Can metrology be value-based?

A case study of SKF’s metrology service Mätcentrum

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Abstract

Metrology is a concept that is not known by many, it is the science of measurement. For such an unknown concept it has significant importance to both the manufacturing companies and the customers as they both need to be sure that the final products are correct and of high quality. Therefore many companies have a quality system within their company to measure and calibrate their instruments. To ensure that the measuring instruments used are correct they need to be calibrated towards national and international standards. If you cannot do that at the company the service needs to be purchased externally. SKF, Svenska Kullagerfabriken AB, has a metrology service that they use for their own manufacturing that they have sold externally before and want to start selling again. The purpose of this study was to investigate what the main value drivers are in the metrology market and based on those values create a service offer. To investigate the purpose a case study of SKF’s metrology service was made and interviews were performed on nine manufacturing companies within the western region of Sweden, with focus on Gothenburg. The theoretical framework is based on the market positioning strategy by Lovelock & Wirtz (2011). The market positioning strategy includes a market section, an internal section and a competitor section. These parts can be seen all through the thesis as it guided the authors through the process. The empirical findings show the interview answers, the value drivers and the competitor response profile.

In the empirical chapter it was discovered that accreditation and accuracy are the two value drivers that the customers find most important in metrology. Those value drivers does both Mätcentrum and most of the competitors have. The empirical also show that the suppliers have a strong position in the market and can offer similar or more value than Mätcentrum. The conclusion is that it would be difficult for Mätcentrum to start selling their service externally again. This is due to the competition, mainly from existing competitors and suppliers in combination with the lack of differentiating elements in their offer. However there is still an opportunity for profitability if the communication of the values is adjusted after each customer’s need and received successfully.
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1. Introduction

This chapter gives the introduction of the paper. It begins with a brief introduction of the project and the research area, it then moves on to describing the background of the research followed by the problem discussion. Subsequently the purpose, research questions and delimitations of the project are described, ending the introduction chapter.

Metrology is the science of measurement and it is becoming more and more important for manufacturing firms. The requirements of product quality are continuously increasing due to more sensitive customers on the market. To get the tools to reach their full potential is a major step towards being a World Class Manufacturer (WCM). Measurement is essential for both the customer and the company as both parties need to be sure of the accuracy and reliability of the measurement (Bunday et al. 2007). It is important to have an accurate metrology for a competitive advantage and to become successful (Sendelbach & Archie, 2003; Sendelbach et al. 2004). The need for accuracy is varying depending on company and product, although it is important to always be able to trust the measuring result (Bunday et al. 2007).

“The constant increasing demand on precision within the manufacturing industry makes competence within measuring techniques more and more important”

(Carlsson, 1999, p.1).
The market of the manufacturing industry is very competitive, which makes quality a basic element in order to maintain a good position. To be able to confirm that the quality of the measuring instruments is accurate it is essential to have continuous calibration. In order for the calibration and measurement to be accurate it needs to be traceable to national and international standards (Bunday et al. 2007). Metrology services are normally based on cost (Manager of Mätcentrum, 2011-10-12) as many other technical services. From a historical perspective the majority of service contracts have been based and billed upon time and material basis when a higher profit could be earned on value-based pricing. (Ding, 2007).

Value based pricing is an approach that sets price based on an estimation of how customers ”value” the good or service being sold (Philips, 2005). Value-based pricing is increasingly recognised by academics and practitioners as the most effective approach to pricing for companies wishing to achieve increased profitability and sustained success. Despite this support for value-based pricing, more than 80 percentage of companies continue to price their products and services on the basis of costs and/or competitive price levels (Hinterhuber, 2008).

1.1 Metrology

As said in the introduction, metrology is the science of measurement and reducing measurement uncertainty is the goal of metrology services. The uncertainty needs to be less then the process control tolerance, which is a precision / tolerance ratio (Bunday et al. 2007). One way of reducing measurement uncertainty is by calibrating the instrument. Calibration has three purposes: estimate the measurement uncertainty, compensate for bias and continuously insure the reliability of the measurement method (Carlsson, 1999).

When it comes to the manufacturing process they make sure of the accuracy of their instruments through periodically calibrating their measuring instruments against accurate standards. Those standards have their calibration traceable to the national measurement standards or even the international standard. All of these levels of calibration are being documented and create a chain of
traceable calibrations. That the calibration is traceable means that a measurement can be traced to a national and international standard whenever or wherever it has been made (Carlsson, 1999; www.bipm.com).

Another way to reduce measurement uncertainty is by measuring. To measure you need measurement instruments, a measurement instrument normally has a display area that is the area in between the highest and lowest shown value. The measurement range is the area in which the measurement fulfils its specifications. A gauge block does not have a sensor but gives a materialized measurement (Carlsson, 1999).

1.2 Background

SKF is the leading global supplier of products, solutions and services within rolling bearings, seals, mechatronics, services and lubrication systems. The services include technical support, maintenance services, condition monitoring and training. SKF has five platforms: Bearings and units, Seals, Mechatronics, Services, and Lubrication Systems. It also has three divisions in which they do business in: Industrial Division and Service Division, servicing industrial original equipment manufacturers (OEMs) and aftermarket customers respectively, and Automotive Division, servicing automotive OEMs and aftermarket customers. SKF operates in around 40 different customer segments. Due to that it is such a large company they have their own metrology centre called Mätcentrum (SKF Annual report).

Based on the demand from SKF’s own manufacturing, SKF has built a high-level metrology centre. Other companies than only SKF’s own manufacturing today use the services, 5-10% of the metrology centre’s services are sold externally today. Though they wish to increase this number to 10-20% as the demand for the service is expected to grow when they officially start selling the service externally again. The metrology centre is organized within the manufacturing and has little experience in marketing and market strategies. In addition, the sales department of SKF has little experience in this service offering as it is quite different compared to the majority of business
conducted by SKF sales. There is almost no awareness of the metrology centre, as it has not been offered on the market before. However, some customers that use the service at the current time were made aware of it by other customers, so there is some word-of-mouth marketing. This research will help SKF’s sales department to bridge the gap between the organizations and create a good value proposition for the metrology services.

1.3 Problem Discussion

Both manufacturing companies and end users need measurement services to make sure of the accuracy of the measurement instruments and the products (www.bipm.com). Reaching the toolsets full potential can help a manufacturing firm to become a world-class manufacturer, which is something many firms want to achieve (Bunday et al. 2007). However there is a difference in how organizations value metrology: some see metrology as important and value it highly, others think it is nothing but something that needs to be done. The value the company gives their metrology is usually connected to the quality of their metrology (Bunday et al. 2007).

As said in the introduction the market of metrology-services contains mostly cost-based offers even though there seems to be an opportunity for the firms with a high-value metrology service to have a value-based offer (Manager of Mätcentrum, 2011-10.12). By this the company could establish a competitive advantage among the companies where you compete about value and not price. Although it is important to recognize that the uncertainty associated with the purchase of a service is generally higher than for physical goods, which could make it harder to compete on value (Ding, 2007). The main reason for this is that the services are more difficult to examine and compare before purchases in comparison to physical goods. Due to this consumers lower their willingness to pay which results in limiting the service provider’s possible profit margin (Ding, 2007).

Therefore a company that use value as a pricing strategy must communicate the value they offer to target customers as they each have different needs and perceive the value differently from one another. If the value is not communicated properly it can result in high price-sensitivity and more price negotiations. This is due to the fact that the customer might not know or understand the value
of the product as they are unaware of the features, application and how those features would satisfy their need (Nagle & Hogan, 2006). To be able to communicate the value that a metrology service gives to the customers, the values have to be defined. Bunday et al. (2007) mention some values, however the thesis will investigate exactly what values the manufacturing companies think are essential in metrology services.

1.4 Purpose

The purpose of this study is to investigate what manufacturing companies consider as the main value drivers with metrology and based on the findings create a value based offer of SKF’s metrology service Mätcentrum.

1.5 Research questions

RQ 1: What does manufacturing companies consider as value drivers in measurement services?

RQ 2: How do you create a value-based metrology offer?

RQ 3: How successful will it be to sell the value-based service externally?

1.6 Delimitations

The research will be limited within the western region of Sweden, specifically in Gothenburg since that is where SKF is located.
2 Theoretical framework

This chapter explains the theoretical framework of the research. The theory is divided into five main parts: Market Analysis theories, Internal Analysis theories, Competitor Analysis theories, Pricing strategy and Literature discussion. It starts with describing internal market analysis theories with its aspects, it then moves on to describing the different internal analysis theories, the internal theories are followed by the competitor analysis theory, sequential is the different pricing parts and the theory finishes with a literature discussion.

There is to the author’s knowledge no available research done at this date on how to create a market strategy with a value-based offer for a metrology service. Therefore the theory is divided into the five parts that are going to be used in creating the offer. The five parts are the following; Market analysis theories, Internal analysis theories, Competitor analysis theories, Pricing strategy followed by a literature discussion. The three first theory sections are a part of the market positioning strategy; see Figure 1 below, which the authors have chosen to use as a guide when creating the offer. For the market analysis the theory is Porters 5 forces and steps in an industry analysis. The internal analysis theory consists of the Metrology, 7Ps and SWOT. The competitor analysis contains the theory of the competitor response profile. The pricing strategy part is divided into three parts that are all important when it comes to designing a value-based offer for a service. These parts are: communicating value, value drivers and value-based pricing. The literature discussion speaks about how the different parts are connected to each other.
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Figure 1. An overview of the theoretical framework

The basis for the theory part can be seen in the figure below with the market positioning strategy.
In order to create an effective positioning strategy you can focus and develop in the following areas: Market, internal and competitor. The Market Analysis includes size, composition, location and trends. The Internal Analysis includes resources, reputation, constraints and values. The Competitor Analysis includes their strengths, weaknesses and current positioning (Lovelock & Wirtz, 2011).

### 2.1 Market Analysis Theories

Defining the industry is the first step to undertake for creating a good industry analysis. The industry should not be defined too broadly or too narrowly and the strategy must take into account that the boundaries may change. There are two main dimensions when it comes to boundaries: the
scope of products or services and the geographic scope. An example for the product scope: does motor oil belong to the same industry even if it is used for different vehicles? And when it comes to the geographical scope is competition regionally, nationally or globally? If two products have the same buyers, suppliers and barriers to entry they are most likely to belong to the same industry. Furthermore if the structure of an industry is equivalent in every country a global strategy is needed, however if the structure differs within regions the different regions could be different industries (Porter, 2008).

2.1.1 Steps in an industry analysis

There are several steps when it comes to making an industry analysis. The first step is about defining the industry, this is where you define for example what products are in it and what the geographic scope is (Porter, 2008). Defining the market is vital when it comes to marketing as segmentation and positioning is impossible without it (Fennell & Allenby, 2003). A market can be defined in many different ways. Kotler (2000) gives available, geographic, penetrated potential, product, qualified and target markets as things that a market can be defined by. A market definition that is too narrow can limit profitability and potential opportunities, a market that is too large can on the other hand lead to mass market thinking (Weinstein, 2006).

A market consists of many participants and things such as customer needs, customer groups, competition, products and technology, which leads to the second step of the industry analysis (Weinstein, 1996). The second step includes identifying the industry participants, who they are, what they do and what they want. The industry participants are normally the buyers, suppliers, competitors, substitutes and potential entrants. The third step is to define the drivers of the industry participants, the forces and announce which ones are strong and which ones are weak (Porter, 2008). More information about the five forces comes below in the next part of the chapter.

Fourthly comes defining the structure of the industry and to see if the analysis is consistent or changing. There are certain point that need to be evaluated within this step, such as: How is the level of profitability and why? The forces for profitability should be defined, especially the
controlling ones. Another question is if the analysis is consistent in the long-term when it comes to profitability. Also you need to define how the other players are positioned when it comes to the five forces, if the players with more profitability are better positioned (Porter, 2008).

The two last steps include an analysis of the five forces and the changes that might occur, both short-term and long-term and identifying and defining if there are any aspects of the industry that could be influenced by competitors, new entrants or by the own company (Porter, 2008).

2.1.2 Porters Five Forces

Every entrepreneur should apply the thinking that in order to be successful you need to raise competitiveness (Renko et al. 2004). Competitive advantage is having a valuable resource that gives a firm the opportunity to perform a certain activity or several activities better or cheaper than any other company (Collins & Montgomery, 2008; Porter, 2008). To create a competitive advantage you can isolate a firms opportunities and threats, describe its strengths and weaknesses or analyse how those are matched to choose an appropriate strategy (Barney, 1991).

One way to achieve that is to create a well-developed and conducted marketing strategy (Porter, 2008). To develop marketing strategy of a company the strategy needs to mainly be based on the results from the analysis of the industrial structure. (Renko et al. 2004; Porter, 2008). The purpose of a strategy is to understand and deal correctly with competition. Managers sometimes choose to focus only on the direct competition even if the competition goes beyond established industry revivals to include four other competitive forces: customer, suppliers, potential entrants, and substitute products. The extended competition that results from the five forces defines structure of the industry and shapes the competitive interaction within the industry (Porter, 2008).

Industries might appear different on the surface, but the underlying drivers of profitability are still the same. In order to understand any industry competition and profitability one must analyse the industry’s underlying structure in terms of the five forces.
Figure 3. The five competitive forces for strategy (Porter, 2008, p. 80)

The force considered being the most competitive and strongest often determine the profitability of an industry and therefore become the most essential for the strategic formulation. The most salient force, does not necessary has to be obvious. For example, even if rivalry is often mentioned as intense in industries, it might not be the actual factor that limits the profitability (Porter, 2008). According to Porter (1980) the five forces can be describes as following:

Threat of new entrants: With new entrants comes new capacity to the market and the new entrants seek to gain market share. If the new entrants are different and offer some differentiation value to the market they can put pressure on price and cost for the other companies. If the threat of new entry is high the existing companies keep there prices down or increase their investment. However there are various barriers to overcome for new entrants in all markets. If the barriers are low the threat of new entrants is even higher. It also depends on the expected retaliation; if the barriers are low and the expected retaliation is low the threat of entry is considered to be high (Porter 1980, 2008).
Threat of Substitutes: There are direct and indirect substitutes. The more substitutes there are will result in a less intense competition. A substitute is something that has a similar function or something that gives the same result as a company’s product or service. A company has to differ itself from substitutes otherwise the profit potential is bound to be limited. The substitutes are a threat if: the substitute is similar or better when it comes to price and performance, switching costs in between products are low for the buyer, for some reason the companies don’t understand each others signals (Porter 1980, 2008).

Rivalry among existing competitors: Companies use many different ways of competing against each other including: price discounting, advertising, extra services, new product development and introduction. The strengths and intensity of competition of the different companies will depend up on the number of companies that are actively operating in an industry sector. The intensity is strong if: there are few companies on the market or if they are similar when it comes to size and power, companies have to fight for market share due to lack of growth in the industry or if it is hard to leave the industry because of high exit barriers (Porter 1980, 2008).

Bargaining Power of Buyers: These bargaining factors include following: Demand for quality, playing off competitors and buyer concentration. The buyers can be very powerful if they are price sensitive and have a high influence. If this is the case they can pressure the companies to lower their prices. A customer has the power to influence for several reasons: If there are few buyers, if the products don’t differentiate much within the industry and if there are few switching costs in changing seller. Customers also tend to be more price sensitive if the products or services are undifferentiated from one another, differ very little or is considered to be expensive (Porter 1980, 2008).

Bargaining Power of Suppliers: In an industry with powerful suppliers there is a risk that the suppliers charge high prices, limit quality of services or shift costs. An example is Microsoft who has continuously been raising prices on operating systems and helped the profitability of personal computers. A supplier can be powerful for several different reasons; if it is more concentrated than the companies in the industry they sell to, if the supplier is not depending on the industry only for its revenues, if the companies in the industry have the threat of switching costs when changing
suppliers, supplier offer differentiated products and if there are no substitute products or services (Porter 1980, 2008).

2.2 Internal analysis theories

2.2.1 Metrology
Metrology is becoming more and more important for manufacturing firms, reaching a toolset full potential can today mean becoming a world-class manufacturer (Bunday et al. 2007; www.bipm.se). To make the toolset reach its full potential requires an understanding for how it can affect the firm’s productivity. The metrology engineering team needs to reduce sources of measurement error including activities such as choice of equipment set, process development, use of appropriate metrics and techniques for gauging and maintaining toolset performance, measurement optimization, accurate calibration to the process, and optimization of equipment stability and matching (Bunday et al. 2007). To have a successful CD or overlay measurements you need two things: precision and accuracy. Precision is a measure of the uncertainty of the measurement. Accuracy describes how well measurements track the reality of a process as it is outlined by a reference. When the error sources are minimized the value of the metrology increases, the value-added aspect of metrology depends on the team executing the job correctly and thoroughly (Bunday et al. 2007).

There is a difference in how organizations value metrology. Some see metrology as important and of high value, others don’t think it is vital. Metrology is usually connected to the quality of their metrology but also to what the company is producing. A company needs good tooling, methods and personnel for obtaining a good metrology quality so if the organization wishes to have good metrology it can be acquired (Bunday et al. 2007). Some of the dependencies for a good metrology have been named above, all of them are shown in Figure 4 below.
For a good metrology service in a company they need to have the best tools purchased for application; the best possible precision performance attained and maintained, the matching must be well maintained and the accuracy well calibrated. There are some organizational causes that result in good metrology such as that the value of metrology is understood and enough resources are allocated, that the organization recognizes the importance of having a quality metrology team to success of process and that the resources and efforts are not spared in this area. Finally the metrology team need a good expertise and equipped with efficient, up to date methodologies (Bunday et al. 2007).
Metrology can contribute value to the final product through several points: Yield improvement/prevention of yield loss, process improvement, increased learning speed/cycles of knowledge, improved knowledge of individual parts produced, improved time to recover from excursions and improved time to market (Bunday et al. 2007, p. 272). The points mentioned are connected to each other, for example increased learning speed/cycles of knowledge increase the speed in development and allows the products to reach the market faster, ergo improved time to market. Minimizing uncertainty and errors in metrology is vital to any organization, as it has been given a greater role and value with the constant increase in technology (Bunday et al. 2007).

2.2.2 SWOT-analysis

To be able to estimate the internal strengths and weaknesses, as well as external opportunities and threats, of a company an internal analysis need to be conducted. One of the options of an internal analysis is the SWOT analysis. SWOT stands for a company’s strengths, weaknesses, opportunities and threats (Mintzberg & Quinn, 1991). The strengths and weaknesses can be found in the functional company fields. Furthermore, the strengths and the weaknesses of a company must be measured at different levels of the organisation such as: at a group level, individual company level or product or market level (Jain, 1990). The internal analysis is done through determining the strengths and weaknesses. The external analysis is conducted through determining the opportunities and threats. Internal capabilities, resources and positive situational factors make up the strengths. The limitations of the organization make up the weaknesses: it includes anything that stands in the way of the company achieving its goals. Any current or future external factor that could influence the company negatively is a threat. On the other hand is any current or future factor that might influence the company positively an opportunity (Armstrong & Kotler, 2012). The aim with a SWOT analysis is to help marketers match strengths with opportunities and understand how to handle and create strategies towards weaknesses and threats as they prepare the marketing plan (Wood, 2010).
2.2.3 7Ps of Services Marketing

Today companies are competing strategically through service quality for greater differentiation in the current competitive marketplace. Successful companies focus on the services-dominant paradigm where you invest in people, technology, human resources policies, and compensation linked to service performance of employees. This is important because the good level of employees’ attitudes and behaviours significantly influence the quality of service. They present the “face and voice” of their organization’s connection to the customers service (www.continuumlearning.com; Magrath, 1986).

