in the markets are not able offer this functionality. It is also possible that there are some values that emerge only after the product has been in use.

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## Appendix

### **Appendix 1.**

#### **Interview respondents**

##### **End-users**

R 1, Owner, AD-plant

R 2, Head engineer, AD plant

R 3, Operator, AD plant

R 4, Maintenance engineer, AD plant

R 5, Maintenance engineer, Municipal waste water plant

R 6, Head of operations, Landfill

R 7, Maintenance engineer, AD plant

R 8, Operator, AD plant

R 9, Head of operations, **AD plant**

##### **Plant manufacturer**

R 1, Head of engineering, AD plants and Landfills

R 2, Product manager, AD plants

##### **Industry expert**

R 1, Professor, Energy technology

R 2, Professor, Environmental technology

##### **CHP-distributor**

R 1, Sales engineer

R 2, Owner

R 3, Head of Sales

## **Appendix 2.**

### **Guidelines used in interviews**

## **Process control and optimization**

### **Value of continuous and reliable measurement in everyday process control**

- What values are currently used for continuous process control
- How you use this information is used
- Is measurement drift currently a problem in process control
- Accuracy vs. long term reliability

### **Benefits of having multiple measurement points (reactor specific measurement vs. a combined gas line)**

- How many measurement points currently
- Ability to control and optimize a single reactor based on CH<sub>4</sub> and CO<sub>2</sub> readings
- Ability to reach higher gas yields with this kind of process control

### **Measurement device breakdown situations**

- Measurement device breakdowns with current devices
- If yes, is it a common problem with devices currently on the market
- What kinds of problems would it cause if the control system is not able to get CH<sub>4</sub> and CO<sub>2</sub> content data because of measurement device breakdown

### **Ability to detect unusual activities in process with CH<sub>4</sub> and CO<sub>2</sub> readings**

- Ability to detect unusual activities in process by using long-term CH<sub>4</sub> and CO<sub>2</sub> trends
- Ability to prevent problems by using these trends

### **Water separation process and amount of water in gas**

## Appendix

- Interest in controlling water separation process (Devices currently in on the market dry the gas before sampling which prevents humidity measurements from the gas)
- Value of this kind of measurement
- Ability to adjust to water separation process

## CHP

Role of CHP in plants revenue streams.

- All from electricity and heat?
- Size of engines and who has manufactured engines

Do you currently measure CH<sub>4</sub> content in CHP gas inlet?

- If not, why not?
- If uses fixed methane value instead of continuous measurement for CH<sub>4</sub>, what kinds of problems does it cause for CHP and why no continuous measurement

**Ability to control the engine and increase its efficiency with accurate reading**

- What is the preferred accuracy for the CHP use?
- How do you use the CH<sub>4</sub> information for the engine control?
- Do you see that this improves the efficiency of the engine?

Ability to decrease the engine downtime and alarms with continuous CH<sub>4</sub> measurement

- If yes, could you give estimate on how much? (Hours, days, weeks)

Ability to protect the engine and increase its lifetime with CH<sub>4</sub> and **humidity** measurement?

- If yes, could you estimate how much?

## Appendix

- Ability to decrease the maintenance interval of the engine with CH<sub>4</sub> and humidity measurement? (For example longer oil change interval)

## **Lifetime costs and ease of use**

### **What kind of value sees in this and current situation**

- Longer maintenance interval than what the current devices have
- Longer calibration interval than what the current devices have
- Robust design with no moving parts
- Predictable costs over lifetime

Problems with the current devices related to the factors listed above

### **Value in ease of use**

- User being able to perform basic maintenance
- User being able to install and replace devices
- Ease of replacement and “modular” design that enables fast replacement and maintenance

What are the typical problems related to these factors mentioned above with the current devices that have complex structure with sample pumps etc.?

## **Revenue model in biogas plants and landfills**

### **Importance of different revenue sources in your plants**

- Sold electricity
- Sold heat
- Sold gas
- Compensation based on the amount of waste processed in plant
- Other, what? (incentives etc.)

## Appendix

**Are you confident with the methane value you get from your current measurement device?**

-If you use this value for pricing the sold gas is there a need to use lower methane value than what you believe the actual concentration to be (due to inaccurate measurement)?

-What would be the preferred accuracy when selling the biogas?

-Preferred accuracy with biomethane

How you see the future, more electricity or biomethane or both?

**Is there a need to measure CH<sub>4</sub> and CO<sub>2</sub> for compliance reasons? (For example government requires plants to report the amount of produced/captured methane)**

-If yes, is this measurement a base for some monetary compensation?

-Have you had problems with compliance related measurements, if yes, what?