The 4Ps marketing mix: Product, Process, Pricing and Promotion, has almost always been applied when it comes to product marketing (Armstrong et al. 2009). When applying and changing the 4Ps the company is normally looking for a competitive advantage over their competitors. For example if it is the product features that give the competitive advantage the other Ps are managed to highlight the product (Magrath, 1986).

**Product** refers to what the company offers its target customers; it includes the products, services and possibly the combination of both. For example a Peugeot 207 consist of thousands of different basic parts, it comes with different features and exist in several different models. Together with the service and warranty they all make up the offering (Armstrong et al. 2009).
Price refers to the amount of money the customers pay to be able to use/have the product or service. If you take the Peugeot example again, the dealers negotiate price with the customers, they offer discounts, trade-in allowances and credits (Armstrong et al. 2009).

Place refers to the activities a company pursue to be able to make the product or service available to the target consumers. As explained above Peugeot uses independent dealers to sell their cars, they select them carefully and rely on them to sell the vehicles (Armstrong et al. 2009).

Promotion refers to all the activities related to communicating the values of a product or service with the intentions of persuading the customers of buying it. It can be advertising, for example Peugeot spend more than €1.0 billion on advertising its vehicles each year (Armstrong et al. 2009).

The 4Ps of marketing have been the key areas where the marketing managers allocate scarce corporate resources in order to achieve the business objectives. However the four Ps are not enough when marketing services (Magrath, 1986). Services have unique characteristics such as: intangibility, heterogeneity, inseparability and perishability (Berry, 1984; Lovelock, 1979; Shostack, 1977). To discern the differences between services and physical products, Booms and Bitner (1981) suggested an extension of the 4Ps framework to include three additional factors: People, Physical evidence and Process as the marketing mix is different for services marketing (Booms & Bitner, 1981). The points are a part of the service, for example the quality of the employees reflects on the quality of the service (Ahmed & Rafiq, 1995).

People refer to all people directly or indirectly involved in the consumption of a service, examples are the employees and final customers (Ahmed & Rafiq, 1995; www.continuumlearning.com). The personnel of a service are vital to creating and delivering it. The consumers will as said above identify the service personnel with the company and the quality of the service (Magrath, 1986).

Physical evidence, are related to the environment in which the service is delivered, and it also include the tangibles that help in order to communicate and perform the service (Ahmed & Rafiq, 1995; Magrath, 1986; www.continuumlearning.com). As a service is intangible the potential customers will use any tangible elements to assess the quality of the
service (Ahmed & Rafiq, 1995). The more intangible it is the more the customer require tangible elements (Shostack, 1977).

**Process** is referring to the delivery and operating systems of procedures, mechanisms and flow of activities in which services are being consumed (Ahmed & Rafiq, 1995; www.continuumlearning.com). Process management ensures the availability and quality of the service (Magrath, 1986). The marketers need to ensure that the service process and accepts it so that the points such as delivery time will not make them think less of the quality of the service (Ahmed & Rafiq, 1995).

The additional 3Ps has gained great acceptance in the services marketing literature. Together the 3Ps represent the service and provide the evidence that makes services more tangible (www.continuumlearning.com).

### 2.3 Competitor analysis theories

#### 2.3.1 Competitor response profile

It is essential for companies to analyse their competitors and their strategies in order to find out what drives them and to find out their current profile, their capabilities and future intentions. If you have this knowledge about your competitors you can easier create a competitive advantage for your business by maximize the values of the capabilities that differentiates your business from the competitors (Porter, 1980).

“The objective of a competitor analysis is to develop a profile of the nature and success of likely strategy changes each competitor might make, each competitor’s probable response to the range of feasible strategic moves other firms could initiate, and each competitor’s probable reaction to the array of industry changes and broader environmental shifts that might occur.” (Porter, 1980 P.47)
Competitor Response Profile;
Is the competitor satisfied with it’s current position?
What likely moves or strategy shifts will the competitor make?
Where is the competitor vulnerable?
What will provoke the greatest and most effective retaliation by the competitor?

![Diagram of competitor response profile]

Figure 6. Competitor response profile (The authors, inspired by Porter, 1980, p. 47)

Porter (1980) describes the four diagnostic components as following; Future Goals can be defined as what drives the competitors. By predicting the competitor’s goals you can draw conclusion regarding if they are satisfied with their current market position or not. Knowing the competitors goals will also provide in future changes within their strategy. Assumptions are the second crucial component in the analysis, which chose to focus on to identify the assumptions hold of the company. It includes assumptions that are held about the company it selves and assumptions hold of the company within the industry. By examining different assumptions one can find out if the assumptions are correct or no. In many cases firms to over estimate or underestimates a competitors power, resource or skills. The Current strategy refers to how the company is operating in the very
moment. One should think of a competitors’ strategy as a key operating policies in each functional area of the business and how it seeks to connect and integrate the functions. Capabilities refers to more or less everything within the competitors organization such as; products, marketing and selling, operations, research and engineering, financial strengths, over all costs. It would be of great use to be aware of what the competitor’s capabilities are within those areas and find out what they are best at and worse at (Porter, 1980).

2.4 Pricing strategy

Today the service sector has a dominant part of the economy, even though service pricing has not been deeply examined (Ding, 2007). There is not much existing research when it comes to pricing of services and there are only a few people that are aware of the challenges involved (Berry & Yadav, 1996). For organizations, pricing has one of the most essential parts when it comes to revenue and profit results. Pricing has been studied for centuries and many traditional pricing methods are still used and unchanged in today’s situation (Shoemaker, 2003).

There are three common pricing approaches (shown in the figure below). The most used pricing approach is cost-plus; the cost of the service and the desired profit equals the total price (Arnold & Hoffman, 1989; Tung & Capella, 1997), followed by market based pricing (price determined of references to the price of competitors). Both pricing methods are useful when it comes to product pricing (Arnold & Hoffman, 1989). However when it comes to pricing for services, it have been shown that from a historical perspective the majority of service contracts has been based and billed upon time and material basis (Ding, 2007).
2.4.1 Communicating value

When using value as a pricing strategy it requires that the company communicate the value they offer to target customers as they each have different needs and perceive the value differently from one another. If the value is not communicated properly it can result in high price-sensitivity and more price negotiations. This is due to the fact that the customer might not know or understand the value of your product because they are unaware of the features, their application and how those features would satisfy a need (Nagle & Hogan, 2006).

Companies communicate value so that the customers are aware of the value they receive and the company can justify the extra price charged for it. Value communication include advertising, personal sales, trial offers, endorsement, guarantees and other tools that raise the customers willingness to pay to the same level as better informed and experienced customers. Communicating value is critical in increasing the customer’s willingness to pay as the same monetary amount of price, in return for the same amount of value, can give an entire different effect after how the customer perceives it. Value communication works when companies communicate value of a product or service to potential customers that they are not aware of but could help them satisfy a need or solve a problem (Nagle & Hogan, 2006). Still, in pricing of services frequently derail due to the lack of obvious association between price and value (Berry & Yadav, 1996).
All customers want good products and no customers want to overpay. Often the moment of truth in value-based pricing is how effectively the sales force can communicate the value that the innovation as well as the company brings to that customer. Regardless of the product category, it is the customers' perception of value that will determine which vendor gets their business. For this reason, it is important for companies who produce and price product or service to understand how much their offers are worth (Bradley & Swire 2006).

2.4.2 Value drivers

Understanding how customer value differs with market segments can help companies to set price and value, win more loyal customers and gain a greater profit. Value as a term refers to the total savings, monetary gains or satisfaction that customers receive from using the product or service (Nagle & Hogan, 2006) From the customers point of view, value means benefits received for the burdens endured (Berry & Yadav, 1996). An offer's total economic value is the reference value plus the economic value of what differentiate this offering from the alternatives. A customer that is fully informed about the market and seeks the best value would be willing to pay the total economic value (Nagle & Hogan, 2006).

Value drivers are customer needs that a company’s offering could satisfy. Purchases within the business sector tend to focus on objective value drivers such as productivity improvement, fuel economy or durability –factors. These factors are vital to the customer’s business model and cash flow. Differentiation value is the extra benefit that the company’s offering delivers to the customer that is above the competitive reference product. When estimating differentiation value it brings a clear understanding of the impact that the product has in the competitive marketplace. A company estimates by calculating the monetary value of the offer that they cannot receive from reference products. Estimating value for a customer requires that the company knows the needs and problems and can create an offering based on that. The company should translate the product features into customer benefits that then are translated into the value estimation for the customer. When it comes to business markets the estimation is normally based on the economic impact the offering has on
the customers costs and revenues (Nagle & Hogan, 2006). In order to put price based up on values, service marketers need to understand what establishes values for their target markets (Berry & Yadav, 1996).

Developing a value hypothesis begins with a list of the offerings of the potential value drivers: superior performance, greater reliability, additional features, reduced maintenance cost, smaller start up costs, faster service etc. Some of the value drivers are cost drivers; they save the customer time, money or effort if the customer would use the company’s offering instead of the competitive reference product. It can be immediate savings or long-term cost reductions such as capital and inventory investment or replacement costs (Nagle & Hogan, 2006).

“Having estimated value the company can apply pricing strategies and policies to set selling prices” (Nagle & Hogan, 2006, p 44).

2.4.3 Value-based pricing

Value based pricing often refers to the price set as a function of the expected value the customer is going to gain from the service/product. This way of pricing is becoming more common. When it comes to Value-based pricing the aim is to benefit service consumers by improving alignment to business objectives and with the goal to create a long-term relationship where both vendors and sellers share the same interest model. By paying more attention to the client’s risk, the service provider gets the opportunity to achieve better rewards (Phifer, 2003).

Value pricing can be used to seize and drive competitive advantage as long as the customers perceive the value and see it as equivalent to the one provided by the reference product. When determining price the companies must understand value from the customer’s point of view to be able to meet demands from industrial customers (Shapiro & Jackson, 1978). The perceived value of a product is the price the customer is willing to pay for the total bundle of benefits the product delivers the customer will balance the benefits of the offering with its direct and implied costs.
(Gross, 1978; Monroe, 1990; Shapiro & Jackson, 1978). The key to improve service pricing is to truly relate the price to the ultimate value the customer will receive. The customer does not necessarily need to look for the lowest price available for a service, but the customer is most likely to want something worth the price (Berry & Yadav, 1996).

Preferably the offer should have a set of benefits or attributes that gives it “incremental” value.

“Incremental value is the increased level of economic value the customers can expect from this product compared to the reference product (Monroe, 1990, p.71 in Thompson & Coe, 1997).”

Incremental value can be attributes that offer added productivity such as: reduced material costs, increased output per unit time and an increase in the value of the customer’s output. With customers being more demanding in terms or price, value and quality value pricing is more suitable. It can create a competitive advantage if used correctly and drives the company’s costs instead of having the price based on the costs (Monroe, 1990).

Ones the values of the target market has been established, the next step would be to capturing and communicate the value propositions as clearly and interestingly as possible. One strategy of communicating the value is called satisfaction-based pricing. The fact that services are intangible creates barriers for both companies and customers. The intangibility emphasizes uncertainty. Satisfaction-based pricing strategy is to change customer’s uncertainty. This can be done with service guarantees and benefit-driven pricing (Berry & Yadav, 1996).

2.5 Literature discussion

This thesis focuses on how to create a value-based offer of a metrology service. As mentioned above, in the theoretical research it became clear that there is no common definition and information about value-based metrology offerings. There are connections in between market strategies and value-based pricing as value-based pricing is a strategy to gain competitive advantage. There is also a connection in between value-based pricing and metrology as Bunday et
al. (2007) says that there are certain aspects that make a metrology service good and that there is a
difference in how companies value metrology. The connection in between metrology and market
strategy is that the metrology services are sold today, but they are mostly cost-based. Hence, there
is a gap when it comes to research concerning value-based offerings of metrology, both
internationally and in Sweden.

The theories conclude that metrology services are becoming more essential for manufacturing firms
and are an important factor in becoming a world-class manufacturer. It also defines the great impact
both from a manufacture and customer perspective when it comes to be assured of the accuracy and
reliability of the measurement (Bunday et al. 2007).

Lovelock and Wirtz (2009) give a good overview on how to evaluate your offer and create a go-to-
market strategy for any type of service. There is a lot of empirical validation on how to create
market strategies from several different authors for example, Lovelock and Wirtz (2009) and Porter
(2008). There are also many authors who reason for value-based pricing for services such as
Monroe (1999), Phifer (2003) and Ding (2007). According to studies vendors are moving towards
value-based pricing for services (Ding, 2007). It is important to use value-based pricing when it
comes to services thigh highlights Ding (2007) by mentioning the uncertainty of purchasing a
service and how this differs from purchasing a product. The literature suggests that for a
competitive advantage a value-based pricing is a better strategy for services.

Bunday et al (2007) further explains that there is a need for metrology and the level of quality is
linked to how companies visualize the importance of the service and perceive how its value
contributes to the organization. This highlights the value of the metrology service as a main factor
in how the service is being perceived by its users. However a value-based metrology service seems
to be a field that have not yet or is just starting to be explored.

Therefore it can be concluded that both market strategy and value-based pricing have theories with
empirical validation and they can be connected to metrology. Though there is a gap when it comes
to creating a market strategy with a value-based offer for a metrology service. There is a need for
metrology services based on its values and reliability as Bunday et al (2007) explains in their
research, but most of the metrology services offered on the Swedish market are cost-based and not value-based (Manager of Mätcentrum, 2011-10-12). In this thesis we will investigate how to create a value-based offering for a metrology service.
3 Methodology

This chapter aims to explain the methodological decisions that were made throughout the thesis. It begins with describing the research approach with deductive reasoning. The next part describes why the authors choose a qualitative study over a quantitative. It is followed by a definition of research design and a justification of why a descriptive approach was chosen. After the research design is the data sources and then the research strategy. It will then explain the data collection method and the operationalization and pretesting of the interview guide. Subsequently comes the sampling part with the sampling frame and sample selection together with the presentation of the case company SKF. The next part describes the qualitative approach of data reduction and pattern matching. The last part is the qualitative criteria with content validity, construct validity, external validity and the reliability of the research.

3.1 Research approach

“Research is the systematic approach of collecting and analysing information in order to increase our understanding of the phenomenon about which we are concerned or interested” (Sachdeva, 2009, p.14).

For a research to be good it should follow the scientific method, it should be systematic and have empirically based procedures for generating a replicable research (Sachdeva, 2009). This research was problem solving, as the researchers helped SKF with marketing and selling their metrology service value-based in which they had not much experience.
3.1.1 Inductive vs. deductive research

There are two types of research approaches inductive and deductive. Inductive reasoning is when you make specific observations and create theories and generalize based on the results of the observations. Deductive reasoning is more of a top-down approach where you move from the general to the specific. You start with reading about theory related to the topic of interest and finally narrow it down into a hypothesis that can be tested. The theory is then confirmed or denied when you make observations of the hypotheses (Sachdeva, 2009). A deductive research is applied to this study as the empirical findings were created by a test of the pre-existing theories in marketing strategy and value based pricing.

3.1.2 Qualitative vs. Quantitative research

Quantitative research aims towards an accurate measurement that can be validated and transformed into statistics and numbers. Based upon the statistical results from the research you make generalizations. A quantitative research could be a measurement of for example: customer behaviour, knowledge, attitudes and opinions towards something specific. The quantitative method is normally formalized, highly structured and easy controlled by the researcher. Quantitative research is generally identified with a few variables and a large number of units whereas the qualitative research would be described as the contrary (Strauss & Corbin, 1998; Sanjeev, 2010). The purpose of qualitative research is that the researcher gets involved in the topic of interest by collecting data that will provide a detailed and in-depth explanation of situations, events and interactions between people. Qualitative research collects information from people (individuals or groups, Organizations or institutions, texts (published, including virtual ones), setting and environments (visual/ sensory and virtual material), objects, artefacts, media products, events and happenings (Sachdeva, 2009).

Qualitative research further includes informal interactions with consumers, employees, management or competitors. It includes more formal approaches through in-depth interviews, focus
groups, projective methods and pilot studies. The method is useful when it comes to providing significant insight into a given situation. It is also easier to track and see what information that came from what source (Sachdeva, 2009).

The figure below describes key distinctions between the qualitative and quantitative research methods.

Table 1. Distinctions between qualitative and quantitative research

<table>
<thead>
<tr>
<th>Research Agenda</th>
<th>Qualitative</th>
<th>Quantitative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus</td>
<td>Understand and interpret</td>
<td>Describe, explain and predict</td>
</tr>
<tr>
<td>Involvement</td>
<td>High as researcher is participant and catalyst</td>
<td>Researcher keeps himself away to reduce bias</td>
</tr>
<tr>
<td>Purpose</td>
<td>In-depth understanding, theory building</td>
<td>Describe, predict and test theory</td>
</tr>
<tr>
<td>Sample design</td>
<td>Non-probability, purposive</td>
<td>Probability</td>
</tr>
</tbody>
</table>

Source: Sachdeva, 2009 p.185

An alternative option is to use a mixed method research where you combine a quantitative and qualitative approach. With a mixed method both types of data are collected and analysed, increasing the strength of the thesis more than if only one approach was used (Creswell & Plano Clark, 2007).

To carry out this research, it was necessary to obtain information from both individual people and organizations. A mixed method approach that aimed towards a qualitative research approach was
best suited for this study, as individualized and detailed information was needed from specific companies that are in use of metrology services. The information should include the ability to be tracked to the original source. In-depth understanding of SKF was also necessary to be able to get better insight in how SKF worked with Mätcentrum and understand how they have created action plans for previous service offerings. However a generalization of the values of the manufacturing companies in the western region of Sweden was needed. This was to make it even clearer which were the most valued factors in the industry and to strengthen the results.

3.2 Research design

The research design is there to structure the research and show how the parts work together and try to address the research questions.

“Research design is the plan and structure of investigation so conceived as to obtain answers to research questions. The plan is the overall scheme or program of the research. It includes an outline of what the investigator will do from writing hypotheses and their operational implications to the final analysis of data” (Sachdeva, 2009, p. 84).

There are several design approaches; exploratory, formal study, monitoring, communication study, experimental, expost facto, descriptive, causal, cross-sectional, longitudinal, case study, statistical study, field settings, laboratory research, simulation, actual routine and modified routine. The major ones are considered to be: exploratory, descriptive and causal. A descriptive research aims to describe things, such as data and characteristics of the phenomena being studied. It answers the questions who, what, where, when and how and it is a factual, accurate and systematic approach. A downside with a descriptive approach is that it cannot be used to create a causal relationship and thereby has a low requirement for internal validity (Sachdeva, 2009).

A qualitative research often aims to describe and the researchers can follow up with investigations of why the observations exist and what the implications of the results are. The main difference
between a descriptive and an exploratory research is that the exploratory has a less structured format and is more flexible. It is an approach that fit when there is a low understanding of the topic or the topic is new as it strives to gain knowledge about a certain problem. The disadvantage of the approach is that the result is not always useful in decision making afterwards. However the exploratory approach can provide direction for a more formal effort (Sachdeva, 2009).

A causal research aims to test a hypothesis about cause-and-effect relationships. In this approach the researcher investigates if manipulation of one variable (the independent variable) affect another variable (the dependent variable). When the purpose of a topic is either an accurate description or an association between variables the accuracy is vital. Therefore a research design that minimizes bias and maximizes reliability is preferable (Sachdeva, 2009).

When decided what research approach to choose for this study it was easy to rule out the causal, as testing variables against each other was not an option. The purpose was to make an investigation to be able to describe how to create a value-based metrology offering. The exploratory design could also be applicable to this kind of project but as the nature of the study was more towards a descriptive it was chosen. The descriptive approach was chosen because the research aims to describe the characteristics of the metrology service at Mätcentrum and the values the manufacturing companies in Gothenburg see in metrology offers by interviews and secondary data.

3.3 Data sources

When deciding about different methods for data collection the researcher should have two types of data in mind: primary data and secondary data. The methods can be used individually or as a combination with the purpose to complete each other. Secondary data is data that already has been collected by someone and data that have already been used in a statistical process (Sanjeev, 2010).

The main benefits with secondary data are; Cost and Time, as secondary data gives the opportunity to good quality access. Instead of carrying out the data collection yourself it is already there which
results in both saved costs and time. A valid point to be made is that due to the fact that secondary data already has been used for a specific and different purpose it might correspond less effectively to the current research (Yin, 1994). There are two types of secondary data external and internal. External secondary data can be defined as sources from the Internet, any published data and standardized sources. Internal secondary data involves information within a company such as sales records, marketing activities, cost information, distribution reports and feedback (Sanjeev, 2010).

Primary data is explained as first hand source, collected for the first time and defined as an original source. In a situation where a descriptive research is carried out, through surveys for example, primary data is being collected. Primary data often give the researcher a better control, understanding and insight into the topic, as there is a direct contact with the sources. In the contrast of secondary data, a primary data collection is very time consuming and requires planning (Yin, 1994). There are selections of different methods in using primary data, especially with surveys and descriptive research. Essential ones are: observation method, interview method, content analysis, in-depth interviews and distribution audits (Sanjeev, 2010).

The study was depending on information that was up to date and specific information that was directly related to the research topic that concerns the value drivers of metrology. Due to these requirements primary data was highly appropriate. The primary data was gathered through interviews with the manager at Mätcentrum and nine manufacturing companies in the western region in Sweden. However, to be able to create a Market action plan for SKF the availability of internal secondary data was also required in order to get more knowledge, insight in the company and by this reach best outcome of result and meet the objectives of this research. External secondary data was required to be able to investigate the current market and the competitors. The internal secondary data was needed to understand the service they provide.

The external data was collected from SCB, Statistiska Central Byrå, and was concerning how many manufacturing companies that are located in Gothenburg and Sweden who could be a potential customer of Mätcentrum. It was also regarding how many companies that were offering metrology services in Gothenburg and in Sweden. The external data was also collected from Swedac, the Swedish Board for accreditation and Conformity Assessment that was concerning how many companies in the western region and overall in Sweden that were accredited in length which
is the same as Mätcentrum. This was to be able to see how many companies there were in Gothenburg and in Sweden that targeted the same type of customers as Mätcentrum. To save time and costs the competitor data was also collected through secondary data instead of interviews through the webpages of the competitors. The internal data gathered from SKF’s Mätcentrum were different documents explaining the services they offered, their qualities, benefits and characteristics to be able to create an offer of their services and assign the value drivers and the differentiation values.

3.4 Research strategy

There are several ways of doing a social research: experiments, history, analysis of archival information, surveys and case studies (Yin, 2009). The five research strategies are shortly described below.

The purpose with the experiment approach is to confirm, verify, falsify or establish validity of a hypothesis whereby one or a several variables are changed to determine the opposing effects. The survey research aims towards making statistical implication with help from a sampling of people from a population. Archival analysis can be explained as an observational method, the researcher inspects and examines the collected documents or archives of the unit of the analysis. The purpose with history is to collect, inspect and carry out an analysis of historical document. A case study strategy clarifies a concentrated analysis of an individual, group or event. The purpose of the analysis is to emphasis the developmental factors in relation to the context and the relevant theory that has been applied (Bryman & Bell, 2011).

Each of the strategies has its own specific advantages and disadvantages which depends upon three different conditions which are the following: the type of research question, control of behavioural events and focus of contemporary as opposed to historical phenomena (Bryman & Bell, 2011).

Table 2. Describes Relevant Situations for Different Research Strategies
For this research the choice was between making data collection with surveys, personal interviews or the combination of both. This was due to the objectives and the purpose of the study, thus three of the five strategies were eliminated as the study focused on the current and on going situation and required primary information. Therefore history, experiment and archival analysis were excluded in an early stage. After discussions the decision was made that a case study was the most appropriate research strategy based upon that the information needed had to be mostly qualitative with primary sources from different companies in the metrology industry. Specific insight information from SKF was also required in order to relate and be able to create an offering of their measurement service Mätcentrum. Therefore, based on the specifics of this research a case study with interviews had to be conducted. Due to the limited amount of research time, the combination of making a survey and interviews was unfortunately no longer an option. Although a scale similar to ones normally used in surveys was added to several questions in the interview guide to be able to get some amount of generalization that a survey would also provide.

3.5 Data collection method

After the case study was chosen as a research strategy the next step was to develop what type of data collection that was most appropriate. The sources of evidence discussed and showed in Table 3 below are the ones that are used most frequently in case studies: documentation, archival records, interviews, direct observations, participant-observation and physical artefacts. All the six sources
explain different data collection procedures. Each one of the sources are linked to an array of data or evidence. The major objective by using these six sources is to collect data about actual human events and perceptions of behaviour. The method is different, but complements the objectives of surveys when it comes to capturing perceptions, attitudes and verbal reports about events and behaviour, rather than direct evidence about the events and behaviour (Yin, 2009).

Table 3. Six Sources of Evidence: Strengths and Weaknesses

<table>
<thead>
<tr>
<th>SOURCE OF EVIDENCE</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documentation</td>
<td>- Stable –can be reviewed repeatedly</td>
<td>- Retrievability – can be difficult to find</td>
</tr>
<tr>
<td></td>
<td>- Unobtrusive</td>
<td>- Biased selectivity, if collection is incomplete</td>
</tr>
<tr>
<td></td>
<td>- Exact- contains exact names, references and details of an event</td>
<td>- Reporting bias – reflects (unknown bias of author)</td>
</tr>
<tr>
<td></td>
<td>- Broad coverage – long span of time, many events and settings</td>
<td>- Access – may be deliberately withheld</td>
</tr>
<tr>
<td>Archival records</td>
<td>- Same as those for documentation</td>
<td>- Same as those for documentation</td>
</tr>
<tr>
<td></td>
<td>- Precise and usually quantitative</td>
<td>- Accessibility due to privacy reasons</td>
</tr>
<tr>
<td>Interviews</td>
<td>- Targeted – focuses directly on case study topics</td>
<td>- Bias due to poorly articulated questions</td>
</tr>
<tr>
<td></td>
<td>- Insightful – Provides perceived casual inferences and explanations</td>
<td>- Response bias</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Inaccuracies due to poor recall</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Reflexivity – interviewee gives what interviewer want to hear</td>
</tr>
<tr>
<td>Direct observations</td>
<td>- Reality – covers events in real time</td>
<td>- Time consuming</td>
</tr>
<tr>
<td></td>
<td>- Contextual – covers context of “case”</td>
<td>- Selectively</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Reflexibility – event may proceed differently because it is being observed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Cost – hours needed by human observers</td>
</tr>
<tr>
<td>Participants</td>
<td>- Same as above for direct observations</td>
<td>- Same as those for direct observations</td>
</tr>
<tr>
<td>observation</td>
<td>- Insightful into interpersonal behaviour and motives</td>
<td>- Bias due to participant observer’s manipulation of events</td>
</tr>
<tr>
<td>Physical artefacts</td>
<td>- Insightful into cultural features</td>
<td>- Selectively</td>
</tr>
<tr>
<td></td>
<td>- Insightful into technical operations</td>
<td>- Availability</td>
</tr>
</tbody>
</table>

Source: Yin, 2009, p.102
After deciding to have a case study as a research strategy, the choice for interviews where the only relevant option for data collection. According to Rubin & Rubin (1995) interviews are considered to be one of the most important sources when it comes to case studies. In contrast to surveys, interviews are a guided conversation rather than structured and controlled queries. In a case study interview are likely to be fluid instead of inflexible (Sachdeva, 2009). The questions used in the interview guide were mostly fluid but with the less flexible approach of choosing in between the importance and alternatives of the value drivers. An interview can be conducted individually or in groups. The table below shows distinguishes between the individual and group methodology. It should be noted that both have a clearly defined place in qualitative research (Sachdeva, 2009).

Table 4. Elements of group and individual interviews

<table>
<thead>
<tr>
<th>Individual Interview</th>
<th>Group Interview</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research Objectives</strong></td>
<td><strong>Research Objectives</strong></td>
</tr>
<tr>
<td>- Explore the individual in depth. Creates case histories though repeated interviews over time</td>
<td>- Orient the researcher to field of inquiry and language of the field</td>
</tr>
<tr>
<td>- Test a survey</td>
<td>- Explores a range of attitude, opinions and behaviour</td>
</tr>
<tr>
<td>- Add contextual detail to quantitative findings</td>
<td>- Add contextual detail to quantitative findings</td>
</tr>
<tr>
<td><strong>Topic Concerns</strong></td>
<td><strong>Topic concerns</strong></td>
</tr>
<tr>
<td>- Detailed individual experiences, choices, biographic</td>
<td>- Issues of public interest</td>
</tr>
<tr>
<td>- Sensitive issues that might provoke anxiety</td>
<td>- Issues where little is known or of hypothetical nature</td>
</tr>
<tr>
<td><strong>Participants</strong></td>
<td><strong>Participants</strong></td>
</tr>
<tr>
<td>- High status or elites</td>
<td>- Whose background are similar or not so dissimilar as to generate conflict or discomfort</td>
</tr>
<tr>
<td>- Those who have good language skills</td>
<td>- People who offer a range of position of issues</td>
</tr>
<tr>
<td>- Participants whose distinction would inhibit participation</td>
<td></td>
</tr>
</tbody>
</table>

Source: Sachdeva, 2009, p. 168
One kind of case study interview is *in-depth interviews*. The researcher asks respondents about the related topic as well as the respondents opinions of the matter. In some situations the investigator can ask the interviewee to suggest own insight into certain occurrences and could use those kinds of proposals as a basis for further research investigation. Due to this kind of happenings the interview might extend the time limit and might occur more then once (Yin, 2009). A second type of case study interview is *focused interviews* (Merton, Fiske & Kendall, 1990) where a person is being interviewed during a short period of time, an hour or less. As a result the interview might end up open and the investigator are following a set of questions. The main purpose is to validate certain facts that the researcher already believes have been established.

*Focus groups* are another way of doing interviews; they normally consist of 6 to 10 participants and are led by a moderator. The purpose of a focus group is for the moderator to guide the group into exchanging ideas, feelings and experiences on a specific topic. Focus groups are seen as an essential tool for feedback towards new products and various other topics. In social science, focus groups are allowing the interviewers to study individuals during more natural circumstances than in a one-to-one interview (Sachdeva, 2009).

As previously stated this investigation needed detailed and specific information from different companies that use metrology services. Focus groups were not relevant as the interviews took place at different companies and it was highly unlikely that the interviewees would want to share work-related information with other companies, as they could be competitors. Focused interviews were likewise not an option as the interviews was going to take at least one hour with more and deeper information. The purpose of the information was to find out different value drivers of metrology and why different companies decided to use the service internally or externally. In depth interviews with Björn Johansson, the Manager of Mätcentrum, were needed with the purpose to get internal information about Mätcentrum and his understanding of the current market of metrology, current and potential customers and competitors. An interview with Joakim Eliasson, an Account Manager at SKF Nordic Region, was also necessary to get information regarding SKF previous service offering. However the interview with Joakim Eliasson did not take place but the information was gathered through e-mail with another account sales manager at SKF, Åsa Nordström and with a market manager at SKF, Jennie Åkerman.
3.6 Data collection instrument

As earlier stated, interviews are seen as one of the most essential methods for data collection (Rubin & Rubin, 1995). However referring to Yin (2009), table 4, there are a several weaknesses with interviews that need to be taken into consideration before proceeding to carry out the research investigation. To be able carry out a case study research successfully, it requires prior skills from the investigator, training and preparation is essential for the specific case study type. Regarding prior skills, many researchers incorrectly believe they up-hold these skills as they have mistaken the method of being easy to use (Yin, 2009). Instead case study research (including interviews) is the hardest type of research due to the absence repetitive procedures. Due to this it is highly essential that the investigator feel comfortable to the obligations of the study. This can be completed with intensive training which might include how to ask good questions, be a good listener, be flexible and adaptive, know how to avoid bias (Yin, 2009). In case studies, an active mind is required during the data collection as well as before and after. To create good questions is therefore essential for the investigators. The purpose of the researcher is to build up a rich dialogue with evidence, activity that includes:

“Pondering the possibilities gained from deep familiarity with some aspect of the world, systematizing those ideas in relation to kind of information one might gather, checking the ideas in the light of that information, dealing with the inevitable discrepancies between what was expected and what was found by rethinking the possibilities of getting more data, and so on.” (Becker, 1998, p.66)

When collecting case study evidence the investigator must view those evidence matters and frequently ask question why the fact appeared the way it did (Yin, 2009). It is important for the investigator to interpret the information being collected and to right away be able to see if the data information is similar to others or if it contradicts. For this study discussions were carried out between the researchers before and after the interviews, to make sure that the information was relevant and to complement information that one of the researchers missed out on and to make sure that the researchers were on the same page in order to avoid complications. Questions were always
created in advance to use as guidance and for the researchers to feel more comfortable during the interview. Every question was open for a discussion and not always structured after a certain order.

It is essential to have knowledge of the two obligations of an interviewer. The first one is to follow the line of inquiry that the researcher has documented. The second is for the researcher to ask the actual (convosatabonal) questions with avoidance towards bias but that still serves the line of inquiry. As an example the investigator might want (from the investigators line of inquiry) to know “why” a certain process took place in a certain way (Yin, 2009). No question carried out within this research were posing on “why” questions. This might according to Becker (1998, p. 58-60), create defensiveness from the interviewee’s perspective. Posing a “how” question on the other hand is the best way of addressing “why” questions in a conversation matter.

According to Yin (2009), a good listener means to be able to receive and assimilate a large amount of information without bias. The exact words of the interview should be captured and it is essential for the investigator to understand the context of how the interviewee perceives the world. Poor listening skills might result in information being missed out because the listener won’t realize important information that is said between the lines. Other lacks of listening skills could be to have a closed mind and bad memory. During the interviews the absolute focus was on showing interest and not missing out on any important information. Most case studies don’t end up the way the investigators had planned (Yin, 2009). Due to this the investigators must be prepared to take both major and minor changes related to research. It is most vital for the researchers to remember the purpose of the investigation but they must also be able to adapt procedures or second plans if unexpected happenings would occur. In this study a plan B was often created and it was important to get used to the idea that meetings got delayed or cancelled. On one of the interviews the interviewee had forgotten the interview, fortunately one of his employees was able to have the interview the next day instead.

People always have their own bias and prejudices towards situations. The biases are sometimes less of a problem but it can also cause complications when it comes to conclusions and accuracy (Sachdeva, 2009). Investigators of a Case study are particularly prone regarding bias issues, as they must get involved in the topic beforehand (Becker, 1958 & 1967; Yin, 2009). For this research the
knowledge of metrology was very limited which resulted in a limitation of expected responses from the interviewees. Sachdeva (2009) explains that the respondents generally want to give a good impression to others and no one wants to stand speechless and without any answer. The consequence can result in that people, instead of telling the truth, might change the response in order to look better. This kind of situation is most common in face-to-face interviews or on interviews over the phone. When the investigations were carried out in this study it was necessary to be prepared of respondents bias. Like previously stated it is essential to listen very carefully to be able to draw conclusions if what the interviewee says is relevant. If not follow-up questions were asked in order to get more detailed information concerning the answer or statement.

One benefit with personal interviews that are face-to-face is that you, in most cases, know whom you have been talking to and who provided what information. That information helps if the information should turn out to be falsified. This is more difficult to track in surveys. The interviewer might also distort an interview, by not asking questions that make them feel awkward, even if the questions are relevant. There is also a risk that the interviewer won’t listen to the respondent’s answer where they have their own strong opinions regarding the topic (Sachdeva 2009). They may also make prejudgments about the respondent’s answers to the questions based on previous responses, even if this would not be the case.

The research started with interviewing the manager of the metrology service of SKF, Björn Johansson for the second time. An interview for a previous research had been done and then information was provided regarding essential information about Mätcentrum. At the first interview 2011-10-12, the purpose was to get basic knowledge of how they operated, who were their customers, what parts of the service they sold, who were their main competitors etc. At the second interview 2012-03-20, the aim was to find out what main benefits Björn Johansson saw with their metrology services, the strategy they preferred for selling the service, the market structure etc. Then the interview guide was constructed and twenty manufacturing companies were contacted regarding interviews from the ninth of April 2012 to the twenty-seventh of April 2012. The interview guides were pretested by having Henric Widén, Björn Johansson and Professor Hooshang Beheshti take a look at them and decide if they were able to give the answers that we wanted. Information concerning the offers and marketing was gathered from an account sales manager at SKF, Åsa Nordström and a marketing manager, Jennie Åkerman. When all the data was collected the offer
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was created based on the information from Björn Johansson, Åsa Nordström and Jennie Åkerman together with the conclusions of the values from the interviews with the manufacturing companies. When the offer had been created a pilot study was made to test the offer on two potential customers of SKF. Based on the success of the results from the pilot testing conclusions were drawn on whether a value-based market strategy could be used for a metrology service in market of the western region of Sweden, Gothenburg.

3.6.1 Operationalization and measurement of variables

Operationalization is a very complex process that includes different steps. It is about selecting and deciding on the major concepts from the research questions, the purpose and the problem discussion. Concepts can be hard to define as they are normally developed from a shared experience, they can refer to different things or different concepts can refer to the same phenomena. A descriptive or nominal definition is known as a conceptual definition. A conceptual definition is described by other concepts and it should preferably be positive (Krishnaswami & Satyaprasad, 2010). An operational definition is about quantifying a nominal definition: it is about testing or measuring the criteria or operation. “This definition specifies the operations which observe, measure and record the phenomenon symbolized by the concept” (Krishnaswami & Satyaprasad, 2010, p. 43). It should be possible for another researcher to make the same results by using the same definition. There are some important criteria of operational definition: adequacy of meaning, precision of meaning and likability (Krishnaswami & Satyaprasad, 2010).

To create an operational definition you need to operationally define each of the concepts chosen. The major concepts of our research were:

1. The value drivers of metrology: Value drivers are, as said in the theoretical framework, customer needs that a company’s offering could satisfy (Nagle & Hogan, 2006). This thesis aimed to define the values the manufacturing companies see in metrology. The values needed to be put into measurable terms which were why questions such as:
“How important is the possibility of having the measurement/calibration taking place at your own facilities?”

Very important O Important O Somewhat important O Not important O

With these questions we could define how important they saw a potential value driver. We also wanted to know what value drivers they considered to be important. That was asked through questions such as:

“What do you consider to be the most important factors when it comes to measurement and calibration?”

2. How profitable it would be to sell the value-based service externally: as Porter (2008) states there are some strategies that a company could use, one of those is the differentiation strategy. This strategy is when the company focus on providing its customers with unique value. If a value-based strategy was better than a cost-based was assessed by an acceptance rate of the offer when it was tried on potential customers.

3. How to create a market strategy for a value-based metrology offer: Creating a marketing positioning strategy includes analysing the market, the internal situation and the competitors (Lovelock & Wirtz, 2011). The different parts in the market positioning strategy was assessed by asking questions related to the 5 forces, the steps in an industry analysis and the 7Ps. The service was measured by a SWOT- analysis that evaluates the strengths, weaknesses, opportunities and threats (Mintzberg & Quinn, 1991). The strengths of the service were compared to the values according to the interviewed manufacturing companies and an offer created based on them.

3.6.2 Interview guide

There are three alternatives when it comes to interviews, you can have a fully structured, a semi-structured or an unstructured. The one chosen for this research was the semi-structured interview. With a semi-structured interview you have some predetermined questions or key words that you use when interviewing. The difference from a structured interview is that the questions are asked at the time that seems to fit and in an open ended way. You probe and strive to gain more information form the interviewee. Semi-structured interviews are good when you want to compare information
but also wish to gain an understanding of the interviewee’s experiences, thoughts and perceptions (Tutty et al. 1996). The reason a semi-structured interview was chosen was because a comparison in between answers was wanted and to know exactly what the companies thought concerning measurement, calibration and measurement systems in general. Therefore a semi-structured interview was a better fit with its open-ended questions and less structured way.

Table 5. Overview of the interview guides

<table>
<thead>
<tr>
<th>Journal</th>
<th>Theories</th>
<th>Question</th>
<th>Interview</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvard Business review</td>
<td>Five Forces</td>
<td>Question 1-8</td>
<td>Interview with manager</td>
<td>Defining the threats</td>
</tr>
<tr>
<td>Harvard Business review</td>
<td>Steps in an industry Analysis</td>
<td>Question 1-2 and 9-10</td>
<td>Interview with manager</td>
<td>Defining the industry</td>
</tr>
<tr>
<td>Strategic Management Journal</td>
<td>7Ps of Service marketing</td>
<td>Question 13-17</td>
<td>Interview with manager</td>
<td>Defining the service</td>
</tr>
<tr>
<td>Harvard Business review</td>
<td>Five Forces</td>
<td>Question 19-23</td>
<td>Interview with manager</td>
<td>Defining the threats</td>
</tr>
<tr>
<td>Harvard Business review</td>
<td>Steps in an industry Analysis</td>
<td>Question 19-23</td>
<td>Interview with manager</td>
<td>Defining the industry</td>
</tr>
</tbody>
</table>

| The value of Metrology           | Question 1-14 | Interview with manufacturing company | Defining the values of metrology |

**Interview template for the manufacturing companies**

The first four questions are general and were asked to both the companies using it internally and the ones purchasing it externally. The questions were then divided into the questions for the ones using it internal and the ones purchasing it. There are ten questions for the ones purchasing it externally and seven questions for the ones using it internally. The companies using it both internal and external were asked all questions.

Question number one was asked to gain an understanding of their needs when it comes to measurement and calibration. Question number two is related to how high the need for accuracy for their measurement instruments and the final product is within their company. Question number three was asked to find out what they value when it comes to measurement and calibration. Question number four was asked to find out whether they measure or calibrate internally or externally so that we could direct the following interview questions in a certain way depending on their answer.
If externally:

Question five was asked to gain an understanding of why they decided to purchase the service externally instead of working with it internally, the factors that influenced them and persuaded them to purchase it. The questions six to eight were asked to make clear why they decided on a certain service provider, what influenced them and what points they consider to be positive and negative with the firm. Question nine was asked to see whether they send the measurement instrument to more than one company and question ten was a follow up question that was related to the importance and value that they see with sending all the measurement instruments to the same place. Question eleven was asked to gain an understanding of the value they see in having direct repair and adjustment as an alternative for unapproved instruments. Question twelve was asked to see how much they value that the service provider has the latest technology. Question thirteen was asked to see if they considered it to be valuable to have the measurement/calibration taking place at own facilities and why they thought so. Question fourteen was asked to see if they saw it as an important factor if the company offered short lead times.

If internally:

Questions five was asked to see why they decided to use it internally instead of purchasing it externally. What factors that influenced them and made them decide to go in that direction. Question six was asked to see what they would have focused on if they were to decide on purchasing it externally. What factors they would value high. Question seven was asked to see if they themselves sold the service externally and if so, what they choose to focus on when making business with customers. Questions eight to eleven were asked to see how much they would value the different aspects if they were to purchase the service externally. What points that would possibly persuade them to purchase it.

**Interview template for the manager of Mätcentrum**

The interview questions that were asked to the manager of Mätcentrum were divided into the three different parts we investigated: the market, Mätcentrum itself and the competitors.
Market related questions:

The first two questions are related to Porters five forces and the suggested steps for an industry analysis from the Harvard Business review. It is about defining the industry they work within. The third question is related to Porters Five forces, specially: Threat of new entrants from the Harvard Business review. It gives knowledge of whether there are any barriers that stop new firms from entering the market in which they operate. The fourth question is related to Porters five forces, specially: Threat of substitute products or services from the Harvard Business review. It makes it clear how many substitutes to the service that are available for the customers to be able to conclude whether the substitutes are a threat or not. Questions five and six are related to Porters five forces, specially: Bargaining power of suppliers from the Harvard Business review. They are there to define the suppliers and their position in the market to be able to conclude whether they are powerful or not. Questions seven and eight are related to Porters five forces, specially: Bargaining power of buyers from the Harvard Business review. Question seven is asked to see how the offerings differ from each other and how that could affect the power of the buyers. Question eight is there to see how price sensitive they consider the customers to be which could affect the power of the buyers. Questions nine and ten are related to Porters step in an industry analysis from the Harvard Business review. They concern determining the structure of the industry and analysing the profitability.

Internally related questions:

Questions eleven to thirteen are related to the 7Ps of service marketing, especially price. They were asked to gain an understanding of what the minimum price is and what the future price could be. Questions fourteen and fifteen are related to the 7Ps of service marketing, especially promotion. They were asked to find out what their promotion strategy was. Question fifteen is related to the 7Ps of service marketing, specially people. It was asked to investigate who is indirectly and directly involved in the service. Question number sixteen is related to the 7Ps of service marketing, especially physical evidence. It was asked to get a clue about how they make an intangible service offering more tangible with physical evidence to the customers. Question number seventeen is related to the 7Ps of service marketing, especially process. It was asked to be able to define the
processes and procedures of Mätcentrum. Question number eighteen come from Business strategy, Technology Policy and Firm performance: the Strategic management journal and evaluates whether the company think they have speciality product or services and why.

Competition related questions:

The questions nineteen to twenty-three are related both to Porters five forces and steps in an industry analysis: Rivalry among existing competitors from the Harvard business review. They are also related to the competitor response profile. They are there to define the competition within the market and what it is that differentiates the firms in between one another.

3.6.3 Pretesting

A pre-test before the investigation is carried out to give added control for the researcher as pre-test can define the presence of knowledge of the experimental variable before the experiment begins (Sachdeva, 2009). To create validity and get a confirmation concerning if the questions were relevant and structured appropriately, expert’s within the field were asked to preview and examine the questions. Björn Johansson, Manager of Mätcentrum, examined the questions regarding metrology that were asked to the manufacturing companies. The questions were further examined by Henric Widén, Sales Manager SKF, Nordic Region and by Professor Hooshang Beheshti. Professor Beheshti also examined questions for Björn Johansson. After having the expert’s approval that the questions were formed after their purpose in the best possible way, face validity had been established (Nunnally, 1994).

3.7 Sampling

Sampling is another method of obtaining standards for quality control (Phophalia, 2012). The research was made by a sample and not by census. When the information is collected from every individual or item of a given population it is a census study. It is normally assumed that a census study is more accurate than a sample, though if there is even a little element of bias within a census study it will increase drastically and the study cannot be assumed to be perfectly accurate. Also the
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research method requires more time, money and energy than a sample study (Sanjeev, 2010). Therefore in cases where the population is large as in this research where almost all manufacturing companies in Gothenburg make up the population, a census study would be difficult due to the resources needed. There are different types of sampling: deliberate, random and systematic. A deliberate sampling is a purposive and deliberate selection of a particular group for creating a sample.

For this study we had a deliberate sampling, a sample of all of the manufacturing companies within the Western region of Sweden, in Gothenburg, who have previously worked with or are working with the case company SKF were chosen. A sample study is chosen in most cases due to lack of time and money, where the data collection is taken from only a part of the population (Phophalia, 2010). As this research were only going to take place in the spring of 2012 there was a limitation of time that required a sample study. However it is important that the selected companies are representatives of the total population (Sanjeev, 2010).

In a case study the researcher investigate an economical or social unit that can be a person, group, an institution, community or a culture (Phophalia, 2010). In this research, as previously discussed, a case study of the metrology market and company SKF’s metrology service were made. Investigations were carried out in following aspects: the market, the internal aspects and its competitors to be able to create an offer from the data.

3.7.1 Sampling frame

A sampling frame is a listing of the elements that make up a research population. Before deciding on the sampling frame it is important to have defined the research population (Ruane, 2004). For this research a deliberate, convenience sampling was used. A convenience sampling is when researchers select any readily available individuals as participants (Sachdeva, 2009).

The research population for the study were small to medium sized manufacturing companies within the Gothenburg region that use a measurement system, internally or externally. To be able to ensure that the companies chosen were the once that SKF would target they were chosen from a list of all the previous and current customers of SKF. The companies were however not notified that this
study was related to SKF, the reason for this was to avoid bias that might come to affect that the interviewees might answer differently when they are aware of the researchers having a connection to another company and not only the measurement system topic.

3.7.2 Sample selection / case company

**Sample selection**

The study population for this research were nine manufacturing companies who use metrology services to measure and calibrate their measurement instruments within the western region of Sweden, specifically Gothenburg. The manufacturing companies were chosen from a list of previous and current customers of SKF’s metrology service, as they are the type of companies the metrology service targets. The companies that were chosen were the ones that were either inside Gothenburg or as close to Gothenburg as possible. E-mails were sent out to twenty companies explaining the research, the purpose with the interview and the possible interview dates in between the weeks of 14-16 of year 2012. Two companies answered with the time and date most appealing to them. Eight companies answered that they were not interested. There were ten companies who did not answer, they were called on the phone and an interview was arranged that way. The person at the company whom were chosen for the interview was the person titled in charge of the manufacturing or in charge of the measurement or calibration of the measurement instruments. One of the companies did not wanted to have its name included in the thesis and is thereby named as Company X.

Table 6. Companies interviewed

<table>
<thead>
<tr>
<th>Companies</th>
<th>Company Information</th>
<th>Manufactures</th>
<th>Contact person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixtur Laser</td>
<td>Provide solutions for aligning machines and machine components</td>
<td>Laser alignment tools minimizing the time of operation.</td>
<td>Jan Bodgren Production Manager</td>
</tr>
<tr>
<td>BodyCote Ytbehandling AB</td>
<td>Strive to be our customers partners in the surface treatment of aluminium and other processes</td>
<td>Surface treatment methods</td>
<td>Jan Carlsson Production Manager</td>
</tr>
<tr>
<td>Adigo drivers</td>
<td>Develops and improves</td>
<td>Designs complex and</td>
<td>Mikael Fridholm</td>
</tr>
</tbody>
</table>
Can metrology be value-based?

<table>
<thead>
<tr>
<th><strong>PMC Hydraulics</strong></th>
<th><strong>PMC Hydraulics is part of the PMC Group is a leading supplier of hydraulic solutions to industry.</strong></th>
<th><strong>customized electric systems primarily for the Scandinavian and German markets.</strong></th>
<th><strong>Application Engineer</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Company X</strong></td>
<td><strong>International technical solution provider</strong></td>
<td><strong>Wireless solutions</strong></td>
<td><strong>Interviewee X</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Network testing</strong></td>
<td><strong>Instrument and calibration responsible in production</strong></td>
</tr>
<tr>
<td><strong>OLDA Innovation AB</strong></td>
<td><strong>Offer their customers complete solutions, from idea to prototype and serial production of low volumes, or manufacturing on a subcontracting basis.</strong></td>
<td><strong>Areas in seizure, prototype and lego. They develop and manufacture door fittings</strong></td>
<td><strong>Jonas Brandén, Market Manager</strong></td>
</tr>
<tr>
<td><strong>Specma Dunlop</strong></td>
<td><strong>Specma leads the hydraulics market in the Nordic countries. Specma’s aim is to provide their customers with the highest level of competence and service and have therefore three specialist marketing divisions: OEM Division for the mobile market, System Division for industry and marine and Component Division for aftermarket.</strong></td>
<td><strong>Develops, manufacture and market application based hydraulic systems to a global market and to provide industry and aftermarket with a wide range of hydraulic, pneumatic and fluid conveyance components.</strong></td>
<td><strong>Johan Andersson, Logistic Manager</strong></td>
</tr>
<tr>
<td><strong>Poseidon Diving Systems</strong></td>
<td><strong>Poseidon exports to almost Diving equipment</strong></td>
<td></td>
<td><strong>Fredrik Backström, Manager</strong></td>
</tr>
</tbody>
</table>

3-49
AB

| DAROS Piston Rings AB | Daros is one of the world’s leading suppliers of piston rings to the global marine industry. As both designer and manufacturer, we have expertise in key areas such as materials, geometry, tribology and coatings, enabling us to develop optimized and reliable ring packs for the most advanced large bore engines. | Develop piston rings for both new engines, where engine designers have changed the combustion chamber conditions in order to achieve improved engine performance, and for existing vessels in service, where the ship owners require extra characteristics for their engines. | Christina Nilsson, Application Engineer |

Source: Interviews, Appendix C-D

The case company:

The SKF Group is a leading global supplier of bearings, seals, mechatronics, lubrication systems and services, which include technical support, maintenance and reliability services, engineering consulting and training.

3.8 Data analysis method

The purpose of a data analysis is to sort and organize the large amount of information received in the data collection so that the information address the research questions and conclusions concerning them can easily be drawn (Leslie et al. 1996). The method used in this study for analysing the collected data was the data reduction and pattern matching method. It consists of three parts: data reduction, data display and conclusion drawing/verification. When it comes to
data reduction the investigators select, focus, simplify, abstract and transform the collected data. Which for this research were the interview answers from both the staff at SKF and the manufacturing companies in Gothenburg. This part of the analysis sort out the important data and organizes it to make it easier to draw conclusions later (Miles & Huberman, 1994). The data was recorded and notes were taken during the interviews, so after the interviews the recorded data that was missing from the notes were put into the interview answers. The irrelevant information was put aside from the relevant interview answers.

The next part is the data display. According to Miles and Huberman (1994, p. 11) “A display is in general an organized, compressed assembly of information that permits conclusion drawing and action”. When it comes to making displays it can help to understand the situation and take action. For this case it was decided to put the reduced answers into five tables when it came to the manufacturing companies responses. One table was for the first four questions, the second table was for external part 1 and the third was for external part two, the fourth table was for the internal questions. Then the final answers were compared within the tables, and from there key point where identified. The key points were put into a table showing the similarities and differences in the interview answers. The key points from the different tables were later compared with each other to be able to draw conclusions from the similarities and the differences of the answers. The questions that had the quantitative measure part with important- not important and the different choices were put into charts showing how many companies considered the different choices.

Conclusion drawing and verification is the final part: it basically starts when the data collection starts as the researcher tries to define what the data means and notes patterns. The validity of the conclusions is tested as the meaning of the data collected is tested for plausibility and sturdiness (Miles & Huberman, 1994). To conclude, all parts of the analysis proceeds during the data collection: data reduction leads to ideas of what should be included into the data display and entering the data requires further data reduction. Conclusions appear as the reduced data is entered into the display that can lead to entering another column in the display to test the preliminary conclusion. The conclusion drawing started during the interviews, as it was easy to see the similarities in the answers; it was made even clearer when putting it into tables and keywords. With the value charts and the similarities and differences table the conclusions could easily be drawn of
what values the companies considered important. The data was compared to the theories established, even though there were not that many theories concerning metrology there were some. The data gathered from the manager of Mätcentrum was compared to the five forces and the 7Ps to establish which were the main threats, the strengths and weaknesses of Mätcentrum.

3.9 Quality criteria

As research design is supposed to present a logical set of statements it should also be possible to judge the quality given design given certain logical tests. Ideas that have been offered for these tests include; trustworthiness, credibility, conformability and data dependability (U.S. Government Accountability Office, 1990) Four tests are frequently used in order to establish high level of quality for empirical social researches. Case studies are one form of such research (Yin, 2009), which makes these tests relevant for this study, with an exception of internal validity that is only for explanatory or causal studies and not for descriptive (Kidder & Judd, 1986). Table 5 lists the four commonly used tests and the recommended case study tactic for each one.

Table 7. The four commonly used tests for case studies

<table>
<thead>
<tr>
<th>TEST</th>
<th>Case Study Tactic</th>
<th>Phase of research in which tactic occurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construct validity</td>
<td>- Use multiple sources of evidence</td>
<td>Data collection</td>
</tr>
<tr>
<td></td>
<td>- Establish chain of evidence</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Have key informants</td>
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<td></td>
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</table>


<table>
<thead>
<tr>
<th>Internal validity</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Do pattern matching</td>
<td>Data analysis</td>
</tr>
<tr>
<td>- Do explanation building</td>
<td>data analysis</td>
</tr>
<tr>
<td>- Address rival explanations</td>
<td>Data analysis</td>
</tr>
<tr>
<td>- Use logic models</td>
<td>Data analysis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External validity</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Use theory in single-case studies</td>
<td>Research design</td>
</tr>
<tr>
<td>- Use replication logic in multiple-case studies</td>
<td>Research design</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reliability</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Use case study protocol</td>
<td>Data collection</td>
</tr>
<tr>
<td>- Develop case study database</td>
<td>Data collection</td>
</tr>
</tbody>
</table>

Source: Yin 2009, p. 41

When it comes to research you are often wondering if you measure what you intend to measure, this is called validity (Sachdeva, 2010). Validity standards are more difficult to achieve in a qualitative study than a quantitative, as a qualitative research is ambiguous and intangible it is hard to establish quality (Whittemore et al. 2001).

3.9.1 Content validity

To establish content validity you examine the content to determine if it truly represents the phenomena that you measured (Wayne et al. 1989). Professor Hooshang Beheshti looked through the interview guide as he can be considered to be an expert in how to construct interview guides and operationalization. Additionally the manager of Mätcentrum looked through the interview guide, as he is highly knowledgeable in the area and a representative of the companies that were interviewed, as he has a similar position. The answers from the manufacturing companies were similar in many areas, which can be seen in the similarities and differences table in chapter 5, which reinforces the content validity and ensures that the research measured what it intended.
3.9.2 Construct validity

Construct validity is according to Sachdeva (2009, p. 63) “If you implemented the program that you were supposed to implement and if you measured the outcome that you wanted to measure”. In more detail:

“It refers to the degree to which inferences can legitimately be made from the operationalization’s in your study to the theoretical constructs on which those operationalization’s were based” (Sachdeva, 2009, p. 70).

Construct validity is particularly challenging when it comes to case study research, due to the common fact that investigators often fail to develop a sufficiently operational set of measures (Yin, 2009). Referring to table 5, the construct validity for this study was assessed by both recording and writing down the answers to the interview questions, as source of evidence. It was also assessed by having the quantitative approach on the interview questions with the very important – not important which made it easier to measure if what they said when they answered the question openly was the same as when they had to put their opinion into a measurable scale. There was a triangulation within the research as on many points the manager of Mätcentrum and the different interviewed manufacturing companies had similar answers and statements when it came to metrology.

The established answers were documented and can be tracked back to the interviewee. Construct validity was also obtained by letting Björn Johansson, the manager of Mätcentrum and Professor Hooshang Beheshti look through the case study report as they could be considered to be key informants.

3.9.3 External validity

External validity is according to Sachdeva (2009, p.63) “Can we generalize this effect to other persons, places or times?”. It is related to whether the generalisations within the conclusions that the investigator has drawn are truthful. It is the questions regarding if the same research would get the same results with other people or if it would be done in another place (Sachdeva, 2009).

External validity problem has been an on going problem for case studies due to that critics state that single cases offers a poor state of generalization. On the other hand does those critics often compare case studies directly with survey research, in which sample has a purpose to generalize to a larger
scale. The major contrast is that survey research depends on statistical generalizations when case studies in contract rely upon analytical generalization. In analytical generalization the researcher is want to generalize a specific set of results to some broad theory (Yin, 2009).

The quantitative measurable scales that were included to the interview questions made it easier to generalize the data. It made it very clear on certain points that the opinions of the interviewed manufacturing companies were the same and it could therefore be generalized that it would be the opinion of all the manufacturing in the western region of Sweden. However it was harder to draw generalizations on other points where the opinions differed and it could not be concluded that all of the manufacturing points in the western region think a certain way. But the study can be generalized and the result would on most points be the same on any other place, time or manufacturing company. Though it should be stated that the perceptions of the companies might change over time as the technology changes and improves. Almost all manufacturing companies need to measure and calibrate their measurement instruments to ensure the accuracy of them. They want it to be as time and cost saving as possible and as easy and accurate as possible.

3.9.4 Reliability

When it comes to reliability within research it can be defined as something that is consistent, that has repeatability. If it gives the same results every time for the same measure then it is considered to be reliable (Sachdeva, 2009). The goal of reliability is that it should reduce and minimize bias and errors related to the study (Yin, 2009). The reliability in this research was assured by using multiple interviews with nine interviewees to ensure that there could be no other responses to our questions than the ones obtained. It could be seen very soon in the interviews that the interview answers were very similar on most points and thereby the reliability of the answers was established.

A detailed explanation was also kept regarding of how the data was gathered and analysed. These explanations were kept together with other documents needed for the investigation. It was unfortunately not an opportunity to repeat the study as there was a lack of time for it, otherwise that would have ensured the reliability as well.
4 Empirical findings

This chapter explains the research findings: it starts with the information from the manager of Mätcentrum, it then moves on to the interview answers from the manufacturing companies followed by the value drivers of the manufacturing companies. Subsequently come the main competitor information with the basic information about their services and the competitor response profile information.

4.1 Interview with the manager of Mätcentrum

Market related information

As explained in the theoretical framework, there are several steps that a company should investigate before entering a new market. SKF belongs to the manufacturing industry within the industrial market. As Mätcentrum is a part of SKF it belongs to that industry as well. When it comes to the industries it targets, it is all the industries that manufacture products that need to be controlled, for example the paper industry and heavy machinery. Mätcentrum also targets the mechanical workshops that work with measuring and calibrating. The current geographical target segment is the market of Gothenburg as SKF Mätcentrum is located there (Manager of Mätcentrum, 2012-03-20)

There is potential for the market to grow as the awareness of the importance of metrology is expected to increase as more companies wish to ensure the quality of their measurement instruments and final products. Most of the companies within the industry have a quality system and/or an ISO certification that requires them to measure and calibrate regularly. Currently the measurement part is very profitable, with the higher awareness of the importance of metrology the calibration part can become more profitable as well (Manager of Mätcentrum, 2012-03-20).
There are few barriers when it comes to entering the metrology market, in some cases the workshops need to be accredited because the customers demands so. Otherwise it is simply that the calibration has to be able to be traceable. A workshop that is accredited means that there are higher requirements on the calibration, it proves that the workshop is documented with 17025 (Manager of Mätcentrum, 2012-03-20. There are no substitutes to purchasing the service externally except having it within the company and working with it internally. If the customers require that you are accredited or your own quality systems require it you still need to be accredited if you use it internally. (Manager of Mätcentrum, 2012-03-20)

The metrology market has several suppliers that delivers measurement equipment, that deliver to Mätcentrum as well, such as: MITUTOYO, Telehompson, Mytolerans and Hexagon. The type of equipment delivered is callipers, dial indicators and micrometres. Mätcentrum also has subcontractors that they pass on measurement instruments that they cannot measure themselves, such as temperature sensors. In the case with the subcontractors it is when the client of SKF have several measurement instruments, some they can calibrate and measure themselves and some that they do not have the equipment for. For the ones that they do not have the equipment they pass it on to their subcontractors but the measurement protocol includes everything and SKF Mätcentrum is the company in charge of providing the service. The suppliers have a strong position in the market within their segments, for example some focus on supplying measurement instrument used by hand for example Nyli has a large range of measurement hand tools and Mytolerans as well. Some of the suppliers earn a great profit on supplying measurement equipment and measurement instruments, such as Telehompson and KTC, which gives them a strong position. When it comes to sensors and smaller instruments Hexagon and Mytolerans are resellers in Sweden, they purchase it from other countries and distribute it in Sweden. Mytolerans are an official reseller of Mahr measurement instruments, they also sell interior design products (Manager of Mätcentrum, 2012-03-20). For more information about Hexagon see chapter 4.5 Competitor information or Appendix F.

When it comes to calibration, the offers does not differ very greatly from each other but they vary more when it comes to measuring. The reason is that for calibration the companies are obliged to send in their measurement instruments continually for calibration to ensure that they uphold the
national or international standard. While for measuring the companies send in their measurement instruments when needed (Manager of Mätcentrum, 2012-03-20. As previously stated there are plenty of companies that are working with calibration. This can be seen in the interviews as well, where many give price as an important thing when it comes to choosing in between service providers, see chapter 4.2 Interviews with manufacturing companies and Appendix C-D. However this is not the case with measurement services or the combination of having a service offer of both calibration and measurement (Manager of Mätcentrum, 2012-03-20).

**Internally related information**

Mätcentrum is a part of Mätteknik that has been there since 1940, from the beginning it was only used for random inspections on the measurement instruments used in SKF. Today 70% of the usage of Mätcentrum is for calibration of the measuring instruments used in manufacturing SKF’s products, such as micrometres and callipers and 5-10 % is for external operations with clients. There are approximately 28 000 measuring instruments registered in the system at Mätcentrum and 16 000 of that are currently active. Nowadays Mätcentrum have two different parts: Measuring and Calibrating.

In the measuring part they apply:

- Reference measuring of SKFs product range. Before, during and after the process.
- Reference measuring, reference samples of product within the manufacturing industry.
- Capability studies of equipment and machines.
- Initiation of improvements in equipment and machines.
- Transferring of competence.

In the calibration area they apply:

- Accredited calibration
- Calibration of fixed, displaying measuring instruments and measuring systems.
- Adjustment and acquisition of measuring instruments
- Transferring of competence (Manager of Mätcentrum, 2011-10-12).
It costs SKF Mätcentrum 375 SEK/hour to perform a measurement or calibration. The current price they charge is 710 SEK/hour. There is a small potential to raise the price of the calibration as there are many companies competing on the market with little service differentiation. However a higher level of profit can be earned on repairs on for example measuring machines. Within the measurement area there is potential to raise the price to about 1000 SEK/hour (Manager Mätcentrum, 2012-03-20).

There is no current promotion of the service, the only marketing happen through word-of-mouth marketing from clients that SKF in general work with and former and current clients of Mätcentrum. The service must be promoted in a way so there will be a successive increase in sales so resources can be added continuously (Manager of Mätcentrum, 2012-03-20). Mätcentrum is located at SKF and use the sales personnel to sell the service to its potential customers. In the upcoming future Mätcentrums metrology services might be a part of the solution factory, which combines all part of SKF and offers a range of customized services and technology solutions to the customers (Manager of Mätcentrum, 2012-03-20). Björn Johansson, the manager at Mätcentrum and his staff are the ones involved in providing the service to SKF and the customers. Björn Johansson, Joakim Eliasson and the other sales personnel at SKF are the ones in charge of selling the service to potential customers (Manager of Mätcentrum, 2012-03-20).

One thing that gives proof of the quality of the service is the accreditation (Manager of Mätcentrum, 2012-03-20). When they examine the workshop for accreditation there is one person looking at all the documents of SKF and one person observing the practical work to ensure that everything upholds the high demands. See chapter 4.3 Secondary data about more information about accreditation. That the company SKF use the service themselves is also a proof of the quality of the service as with their high need of accuracy they would not use a low quality measurement system (Manager of Mätcentrum, 2012-03-20).

The process of calibration and measurement can be explained in the figure below. The start of the process begins with a list sent from SQ the first Monday of every month. The order gets registered in the API and looked over in order for Mätcentrum to prepare and to see if they are able to proceed themselves or need to outsource the calibration. If they can carry out the procedure themselves they
prepare the assessment of the status. When the customer has responded to the order confirmation they calibrate according to the instructions. If the instrument is approved it is followed by a report and returned to the customer with invoicing. If it is not approved the customer is being asked if they would like to accept the option if direct repair/adjustment/replacement. If the customer agree to make any kind of correction, the instruments will be calibrated once again and followed by a report and later returned with invoicing. If the customer chose to decline the possibility of correction the instrument is being sent back to them (Manager of Mätcentrum, 2012-03-20).

Figure 9. The process of calibration

(Manager of Mätcentrum, 2011-10-12).
Competitor related information

The main competitors, that offers the same services for the same target customers are SP – technical Research institute of Sweden, Elastocon AB, Exova Metech AB, MTS Systems Nordic AB, Nyli Kvalitets & kontoll teknik AB, Trescal AB, ZR Sverige AB, MYLAB, Hexagon Metrology Nordic AB, Kalibreringscentrum i Eskiltuna AB (Manager of Mätcentrum, 2012-03-20). For more information see chapter 4.5 Competitor information or Appendix E.

4.2 Interviews with manufacturing companies

The interview answers from the manufacturing companies have been reduced into keywords and displayed in the tables to make them easier to compare to one another. First the four general questions that were asked to all the manufacturing companies are displayed, then the external questions part one and two. The internal interview answers are written instead of shown in a table.

Table 8. The keywords of the four first questions in the interviews

<table>
<thead>
<tr>
<th>General</th>
<th>Question 1</th>
<th>Question 2.</th>
<th>Question 3</th>
<th>Question 4.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixturlaser</td>
<td>Meet expectations and purpose.</td>
<td>Measure thousandths Accuracy Meet customer demands</td>
<td>Accreditation due to: Protocol International standard Traceability Security Trust To be able to give certification</td>
<td>Both Internal service stations Externally to get national and international standard Accuracy</td>
</tr>
<tr>
<td>Bodycote</td>
<td>Correct value Ensure quality Guarantee</td>
<td>Ensure correct base value</td>
<td>Quality Accuracy</td>
<td>Mostly internally External company once a year</td>
</tr>
<tr>
<td>Company</td>
<td>Core Values</td>
<td>Key Considerations</td>
<td>External Standards</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>---------------------------------------------</td>
<td>-----------------------------------------------------------</td>
<td>-----------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Adigo Drives</strong></td>
<td>Ensure quality</td>
<td>No need for extreme accuracy</td>
<td>Demand of high quality standard</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Customer satisfaction</td>
<td></td>
<td>Cost</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Save reclamation cost</td>
<td></td>
<td>Almost all externally</td>
<td></td>
</tr>
<tr>
<td><strong>PMC group</strong></td>
<td>Ensure correct products</td>
<td>Depends on purpose</td>
<td>Certification accreditation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meet customer demands</td>
<td>Correct measurement</td>
<td>Customer demands accreditation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Either it is good or bad</td>
<td>For accreditation you need accuracy and regularity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>From 3 to 0,05% accuracy</td>
<td>The standard measurements and machines externally</td>
<td></td>
</tr>
<tr>
<td><strong>Company X</strong></td>
<td>Meet customer expectations</td>
<td>Depends on instrument</td>
<td>Accreditation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meet standards</td>
<td>Calibrate after performance test and own requirements</td>
<td>Everything is connected together</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ensure consistent measurements</td>
<td></td>
<td>Ensure that the work is properly done</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Accurate instruments</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Good quality</td>
<td></td>
</tr>
<tr>
<td><strong>OLDA</strong></td>
<td>ISO certification: quality and environment</td>
<td>Depends on instrument</td>
<td>Regularity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meet customer requirements</td>
<td>Not high tolerance level</td>
<td>Accuracy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check function or problem</td>
<td>Sometimes small details</td>
<td>ISO certification</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Customers demand accuracy</td>
<td></td>
</tr>
<tr>
<td><strong>DAROS</strong></td>
<td>Ensure correct instruments</td>
<td>Important for thousandths</td>
<td>Accuracy</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Depends on what characteristics you check</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Both: Internally: feeler gauges,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>micrometres, callipers, film</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>thickness gauges, micrometre</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>gauges, dial indicators</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Externally: gauge blocks, special</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>indicators length measuring</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>instrument</td>
<td></td>
</tr>
<tr>
<td><strong>Specma</strong></td>
<td>Ensure quality</td>
<td>Accuracy</td>
<td>Accreditation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meet customer demands</td>
<td></td>
<td>Certification</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Own requirements</td>
<td></td>
<td>Fulfils other obligations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Certain tolerance level</td>
<td></td>
<td>Both: Internal: measuring</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>External: calibration</td>
<td></td>
</tr>
<tr>
<td><strong>Poseidon</strong></td>
<td>Ensure correct instruments</td>
<td>Depends on product</td>
<td>Accreditation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Have to trust outcome</td>
<td>Both: Internal: pressure</td>
<td></td>
</tr>
</tbody>
</table>
Can metrology be value-based?

Control and handle processes
Verify
Receive good results

<table>
<thead>
<tr>
<th>Control</th>
<th>Handle</th>
<th>Verify</th>
<th>Receive</th>
</tr>
</thead>
<tbody>
<tr>
<td>gauges, torque wrenches</td>
<td>External: Geometry Instruments, altitude indicators, master pressure instruments.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Interviews, Appendix C-D

Table 9. Question 5-9 of the companies purchasing metrology externally

<table>
<thead>
<tr>
<th>External</th>
<th>Question 5</th>
<th>Question 6</th>
<th>Question 7</th>
<th>Question 8</th>
<th>Question 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixturlaser</td>
<td>Easier</td>
<td>Meet national and international standard</td>
<td>Trustworthiness</td>
<td>Shorter delivery times</td>
<td>Yes, SP and Arios Multical (comes to us)</td>
</tr>
<tr>
<td></td>
<td>Save costs</td>
<td>Reliability</td>
<td>Do what we expect</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practical reasons</td>
<td>Convenience</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bodycote</td>
<td>Ensure accuracy</td>
<td>Purchased from company</td>
<td>Reliable due to measurement protocol</td>
<td>No, not really</td>
<td>Measure here for the scale</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Natural to use their service</td>
<td>Easy to read status of instrument</td>
<td></td>
<td>Send out resisting</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Use same company for all.</td>
</tr>
<tr>
<td>Adigo drives</td>
<td>Lack of competence</td>
<td>Three companies</td>
<td>Do what we ask for</td>
<td>Fast lead times</td>
<td>Three different companies.</td>
</tr>
<tr>
<td></td>
<td>Save time</td>
<td>Nearby</td>
<td>Deliver what we expect.</td>
<td>Need instruments</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Different purpose -SP, Exovameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>past internal service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMC</td>
<td>Ensure correct measure</td>
<td>Easier to use suppliers</td>
<td>Price</td>
<td>Done faster</td>
<td>Different suppliers</td>
</tr>
<tr>
<td></td>
<td>Delivery time.</td>
<td>Price</td>
<td>Speed</td>
<td></td>
<td>SP, Hydac, Atos, Bodycote, Keller</td>
</tr>
<tr>
<td>Company X</td>
<td>Convenience</td>
<td>Long relationship</td>
<td>Trust</td>
<td>Could be accredited</td>
<td>Coming to facilities.</td>
</tr>
<tr>
<td></td>
<td>External party responsible</td>
<td>Know the organization and instruments</td>
<td>Deliver what we expect.</td>
<td></td>
<td>Few instrument sent away</td>
</tr>
<tr>
<td></td>
<td>Issue to keep track of everything</td>
<td>Same people involved</td>
<td>Developed relationship</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Can metrology be value-based? 4-63
<table>
<thead>
<tr>
<th>Company</th>
<th>Pros overweigh the cons</th>
<th>Cons overweigh the pros</th>
<th>Additional Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daros</td>
<td>SKF before Now Swedac certified by Swedac.</td>
<td>Not worth it.</td>
<td>Could be closer.</td>
</tr>
<tr>
<td>Specma</td>
<td>Proven knowledge Trust</td>
<td>Accuracy Speed Nice protocols</td>
<td>No</td>
</tr>
<tr>
<td>Poseidon</td>
<td>Don’t have the equipment Need to measure several times Traceability</td>
<td>Knowledge of instruments Good lead times Easy to work with Price worthy</td>
<td>Better price Be faster</td>
</tr>
<tr>
<td>Fixturlaser</td>
<td>Not important as long as it gets done.</td>
<td>Very important Multical measures 20-30 units/day when they come Would not have measurement instrument if we need to send them away.</td>
<td>Not important</td>
</tr>
<tr>
<td>Bodycote</td>
<td>Depends on what you measure Doesn’t matter if there is a difference in half tenth</td>
<td>Not important.</td>
<td>Clear advantage Most done at place Saves resources Wont risk instruments Prefer it</td>
</tr>
<tr>
<td>Adigo drives</td>
<td>Convenience</td>
<td>Appreciated</td>
<td>Big difference</td>
</tr>
</tbody>
</table>

Source: Interviews, Appendix C-D

Table 10. Question 10-15 of the companies purchasing it externally
Can metrology be value-based?

When it comes to the internal answers there were only one company using it only internally, the others did some things internally and some things externally. For question five, why they chose to do it internal they answered: easier, to have the knowledge, more flexible, feels safer, the measuring and calibration happens continuously, they use easy methods to do it, that they don’t need external help, that it is better, several said cheaper, so that they know the results. Several companies want the control and can’t afford having the instruments away from the facilities, delivery time, that they can trust the outcome, Daros have the expertise and have done it for 20 years, Poseidon says that it is a matter of price and expertise.

Source: Interviews, Appendix C-D
For question six what would be the most important factor if they would purchase it externally, some did not answer other said things such as price, delivery time, attain standards, accuracy, accreditation, short lead times, good documentation, Daros said they would put the same demands as they put from themselves, Poseidon say that they base the strategy on the instruments.

When it comes to question seven if they sold their services externally most of them say that they don’t do it and have never done it. Out of the nine interviews only three sold their services externally and only indirectly. Fixtur say that they used to but it was too hard, Adigo drives are the only company that says they do it and not only indirectly, but if the customers want them to. PMC does it indirectly when they do their field calibration. Poseidon sells it indirectly through that they manufacture and sell measurement instruments that you need to be able to set the diving equipment. They calibrate the measurement instrument if the customers ask them too, however they are delivered fully calibrated. When asked, the companies were not planning on selling their services in the future either (Interviews, Appendix C-D).

Table 11. Interview question number three of the internal questions

<table>
<thead>
<tr>
<th>Companies</th>
<th>Do you sell your services externally?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

Source: Interviews, Appendix C-D

4.2.1 The offer
There were one company that accepted the offer and one rejecting the offer (pilot testing).
4.3 Value drivers of the manufacturing companies

To be able to extract the value drivers the companies were asked what they considered to be the most important factors when it comes to measurement and calibration. And then how important they considered the different factors. Two answered accuracy, none continuously, three quality, four that the workshop is accredited or certified.

Table 12. Question three of the general questions

<table>
<thead>
<tr>
<th>What do you consider to be the most important factors when it comes to measurement and calibration;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Companies</td>
</tr>
<tr>
<td>Accuracy</td>
</tr>
<tr>
<td>6</td>
</tr>
</tbody>
</table>

Source: Interviews, Appendix C-D

When it comes to how important it is that the measurement or calibration is accurate six companies answered very important and three companies answered important. None answered somewhat or not important. None of the companies thought that the service provider having the latest technology was important, three said somewhat important and five said not important. None said that it was important or very important. There were differing opinions on how important it is with direct repair/adjustment of unapproved instruments, there were two of each answers. There were also differing opinions when it came to if it was important to send all instruments to the same company instead of several. One said very important, one said somewhat important and six said not important.
Most of the companies, five out of eight, considered it very important to have the measurement and/or calibration at the own facilities. Two said somewhat important and one said not important. There were differing opinions on if the company offering short lead times was important or not, three said very important, one said important, one said somewhat important and three said not important (Interviews, Appendix B). To see more value charts see Appendix C. The importance of the different value drivers can be seen in the cross-case comparison below where the positioning of the different companies are shown for the value drivers.

Table 13. Comparison of value drivers

Source: Interviews, Appendix C-D
4.4 Relevant information for the study

4.4.1 SCB

According to SCB Statistiska Central Byrå there were 38 968 manufacturing companies in Sweden 2011 and 8466 in the western region 2002 (http://www.ssd.scb.se). Which means that there almost 40 000 potential customers in Sweden and almost 8500 within their target region.

SCB, Svenska Central Byrå, also shows that there were 243 companies registered within the field for industries with instruments for measurement, control, testing and navigation in 2007. Furthermore SCB show that in the same year there were 137 companies registered in the area of industry for instruments for industrial process control. Mätcentrum has service offers in both areas (http://www.ssd.scb.se).

4.4.2 Swedac

The company that grants accreditation in Sweden is called Swedac. Swedac is a government authority which purpose is to make products and services safer in Sweden. They also encourage development and competitiveness within the Swedish markets. However their duties focus mostly on quality, environment, safety, health and efficient use of resources. Swedac grants accreditation to laboratories that perform analysis, testing or calibration like the metrology workshops such as SKF. They also grant it to certification bodies, environmental verifiers for EMAS (Eco Management and Audit Scheme) and inspection bodies. The accreditation is performed against requirements that are set out in the ISO standards. There are ten steps that a company needs to go through to get accreditation (http://www.swedac.se):

1. The company have to fill out an application form stating the fields, methods, etc. that should be included in the accreditation. If Swedac approves it they make an offer, suggest a lead assessor, a team and a plan for the accreditation.
2. Swedac will plan the accreditation: when and where the assessment will happen
3. Swedac will review the quality management system and other relevant documentation.
4. The fourth step is the assessment where a lead assessor with a few internal or external assessors check the management system, the practice and evaluate the equipment, management and staff competence. For the laboratories it also includes calibration and proficiency testing.

5. The assessment is documented in a report and the assessment team will describe the points that need to be improved to the company management and personnel.

6. The company address the non-compliances and send the corrective actions to Swedac where they decide if it is approved or not. If all the compliances are approved and the requirements fulfilled the company is granted an accreditation.

7. The responsible manager is the person in charge of granting accreditation. If the requirements are still fulfilled the accreditation applies until further notice, the decision is given to the company together with a certification of accreditation.

8. Six months after the accreditation has been granted a complementary assessment takes place to see if the activities have started and proceeded well. Thereafter Swedac make regular visits once a year, for the laboratories it is not only the surveillance but Swec also require that they participate in test and calibration comparisons. Every fourth year a full re-assessment takes place, after that the surveillance visits are made every sixteenth months. Accredited bodies must pay an annual fee for the cost of surveillance.

9. Additional accreditation can be added, though applying for another area or to another standard. The process is the same for all.

10. If the company stop fulfilling the requirements or fail to pay the fee the accreditation can be withdrawn in whole or partly with immediate effect (http://www.swedac.se).

The companies that accredited after Swedac with length which is the same as SKF Mätcenotum are: Elastocon AB, Exova Metech AB, MTS Systs, NYLI kvalitet och kontrollteknik AB, SP Sveriges Tekniska Forkningsinsitut, Trescal, ZR Sverige AB, BGM Service AB, BR Calibration AB, ICS, Instrument and Calibration Sweden AB, JK Lab Instruemnt AB, LEAX Quality AB, MITUTOYO Scandinavia AB, Mytolerans AB, SM Kalibrering AB and Viking Quality Assurance AB.
4.5 The competitor information

As said above in chapter 4.1 there are several companies accredited with length after Swedac, all the accreditations held by the companies are stated below:

Western region of Sweden:

**SKF Sweden AB – length**
Elastocon AB – speed, hardness, force, length, temperature, time, pressure, mass, elongation.
Exova Metech AB – length
MTS Systems Norden AB – force and length
NYLI kvalitets & kontroll teknik AB – length
SP Sveriges Tekniska Forskningsinstitut – measurement of electricity quality, electricity meters, flexible accreditation, vehicle Components, vapour recovery, geometry, high effect testing, high-voltage test, calibration, density, photometry, force, length, mass, torque, volume, level gauge for fixed storage tanks, optical testing, reflective material, personal protective equipment, petroleum meter, safety test, classification of the laser, protective clothing, Temperature sensor and calculator, water, verification, weights, volume measurements, volume meter, scales, heat meters
Trescal Sweden AB – length, flat plates, temperature.
ZR Sverige AB – hardness, force, length, impact resistance.

The rest of Sweden:

BGM Service AB – coordinate measuring machine, altimeter, length, length measurement benches, flat plates
BR Calibration AB – hardness, force, length, impact resistance
ICS, Instrument and Calibration Sweden AB – speed, hardness, force, length, mass, temperature
JK Lab Instrument AB – hardness, force, length
LEAX Quality AB – length
MITUTOYO Scandinavia AB – coordinate measuring machine, length
Mytolerans AB – length
SM Kalibrering AB – length
Viking Quality Assurance AB – length

All the companies that sell measurement instruments normally sell calibration and measurement services as well, besides those companies there are several companies that sell metrology services. The competitor response profile is given below divided into the three main parts to investigate: the future goals, the strategies, the capabilities and the assumptions of the main competitors. For more information see Appendix F
4.5.1 Future Goals

A common future goal that is mentioned among several main competitors is to keep offering high quality services and meet customer expectations. They want to offer instruments with high precisions that give correct result (Appendix F). Companies are further looking to grow within the industry and expand their markets internationally. MTS Systems Nordics AB states following on their website “We will continue to apply industry-leading MTS expertise and technology leadership to help customers meet new standards and compete on a global scale. We will capitalize on demands created by trends in energy, the environment and globalization”. SP, which is the market leader, says that they want to expand their market, keep their competitive position and focus on safety, conservation of society and good environment. They further state that want to become an international leading institute for research and innovation. The aim for continuous innovation is shared among the competitors. MYLAB sates that they are striving for constant innovation and development for themselves and the programs they use. Hexagon goals are also within the innovation field stating that they invests more than 10 per cent of their net sales in R&D and renews its product portfolio every 18 months (Appendix F). To summarize the main goals of the competitors, from public information, is to deliver high quality, meet customer expectations, expand internationally and continuous innovation and research.

4.5.2 Strategies
Elastocon AB current strategy is to align themselves with Exova Metech and Leax Quality with the purpose to offer a solution for all the customer instruments with only one contact. Their strategy is to focus on enhancing the costs of calibration and how the customer can save money having all the calibration taking place at the same company. They offer one solution for all the customers with only one contact and gives discount if the customer let them service a certain amount of instruments. Exova Metech says their strategy is to be a full service provider with everything from requirement analysis to divestment and disposal. They want companies to “focus on their core business” by outsourcing the calibration and measuring service to them. Nyli’s strategy is to sell measuring instruments together with calibration and measurement services. Competitors strategies also involve to keep an affordable calibration with short delivery times. Kalibrerings Centrum i Eskiltuna AB has the ambition is to carry out the process within five working days and MYLAB also states their strategy is to focus on speed and correct results. Further strategies involves focus on points as cost savings, worry free, flexibility, same local presence and access to in depth expertise in measurement (Appendix F).

4.5.3 Capabilities
Many of the competitors sell measurement instruments and instruments for testing and together with the products they offer calibration and measurement services. Many also offer education such as Trescal and ZR Sverige AB. All of the competitors have a calibration that is traceable to national or international standards. Most of the companies are certified with one or several ISO certifications. Most of the services state that they have high quality and accuracy of the work.

The customers have some strengths that they don’t share with each other. Exova Metech AB states that they have Europe’s widest capability when it comes to calibration and accredited calibration. They say that they are one of the leading third party suppliers of calibration services in Europe and the leader of calibration and independent measurement services. The MTS group has software that provides the industry’s fastest and most efficient calibration. Their proven automated process ensures that the calibration is done correctly the first time. Nyli Kvalitets & Kontrollteknik AB offer calibration on 73 measurement instruments which is more than any of the others, for full list see Appendix E. Nyli also offer particle measuring together with the company Cleanliness control,
they are the only once in Sweden with a laboratory that enables them to make cleanliness measurement under optimized circumstances and thereby receive very accurate numbers. SP is the highest positioned in the Swedish market when it comes to calibration, they also provide the widest rage of services in the Nordic countries when it comes to calibration. MYLAB has the latest and most advanced measurement technique. Hexagon measure almost everything, details in 2D and 3D with CAD, laser scanning, they have a wide product programme and over 1500 coordinating measurement machines in the Nordic area.

The competitors offered following calibration services; electrical quantities, dimension, torque, force, mass, pressure, temperature, air humidity, flow/volume, acoustics, optical, load, strain, displacement, angle, weighing and lengths.

The measurement services offered by the competitors were; optical measurement, digitization of surfaces, reference sample, dimensional shape and position, product audit, body measuring, 3D nufo/CAD, full speed tests, dims in-out, advanced programing, measurement assignments, create measurement programs, measurement services, altimeter, laser scanning, mobile measurement tasks, laser scanning, measurement advice and support. They further offer needs analysis, methodology and project management, measurement of individual parts, longer sequences, detailed programming for CMM even in product projects and outcomes testing, consultation and advice.

Common instrument types among the competitors were the following; calliper, micrometre, plain ring gauge, plain ring plug, thread ring gauge, thread ring plug, dial indicator, gauge block, inspection plate, optical flat, measuring rule, measuring tape, height gauge, length transducer, measuring machine, profile projector, surface roughness tester, threaded interpreters, thread rings, check plug, call Interpreters, setting rings, outside micrometre, control measure for outside micrometre, inner micrometre, dial gauge, angles, talmetre, flat plates and altimeters.
4.5.4 Assumptions

There did not seem to be that many assumptions about the industry among the companies. The few things that the companies stated were that in today’s competitive and cost-conscious marketplace, you need to generate accurate test data faster than ever before. And that how quickly you can produce accurate results has a direct impact on your project’s success, which is why proper calibration is critical. One of the companies also said that within more and more areas within the industry it has become important to ensure the cleanliness of technical systems and in the manufacturing process.

Although they seemed to have more assumptions about themselves and their own capabilities. MTS Systems Nordic AB state, that they are uniquely equipped to help their customers adapt to change, anticipate new requirements and take on even the most difficult tasks with speed and confidence. And that nobody is more qualified to help you deliver consistent, verifiable results, test after test, in the most cost-efficient manner possible than MTS. Nyli Kvalitets & Kontrollteknik AB say that they became a company known to many in the manufacturing industry due to their high quality and of products and services in the manufacturing industry. Mylab think that their combined expertise, use of a variety of accurate CMMs in the climate stabilized space guarantees high quality of work done. Heaxagon assume that their technologies measure with great precision and rapidly provide access to large amounts of complex data that is visualised via engineering and geospatial software, empowering their customers to create, manage and share information to increase productivity, improve quality and make better, faster operational decisions by exploiting multidimensional data.
5 Analysis

In chapter five the result displayed in the empirical findings is analysed together with the relevant theory from the theoretical framework chapter. First the value drivers and the similarities and differences are compared and discussed and then market is analysed with the impact of the different forces. In the second part the service is evaluated through a SWOT-analysis. The third part is a discussion around the main competitors and their influence on the market. The last part of the analysis is the summary of findings where the research questions are discussed.

The analysis is divided into the same three parts as the theoretical framework: The market, internal and competitors. Although it also includes a discussion of the value driver, similarities and differences of interview answers in the first part of the chapter and a summary of findings in the last part of the chapter. The market analysis discusses the impacts of the different threats within the five forces and an analysis of the industry. The internal consist of a SWOT- analysis of Mätcentrum and their services. The competitor part compares the different strengths of the competitors with Mätcentrum’s strengths and discuss the competitor response profile.

5.1 Value drivers of metrology services

5.1.1 Value drivers

As said in the theory a value driver is a customer need that a company´s offer could satisfy. When it comes to business markets the estimation is normally based on the economic impact the offering has on the customers costs and revenues (Nagle & Hogan, 2006).
The value drivers of metrology services were extracted from the interviews. Four out of nine companies considered accreditation/certification being the most important factor (Interviews, Appendix C-D). This was mostly because they thought the other points were connected to it as they need to be fulfilled to be able to be accredited. The rest held opinions regarding that accuracy and quality were the most important value-factors (Interviews, Appendix C-D). Those points are connected to greater reliability, reduced maintenance cost and superior performance. Greater reliability, reduced maintenance cost and superior performance are main value drivers (Nagle & Hogan, 2006). Greater reliability comes with having an accredited company taking care of the instruments result in that it is ensured that the measurement or calibration is correct and the instrument is within the tolerance level. Reduced maintenance cost derive from that if it is ensured that the instrument is correct and within the tolerance level and the quality is optimized it will only need to be checked at the appointed check-ups, it is less likely that it will brake down in between the check-ups. The superior performance is due to that optimized instruments generate improved productivity and having an optimized tool set is one way to have WCM (Bunday et al. 2007). Mätcentrum is accredited but so are most of the other main competitors that are selling calibration services on the market. Greater reliability means that the risk of the instruments braking down and unplanned stops in productions are decreased. An unplanned stop in production can cost a company several hundredths of thousandth per hour, which clearly means that this is something that they are trying to avoid.

All of the companies considered accuracy to be either very important or important leaving it a vital value-factor. The companies also said that the accuracy depended on what they were going to measure or calibrate, for some things it can be very important but for others it is not that vital. Even if the level of accuracy seemed to vary depending of products and company it does not change that the calibration result needs to measure correctly and be completely reliable. (Interviews, Appendix B). Both Mätcentrum and most of their competitors offer a very accurate measurement and calibration. As said above accuracy is related to greater reliability, which can be essential for a manufacturing company.

None of the companies thought having the latest technology was important as long as the results were according to their expectations. This does not make it a value driver and suggests that the companies that use latest technology as an argument are doing it pointlessly. On repairs and
adjustments there were differing opinions on whether it was important or not (Interviews, Appendix C-D). This has to do with companies different needs within their production and the different instrument used. However for the companies that valued the opportunity of direct repair and adjustment also held opinions about the importance of lead-time. Time and costs are important issues for those companies that are essential to take into consideration when creating an offer (Interviews, Appendix C-D). This suggests that lead-time and direct repairs and adjustments are cost drivers. A cost driver can save the customer time, money or effort if the customer would use the company’s offering instead of the competitive reference product (Nagle & Hogan, 2006). Direct repairs and adjustment would reduce both the time and effort that the customer would need to undertake to send the products somewhere else. Mätcentrum offers repairs and adjustments together with few of its competitors, which is a highly valued driver for some customers but not for others suggesting that the company should find out if it is a need for the customer and highlight that they can offer it if it is one.

One out of eight companies considered it very important to be able to send all the instruments to the same company. The remaining companies did not consider it to be a value factor. Still a few companies stated that it would be convenient and simple to be able to send all instrument to the same company, due to less administration work and to be able to keep track of the documents more easily (Interviews, Appendix C-D). This suggests that it is a rather low valued cost driver, a cost driver save the company time, money or effort (Nagle & Hogan, 2006) as it would save the customer time and effort to send the instruments to the same company. It could possibly also reduce the cost as some of the companies offering metrology services give a discount if you send all the instruments to them. Still there are not many companies that are able to measure exactly everything that manufacturing companies’ need and therefore the customers choose different companies depending on the instruments. The manufacturing companies also stated that it was an easy option to purchase the service from the supplier as they have competence and knowledge about the instruments and are able to carry out the calibration (Interviews, Appendix C-D). This implies that Mätcentrum offering to send away instruments that they cannot measure themselves but giving all measurement information on the same protocol is not valued by its potential customers.
Five out of eight companies considered it to be very important to be able to have the measurement taking place at their facilities (Interviews, Appendix C-D), making it a strong value driver. This was due to three main reasons: The companies could not afford having the instruments away from production for too long, they were unable to move the instruments and so the instruments would not be damaged during transportation (Interviews, Appendix C-D). Having the measurement taking place at facilities seem to be both a value driver and a cost driver. Having the measurement taking place at the facilities is a need for many of the companies and thereby it is an important value driver but it is also a cost driver as it saved the customer time and effort as they do not have to move and transport the instruments or have them away from production. Having the instruments away from production could mean that they production would had to stop temporarily until they would get back which would lead to decreased productivity. Mätcentrum and most of their competitors offer the possibility to measure at the customer’s facilities, which does not make it a differentiation value for Mätcentrum but still a strong value driver for customers. Differentiation value is the extra benefit that the company’s offering delivers to the customer that is above the competitive reference product (Nagle & Hogan, 2006).

Half of the company interviewed considered short lead times to be important, the other half believed more in good planning and structure (Interviews, Appendix C-D). Short lead-time is as said above a cost driver as it reduces the time the instruments are away from production. It can also be a value driver as short lead-time can be a need for a company if they cannot afford having the instruments away for too long. Mätcentrum offers short lead times together with some of its competitors, which as stated above is a highly valued driver for some customers but not for others. It should be highlighted to those customers who think it is important and have a need for it but no to those who don’t consider it essential.

5.1.2 Similarities and differences in interview answers
There were definitely some similarities in the interview answers from the manufacturing companies, but there were also some differences. But they all seemed to agree on certain points when it came to the purpose of the measurement. Almost all companies answered to ensure the quality of the instruments, which seem to be the most important factor (Interviews, Appendix C-D). Ensured quality is related to greater reliability of the instruments, which is an important value
driver. This factor was used when creating the value-based offer of Mätcentrum. To receive higher
good quality of instruments and products was the main point highlighted in the offer, see offer in
Appendix G.

One of the customers said to save reclamations costs, which is also related to quality and a
quantified value driver. It is also a cost driver as it saves the company a certain amount of money
(Nagle & Hogan, 2006). As said before they all agreed on that accuracy was important, but they
also said that it depended on the instrument and purpose. That the measurement or calibration is
accurate, and in turn that the instrument is accurate, is related to greater reliability and reduced
maintenance cost. Greater reliability and reduced maintenance cost are both value drivers (Nagle &
Hogan, 2006). That the importance differed implies that it should be highlighted differently to the
customers, more or less depending on what type of instrument they use and what the purpose is.
Understanding how customer value differs can help companies to set price and value, win more
loyal customers and gain a greater profit (Nagle & Hogan, 2006).

Accuracy became one of the five value drivers of our value-based offer as it is of such importance
to some. Accuracy might seem as immeasurable but it can be measured by if the measurement or
calibration can show thousandths or not. Thousandths is of great importance in some situations with
small details and very important measurements (Interviews, Appendix C-D). There is a need of
accurate measurements. In order to put price based up on values, service marketers need to
understand what establishes values for their target markets (Berry & Yadav, 1996). One of the
things that has value for the manufacturing companies is accurate measurements, they require it,
their customers requires it and the industry requires it.

As said before in the empirical chapter, accreditation was the most important factor with
measurement and calibration according to the companies. Due to that all of the other important
points are connected to it. Others also said traceability and to be able to give certification as
important points. Traceability is a need within the industry as all calibration has to be traceable to
national and international standards, which makes it an important and obvious value driver. This is
as value drivers are needs that a company’s offering could satisfy (Nagle & Hogan, 2006). Many
did calibration both internally and externally, usually the smaller instruments and the daily
calibrations internally and the reference instruments and the machines externally. This was mostly because it is easier to do the other things externally and it is cost and time saving making it a cost driver. When it comes to business markets the estimation is normally based on the economic impact the offering has on the customers costs and revenues (Nagle & Hogan, 2006). If the cost of having it externally is lower than investing on it internally there is no purpose for the company to have it internally. Other reasons were due to practical reasons, lack of competence and to get traceability.

Common reasons for choice of service provider were that they used the suppliers of the instruments because that was easier and they know the products or SP, as they have a good reputation and do almost everything when it comes to calibration in Sweden. They all had very good things to say about their service providers such as that they deliver what is expected, they are fast and have good protocols. They had few things that could be improved, but the answers they had in common when they had to say something were that it could be faster and have shorter lead-times. One company also said price (Interviews, Appendix C-D).

Most of them sent their instrument to more then one company, a common thing was also that they had someone coming in to measure the scales. The scales cannot be moved as they are heavy and can possibly be very damaged during transportation making it a need for the customers using scales to have them come to the facilities. It was unusual that there were only few things that were sent away. Most of them did not care about if the instruments were sent to more than company either, they said that it would be convenient but also that it depended on the instruments. It was obvious that it was very different for different instruments on this point, generally they all thought of it as a positive but unnecessary thing (Interviews, Appendix C-D). It was nevertheless included in the value-based offer as it is a value-driver that Mätcentrum has and a need for some customers even if not an important one.

There were very differing opinions on if direct repair and adjustment was important or not, it depended very much on the type of instrument that it was that broke and what the purpose of the measurement instrument was. But a common note was that it would be convenient and appreciated to have it. The perceived value of a product is the price the customer is willing to pay for the total bundle of benefits the product delivers. The customer will balance the benefits of the offering with its direct and implied costs (Gross, 1978; Monroe, 1990; Shapiro & Jackson, 1978). So even if
direct repair is not the most important value it is a part of the total bundle of benefits Mätcentrum can offer. One company said that the communication from the supplier was more important than offering direct repairs (Interviews, Appendix C-D). The direct repairs were included in the offer as an extra service offering. When it came to the new technology most of them agreed that it was not essential as long as the result of the measurement was correct (Interviews, Appendix C-D). So this point was not included into the offer, as it was not considered important.

All of the statements concerning have the measurement taking place at your own facilities were positive saying that you don’t risk harming the instruments and save resources. This was included into the offer as an extra service offering. There were also differing opinions about the importance of short lead-times. Many said that as they have a good planning and book appointments in time they don’t need short lead times. But one company said that it could be an issue if it takes too long. Mätcentrum could offer short lead times if the appointments were booked in time who this point was not included in the offer as it was not considered a value driver.

The reasons that they decided to do some of the thing internally were many it was about having control, that they instruments need to stay at the facility, it costs less, they have the competence, it is easier etc. They also said that for most of the things they do it internally is not possible to do externally as they are done so often, even daily. But if they were to purchase it there were some things that all said were of importance were: Price, short delivery time, short lead times and that they attain our standards. Those are very cost-based answers. Surprisingly accuracy and accreditation was only said by one company. As it seemed to be important it could be assumed that more would say it. However the key to improve service pricing is to truly relate the price to the ultimate value the customer will receive. The customer does not necessarily need to look for the lowest price available for a service, but the customer is most likely to want something worth the price (Berry & Yadav, 1996). So if they find a service that provides exactly what they need it will probably have a higher impact on them than one that does not but is cheaper. But it can be assumed that when they are asked the direct question of what they would look for price and delivery time is the first thing that cross their mind. They did not sell their services externally and most of them were not planning on doing it in the future either (Interviews, Appendix C-D).
Table 14. Similarities and differences in interview answers

<table>
<thead>
<tr>
<th>General Questions</th>
<th>Similarities</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. For what purpose do you measure or calibrate your instruments?</td>
<td>Ensure Quality, Meet customer Demands, ISO certification, Ensure correct instruments</td>
<td>Save reclamation cost, It is recommended, Standardisation, Own requirements</td>
</tr>
<tr>
<td>2. How important is it for you that the measurement or calibration is accurate?</td>
<td>Accuracy is important, Depends on instrument, Depends on purpose, Need to deliver correct products and meet customer requirements, Have to trust outcome of the measurement, correct measure</td>
<td>Don’t have a high tolerance level, We calibrate after performance test and own requirements, Not important for diameter</td>
</tr>
<tr>
<td>3. What do you consider to be the most important factors when it comes to measurement and calibration?</td>
<td>Everything is connected within accreditation, Accreditation, Accuracy, Quality, Certification, Regularity</td>
<td>Traceability, To be able to give certification, Customers want quality, Customers demand accreditation, Ensure that the work is properly done</td>
</tr>
<tr>
<td>4. Do you measure and/or calibrate internally or externally?</td>
<td>Calibrates both internally and externally, Machines externally, Reference instruments externally</td>
<td>Daily calibration internal, What we have capacity for internally</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External Questions</th>
<th>Similarities</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. For what reasons did you decide to purchase the service?</td>
<td>Easier, Ensure correct measure, Save time and costs</td>
<td>Practical reasons, Lack of competence, Traceability, Pros outweighed the cons, Convenience</td>
</tr>
<tr>
<td>6. For what reasons did you choose to work with the company you are working with, which were the main factors?</td>
<td>Suppliers, Reliability, Price</td>
<td>Meet standards, Nearby, Need to measure several times</td>
</tr>
<tr>
<td>7. What are the positive aspects of the service and the service provider?</td>
<td>Trustworthiness, Deliver what is expected, Good relationship, Speed, Protocols</td>
<td>Easy to read the status of the instrument</td>
</tr>
<tr>
<td>8. What could be improved with the service from your point of view?</td>
<td>Shorter lead time, Nothing, Have it done faster</td>
<td>Price, Could be closer</td>
</tr>
<tr>
<td>9. Do you send the measurement</td>
<td>Different companies/Suppliers</td>
<td>Few instruments sent away</td>
</tr>
<tr>
<td>instruments to more than one company for measurement and/or calibration?</td>
<td>SP</td>
<td>Less time consuming</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Come to facilities</td>
<td>Depends on instrument</td>
<td>Creates a closeness</td>
</tr>
<tr>
<td>Measure at facilities for scales</td>
<td>Prefer one company, advantage</td>
<td>Appreciated</td>
</tr>
<tr>
<td>Things can brake in transportation</td>
<td>Leads to better price</td>
<td>Less administration</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10. How important is it to be able to send all the measurement instruments to the same company instead of several?</th>
<th>Not important</th>
<th>If the calibration was unique it would be important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convenient</td>
<td>Communication from supplier</td>
<td>Conveniant, good</td>
</tr>
<tr>
<td>Depends on instrument</td>
<td>more important</td>
<td>Important</td>
</tr>
<tr>
<td>Prefer one company, advantage</td>
<td></td>
<td>Not important</td>
</tr>
<tr>
<td>Things can brake in transportation</td>
<td></td>
<td>Get it through the suppliers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>11. How important is it to have the possibility of direct reparation/adjustment of an unapproved measurement instrument?</th>
<th>Convenient</th>
<th>If the calibration was unique it would be important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appreciated, good</td>
<td>Communication from supplier</td>
<td>Important</td>
</tr>
<tr>
<td>Important</td>
<td>more important</td>
<td>Not important</td>
</tr>
<tr>
<td>Not important</td>
<td></td>
<td>Get it through the suppliers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>12. How important is at that the service provider has the latest technology?</th>
<th>Not important</th>
<th>We have new and old technology, need a mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>If the instruments are correct it is not important</td>
<td>For our type of instruments it is not important</td>
<td>We have new and old technology, need a mix</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>13. How important is the possibility of having the measurement/calibration taking place at your own facilities?</th>
<th>Important</th>
<th>Clear advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Save resources</td>
<td>Price over speed</td>
<td>Important</td>
</tr>
<tr>
<td>Don’t risk injuring instruments</td>
<td></td>
<td>Not important</td>
</tr>
<tr>
<td>Many of our instruments are measured at facilities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>14. How important is it that the company offers short lead times?</th>
<th>We have good planning</th>
<th>It is an issue if it takes to long</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead time need to be short</td>
<td>Don’t have enough storage</td>
<td>Important</td>
</tr>
<tr>
<td>Important</td>
<td></td>
<td>Not important</td>
</tr>
</tbody>
</table>

### Internal Questions

<table>
<thead>
<tr>
<th>Similarities</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Instruments need to stay at facility</td>
<td>To have the knowledge</td>
</tr>
<tr>
<td>Cost less</td>
<td>More flexible</td>
</tr>
<tr>
<td>Have the competence</td>
<td>Feels safer</td>
</tr>
<tr>
<td>Easier</td>
<td>It is better</td>
</tr>
<tr>
<td>Don’t have to send them away</td>
<td>Don’t need external help</td>
</tr>
<tr>
<td>Calibration and measurement happen continuously</td>
<td></td>
</tr>
<tr>
<td>Know results</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6. Which factors would have the highest influence if you were considering purchasing it externally?</th>
<th>Price</th>
<th>Good documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short delivery time</td>
<td>Accuracy</td>
<td></td>
</tr>
<tr>
<td>Short lead times</td>
<td>Accreditation</td>
<td></td>
</tr>
<tr>
<td>That they attain our standards</td>
<td>Same demands as on ourselves</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7. Do you sell your measurement/calibration services externally?</th>
<th>No</th>
<th>Used too</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indirectly</td>
<td>It was too hard</td>
<td></td>
</tr>
<tr>
<td>If customers want to</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.2 Market analysis

5.2.1 Five forces

**Threats of new entrants**

Due to high competition in the manufacturing industry, the complex process of accreditation (see chapter 4.4) and the correct expertise needed, new manufacturing companies are more likely to purchase the calibration and measuring service externally. By purchasing the service externally the new entrants can put focus on developing other parts of their business area. According to the companies interviewed the main value driver was for the service providers to be accredited in order to get an outcome of good and reliable results and therefore a reliable reputation (Interviews, Appendix C-D). This is quite hard to establish if you are new on the market.

The price for calibration services is generally standardized (Manager of Mätcentrum, 2011-10-12) which could be due to that companies are not sensitive to new entrants and their prices. As a new entrant you will have difficulties to push to raise prices if you don’t offer something unique that the customers consider been an important value driver (Porter, 2008). The offers among the companies do not seem to differ much. Many companies offers certificated calibrations, measure at facilities, direct repair. They also calibrate and measure the same kind of instruments (see appendix F). The possibility for a new company to enter the market with new unique offerings is there for unlikely. Due to those factors the barriers for new entrants are high which therefore do not make it a major threat towards Mätcentrum.

**Threat of substitute products:**

Referring to Porter (2008) a substitute is something that has a similar function or something that gives the same result as a company’s product or service. All companies interviewed carry out some measuring and calibration internally; one did not purchase the service externally at all. This means that there is a threat of substitute to some extent. Still eight out of nine companies choose to purchase the calibration and measuring service externally and the instrument they choose to measure and calibrate internally were on most cases small and needed quality checks more regularly. If the price or performance is similar or better the substitutes becomes a threat (Porter,
Some companies stated that one of the reasons why they decided to do calibration internally was related to price or cost savings (see appendix C-D). The major threat when it comes to substitute is that companies will be more independent and invest in equipment to calibrate and measure bigger instruments themselves. Then there is also a small risk that they will offer the service to other companies. Some companies stated that the main advantage to do all calibration internally was to be in control and they did not have to be without the instrument, which were according to a several companies, a disadvantage when they purchased the service and why companies found it highly valuable to have the calibration and measuring carried out in their facilities (see appendix C-D).

**Bargaining power of suppliers:**

The suppliers within the field of calibration and measuring have a big influence on the market. As Porter (2008) states a supplier can be powerful if it is more concentrated than the companies the industry sell to. When it comes to complex and expensive products or instruments customers are likely to turn to the supplier for the best possible calibration and measurement due to the knowledge the supplier has about the products. The original supplier knows exactly how the product/instrument work and how it should calibrated. The customer will therefore find the suppliers trustworthy and reliable, something that turned out to be important value factors in the interviews. One company even decided to send some instrument to the original supplier in Germany for calibration, which shows that the company must value the calibration provided by the supplier and the standard of the service must be worth the transportation costs and lead-time. This further explains that the supplier has a big impact due to that they have the knowledge of the products and also because the customer find it convenient and simple to purchase the service from the original supplier. In the interviews (see appendix C-D) the companies stated that they preferred calibration and measurement services that were convenient. There is a risk that the supplier charge a higher price if it is for a certain product where they are the only one with the expertise. The suppliers are a major threat towards Mätcentrum, an example is Hexagon which is one of Mätcentrum’s supplier and also one of their main competitors.

**Rivalry among existing competitors:**
The strengths and intensity of competition among the different companies will depend on the number of companies that are actively operating within the industry (Porter, 2008). There were eight companies accredited with length in the western region of Sweden and seventeen in total, which clearly indicates that there is competition in the market, specified within the same range of offerings. Porter (2008) further explains that the intensity is strong when different companies are similar when it comes to size and power, companies have to fight for market share due to lack of growth in the industry. The market within the manufacturing industry seems to be growing and expanding which is a positive aspect for Mätcentrum as more companies are going to need calibration and measurement services. Most of the competitors have, alike Mätcentrum, a strong focus on the quality importance and to meet their customer’s expectations. The negative prospect is the competitors are accredited and have somewhat the same range of service offerings as Mätcentrum. Mätcentrum don’t have any unique qualities in their offerings that differs them from competition. Many of the main competitors such as SP, Exova Metch and MYLAB have strong market positions with better and broader service offers then Mätcentrum currently has (see appendix F). However it is not confirmed that all the competitors sell their services externally, the accreditation might only apply for internal use. The company SP have the superior leading market position, and was well known to all companies interviewed.

**Bargaining power of buyers:**

Almost every manufacturing company needs calibration due to quality systems and ISO certifications. Porter (2008) explains that customers tend to be more price sensitive when products or services are undifferentiated from one another. When it comes to calibration there are a lot of firms offering the same type of services, which makes the customers more sensitive towards the price. However the customers seem to be very accurate with whom they purchase their service from and seem to be willing to pay extra to be sure to get the right results. As Porter states, buyers can be very powerful if they are price sensitive and have a high influence. This can result in that the customers can pressure the companies to lower their prices. When it comes to calibration services, some companies have fixed prices on their websites and some companies adjust the price to the customers. Mätcentrum will not have a fixed price. As previously stated the price tends to vary
among the companies when it comes to measuring and calibration but not seem to change once it set. The bargaining for the buyers is relatively low. Some companies for the interviews has stated that “it could be cheaper” to calibrate if something could be improved, but most companies seem to be more concerned about the lead time and that it is carried out professionally by a accredited company.

5.3 Internal analysis

5.3.1 SWOT- analysis

To be able to estimate the internal strengths and weaknesses, as well as external opportunities and threats of a company an intern analysis need to be conducted. One way to do this is by a SWOT-analysis (Mintzberg & Quinn, 1991). The strengths are the benefits and value drivers of Mätcentrum that match the customer’s values. The strengths and weaknesses can be found in the functional company fields (Jain, 1990; Kotler & Armstrong, 2012). The accreditation in length is an advantage, as according to the companies an accredited company feels more secure and trustworthy (Interviews, Appendix C-D). Adjustments and repairs is also an advantage as this is only offered by few of the firms on the market. Which makes it a differentiation value to a certain extent as it differentiates them from most of their competitors. Differentiation value is the extra benefit that the company’s offering delivers to the customer that is above the competitive reference product. When estimating differentiation value it brings a clear understanding of the impact that the product has in the competitive marketplace (Nagle & Hogan, 2006).

Mätcentrum offers the possibility to measure at facilities, which was considered important by 65 % of the companies interviewed making it a strong value driver of Mätcentrum. When it comes to accuracy 67 % of the companies considered it to be very important and the remaining 33 % thought it was important. This implies that the accuracy is the most important value driver of Mätcentrum. That they offer both calibration and measurement services is a strength and differentiation value of Mätcentrum as few of their competitors offer both. When it comes to the measurement part there
are few services out on the market rendering it a vital strength and differentiation value of Mätcentrum.

However there are also some weaknesses, Mätcentrum lack experience in selling the business with value-based offerings, which could make it difficult for them to get their customers to see the value of the service and be willing to pay the price for it. If the value is not communicated properly it can result in high price-sensitivity and more price negotiations. This is due to the fact that the customer might not know or understand the value of your product because they are unaware of the features, their application and how those features would satisfy a need (Nagle & Hogan, 2006). There is no awareness of the fact that Mätcentrum is planning to offer their metrology services externally again. Their previous customers have not been informed and most of them have moved on to other firms or with working with it internally. The toughest weakness is that their services are not that different from their competitors when it comes to calibration, which makes it very hard for them to differentiate themselves. One of their most important differentiation factors, the direct repair and adjustment, is not considered very important as there were only two companies saying that and the rest considering it somewhat important or not important. The lead-time could also be a strong value diver but three of the companies said that they consider it as not important, one said somewhat important. This implies that it is a lesser-valued driver of Mätcentrum, since it is not a need for all companies. And it is the needs that the offer can satisfy that are value drivers (Nagle & Hogan, 2006).

A current or future external factor that might influence the company positively is an opportunity and part of the external analysis (Kotler & Armstrong, 2012). Mätcentrum has the possibility to expand their external business and develop their operations through once again offer the metrology service on the market. There is also the possibility to gain a greater profit from external business due to value-based pricing instead of cost-based making it a more successful service than before. There is a potential to raise the price for the measurement services to 1000 SEK/ hour as said in the theory, which would be approximately a 30 % increase in income. That the importance of metrology is expected to increase making more companies aware of their needs when it comes to the measurement instruments could potentially lead to more business for Mätcentrum in the future. With an increase in external businesses the metrology department of SKF might develop and add more knowledge and equipment that in the end could improve SKF’s own products.
The external factors that influence the company negatively are the threats (Kotler & Armstrong, 2012). The main threat is the influence the suppliers have on the market as most of the suppliers sell their services externally themselves and many customers choose to do the calibration and measurement of the instrument from the suppliers. This is due to that the suppliers know the products and the companies find it more convenient and simple to purchase a product and then buy the after sale services from them to (Interviews, Appendix B). Mätcentrum is planning on selling the service together with the small part at SKF that sell measurement instruments. However for the clients who already purchased the instruments from another company they need a good argument to persuade the potential customer to switch from the supplier to Mätcentrum.

Another threat is that if SKF increases their prices due to value-based pricing and fail to communicate the value to the customers, the customer’s willingness to pay would decrease and Mätcentrum might loose business. When using value as a pricing strategy it requires that the company communicate the value they offer to target customers as they each have different needs and perceive the value differently from one another. If the value is not communicated properly it can result in high price-sensitivity and more price negotiations (Nagle & Hogan, 2006). The consequence of this would be that the customers would put the focus on the costs and it would increase the risk of the customer declining the offer. Furthermore the offers when it comes to calibration don’t differ much in between the companies, which result in more price sensitive customers and makes it more difficult to base the service on value. That is explained in the five forces because if the products don’t differentiate much within the industry the customers tend to be more price sensitive (Porter, 2008).

5.4 Competitor analysis

The competitor response profile evaluates the strategies and actions of the competitors to see if the competitor is satisfied with it’s current position, what moves or strategy shifts will the competitor make, where the competitor is vulnerable and what will provoke the greatest and most effective
retaliation by the competitor. It evaluates four points: the future goals, the current strategies, the assumptions and the capabilities (Porter, 1980).

The common goal in between the competitors seemed to be to continue to have a high quality of their services and to meet customer expectations. Many of the companies want to keep their current strong positions, grow within the industry and expand their markets internationally. The competitors seem to strive for continuous innovation and development to be able to get an advantage over the others. One of the questions in the CRP is if the competitors seem satisfied with their current positions (Porter, 1980). It seems like the competitors are not satisfied within their current positions. They want to grow both in Sweden and internationally. It can be assumed that none of the competitors will let go of their market share easily if Mätcentrum were to enter. Another question is what will provoke the greatest and most effective retaliation by the competitor (Porter, 1980). Some of the competitors have taken over previous customers of Mätcentrum who might still be interested in using their metrology service. So if Mätcentrum tries to get their previous customers back it could possibly cause a strong reaction from the competitor. Additionally their current suppliers will probably not give up their customer so easily.

The strategies seem to differ in between the competitors. Some of the competitors focus on cost and having an affordable metrology service (Appendix F). This is probably because the market is very cost-based at the current moment as said in the introduction chapter. Other focus on having short delivery and lead times which is a clever choice of strategy as this was very important to some of the customers (Interviews, Appendix C-D). MYLAB focus on correct results which also is a very good strategy as this was one of the main issues to why the companies used metrology services, to ensure that the results are correct (Interviews, Appendix C-D). MTS Nordic has however already chosen a strategy that focus on enhancing the values of their service. One of the questions in the CRP was what likely moves or strategy shifts the competitor would make (Porter, 1980). If anything more and more companies on the market will choose to have value-based offers instead of having it cost-based.

The capabilities of the companies seem to be more or less the same. When it comes to accreditation ten of the competitors are accredited in more than length with SP accredited in most among the
companies. The accreditation gives them all a good value driver as accreditation was considered the most important factor according to the interviews (Interviews, Appendix C-D). All of the competitors have high accuracy and quality of the work, which is strong value driver according to the interviewed companies. Many of them also offered the possibility to have the metrology services taking place at the customers facilities which was highly valued by some.

The competitors who are a threat because they are a supplier of measurement instruments are Elastocon AB, MTS Systems Nordic AB, Nyli Kvalitets & Kontrollteknik AB, ZR Sverige AB and Hexagon metrology Nordic AB. Elastocon AB offer more services when it comes to calibration that Mätcentrum does and are accredited in more areas making them a highly positioned competitor of Mätcentrum. The strongest points of Elastocon is that they offer a discount if you send all the instruments to them as the customers seem to focus a lot on price (Interviews, Appendix C-D). A weakness is that they focus on cooperating with other companies, as the customers don’t mind sending the instruments to different places (Interviews, Appendix C-D).

Exova Metech say that they are one of the leading third party suppliers of calibration services in Europe and the leader of calibration and independent measurement services which makes them a strong competitor of Mätcentrum. They offer measurement of the same type of instruments as Mätcentrum. However they do not speak of lead times in their offers and for some customers short lead times were essential (Interviews, Appendix C-D). MTS Systems Nordic AB software gives the industry´s fastest and most efficient calibration according to themselves. MTS System Nordic AB has a value-based metrology offer which makes them a competitor when it comes to strategy as well. The values they give themselves are: Industry-leading software, test system calibration expertise, a deep understanding of the test equipment and the latest industry standards, calibration equipment traceable through National Metrology Institutes. All of those values are values that Mätcentrum holds except for the industry-leading software. But it does not give them any particular differentiation value.

Nyli Kvalitets & Kontrollteknik AB offer calibration for a wide range of instruments, more than any of the other companies giving them a differentiation value when it comes to that. The fact that
they are a supplier of measurement instruments makes them a threat, as the companies prefer to work with suppliers (Interviews, Appendix C-D). Another strength is that they are the only once in Sweden with a laboratory that enables them to make cleanliness measurement under optimized circumstances and thereby receive very accurate numbers and accuracy is very important to the customers (Interviews, Appendix C-D).

SP is the highest positioned in the Swedish market when it comes to calibration. They provide the widest rage of services in the Nordic countries when it comes to calibration. They are the national metrology institute of Sweden, which means hat they are responsible for the national standards for a number of quantities in the SI system. All of the things above are value drivers of SP, that they are the national metrology institute is also a differentiation value of SP. SP is a strong competitor of Mätcentrum although they do not offer many measuring services. Which makes them a strong competitor for the calibration services but not for the measuring services. Trescal Sweden AB is the leading company when it comes to measuring length, flats and angles. They offer accredited calibration of gauge blocks, the same as Mätcentrum. That they offer the same type of calibration, adjustments and repairs and are the leading company when it comes to measurement services makes them a strong competitor of Mätcentrum. ZR Sverige AB is the leading supplier of test equipment of destructive and non-destructive testing. They also offer services and calibration of material testing systems in the Nordic area, provides spare parts and holds education when it comes to material testing. Their services have high quality and accuracy which were both important factors according to the companies (Interview, Appendix C-D). That they are a supplier of instruments also makes them a strong competitor of Mätcentrum.

MYLAB carry out control measurement with accuracy and precision. They also construct client adapted measurement fixtures. MYLAB has the latest and most advanced measurement technique, though the latest technology was not considered important by the companies asked (Interviews, Appendix C-D). Hexagon Metrology AB is a supplier of measurement instruments, CMM among other things. With four measurement centres in Sweden and a Network of seven agents they consider themselves the strongest supplier of advanced measurement solutions. Hexagon can measure from: 1 micrometre to 120 metres and up to 3.6 cubic metres when it comes to size. That they are a supplier of measurement instruments makes them a strong competitor and threat, however they do not offer calibration services. Hexagon is a competitor of the measurement
services but not of the calibration services and their offices in Sweden are not that large making them a rather small threat.

Kalibreringscentrum i Eskilstuna perform calibration of measurement instruments within length and angle. Their mission is to keep an affordable calibration with short delivery times. That is a value driver for the customers as they think both short delivery times and the price of the service is important (Interviews, Appendix C-D). All calibration is traceability to national or international standard which is also an important factor. They offer the same type of calibration as Mätcentrum. But they do not offer repairs and adjustments or measuring services. This makes them a competitor of the calibration services but not the measuring services.

The last question was regarding where the competitor is vulnerable (Porter, 1980). The different points making them vulnerable were that they either offer measuring or calibration services and not both, that the offerings are very similar to one another and that some of them do not offer repairs and adjustments.

The assumptions within the industry were such as that you need to generate accurate data faster than before and that it has impact on the success of your projects. When it came to them they all assumed that they were better than any other company. Either uniquely equipped, or have an extensive expertise of the area, or are known in the industry because they have the highest quality. Many of the competitors seem to believe that they are the leader within the industry (Appendix F).

5.5 Summary of findings

**Research question 1: What does manufacturing companies consider as value drivers in measurement services?**

The strongest value driver for the customers was the accreditation (Interviews, Appendix C-D). The accreditation includes the other important value drivers such as accuracy, quality and regularity. It is also an insurance that the company can be trusted. Accreditation, quality, accuracy and regularity
are all value drivers as they result in greater reliability, reduced maintenance cost and superior performance, those three points are main value drivers according to Nagle & Hogan (2006). Greater reliability comes with having an accredited company taking care of the instruments resulting in that it is ensured that the measurement or calibration is correct and the instrument is within the tolerance level. Reduced maintenance cost derive from that if it is ensured that the instrument is correct and within the tolerance level and that the quality is optimized thus it will only need to be checked at the appointed check-ups, it is less likely that it will brake down in between the check-ups. The superior performance is due to that optimized instruments generate improved productivity and having an optimized toolset is one way to have WCM (Bunday et al. 2007).

Accuracy is also one of the most powerful value drivers. Even if the level of accuracy seemed to vary depending of products and company, the result of the measure need to be correct and reliable. Most of the companies considered the possibility of having the service at their facilities as important which also makes it a strong value driver (Interviews, Appendix C-D). Though it is not valued by all, it was mostly valued by those who could not afford having the instruments away from production for too long, that were unable to move the instruments and who wanted to avoid damage of the instruments during transportation. From the customer’s point of view, value means the benefits received for the burdens endured (Berry & Yadav, 1996). In this case it would be less of a burden for the customers as they would not have to transport their instruments and have them away from productions. Having the measurement taking place at facilities seem to be both a value driver and a cost driver. It can be considered as a need for many of the companies and thereby it is an important value driver but it is also a cost driver because they do not have to move and transport the instruments or have them away from production. A cost driver is a driver that save the company time, money or effort (Nagle & Hogan, 2006). Having the instruments away from production could mean that they production would had to stop temporarily until they would get back which would lead to decreased productivity.

Direct repairs and adjustments were important to some of the companies (Interviews, Appendix C-D). The companies that valued the opportunity of direct repair and adjustment also held opinions about the importance of lead-time. Time and costs is an important issue for those companies that is essential to take in consideration when creating an offer. As said above, a cost driver saves the company time, money or effort (Nagle & Hogan, 2006). Short lead-time is as a cost driver as it
reduces the time the instruments are away from production. It can also be a value driver as short lead-time can be a need for a company if they cannot afford having the instruments away for too long.

The points above should all be included when creating a general offer to present the service to potential customers. In order to put price based up on values, service marketers need to understand what establishes values for their target markets (Berry & Yadav, 1996). They are all strong value drivers of Mätcentrum and should be pointed out when trying to gain the interest of a potential customer. When creating an offer for the customer the company should enhance the value drivers that they customers think are the most important (Nagle & Hogan, 2006), whether it is lead-time or direct repairs and adjustments but they should also mention the points above as they are general value drivers of the industry. They should see which value drivers satisfy a certain need for the customers as needs turn into value drivers. Do they give a superior performance, greater reliability, additional features, reduced maintenance cost, smaller start up costs or faster service? Are they cost drivers, do they save the customer time, money or effort (Nagle & Hogan, 2006)? Mätcentrum needs to be able to translate the need into costs for the company and from that turn them into value drivers. From the value drivers an offer can be created that satisfies the customer’s needs. And with the value for the customer estimated an appropriate price can be set based on it (Nagle & Hogan, 2006).

Research question 2: How do you create a value-based metrology offer?

To be able to create a value-based offer a company need to find out the strengths and weaknesses of their service offer (Kotler & Armstrong, 2012). Mätcentrum need to focus on their strengths, which are: the accreditation in length, the possibility of direct adjustment and repair, that they can measure at facilities, that they offer high accuracy and offer the combination of both calibration and measurement. These points were all included into the value-based offer of Mätcentrum, see the offer in Appendix G. The values that were highlighted the most in the explanation of why metrology services are important were: traceability, accuracy, ensured quality and meet customer requirements. These points were all emphasized in the interviews and thereby considered important to mention in the offer as well (Appendix C-D).
Another point that was highlighted in the offer was that by using metrology services you receive a higher quality of measurement instruments and products. This was because “to ensure the quality of the instruments and products” and “to have correct instruments” were the purpose of metrology for most of the companies. Mätcentrum also brings some incremental value in terms of reduced material costs to the customer, as the continuous calibration of the measuring instruments decreases the risk of maintenance costs (Monroe, 1990). Another aspect that was taken into account is the fact that Mätcentrum is a reference measure site that has been used for SKF’s internal production. SKF would not use a low-quality measurement service for their own high-quality products, which is an insurance of the quality of the service to the customers. Hinterhuber (2003) emphasizes the relationship between price and quality. It is common for consumers to associate higher prices with superior quality. Because SKF is a well-recognised brand name in the bearing industry, thereby the company is in a position to use their brand to have slightly higher prices to create a perception of quality in the minds of customers.

Two things drive customer purchases: customer objectives and the next best competitive alternative. The customer objective is to reduce their costs, increase the performance and get the highest quality possible from the calibration and measuring. They need to know that they benefit from doing the calibration externally instead of internally and that they benefit from using your service and not your competitors (Nagle and Hogan 2006). Their customers will compare the benefits that Mätcentrum offers with is implied and direct costs (Gross, 1987; Monroe, 1990; Shapiro & Jackson, 1978). Some manufacturing companies highly value accuracy, some lead-time and some to have the possibility to get the service at their facilities. Depending on the customers need the company must adjust the offer towards the customer as their value drivers and way of working varies. The main issue is to link the strengths of the service to the customer’s values and make the customers perception of the service change from a fixed cost to a strategic solution. Mätcentrum must be able to translate and communicate the true value of the offering. This means that the customer must see the offering as a strategic valuable solution instead of costs and numbers (Nagle & Hogan, 2006).

To implement a value-based pricing model it is important that they are aware of the value the offer has to the specific customer and that they are able to communicate that value in terms of value drivers. SKF must be able to identify and quantify all the additional value customers receive by
Can metrology be value-based? This requires a greater level of research and understanding of customer operations. If you take for example DAROS Piston Rings:

The four following points where the main value drivers and needs of DAROS, all matching what Mätcentrum can offer.

- **Accuracy:** was considered very important and the most important factor when it comes to calibration. Daros said that the accuracy is the most important and they need the calibration and measurement to be accurate, as it determines if the instrument can handle measuring the characteristic/quality that it is supposed to measure. If the measurement instruments measure incorrectly the products will be incorrect and there will be reclamation costs and costs of having to adjust the products/produce new products.

- **Cost-saving:** The service was purchased externally to save costs. DAROS does not have the equipment needed to calibrate all their instruments internally. They consider it more cost-saving to purchase it externally than investing in equipment. A measurement machine costs at least 200 000 SEK and lasts for about 5-7 years.

- **Direct repair:** It was considered as very important. DAROS send away many instruments for adjustments and repairs to the suppliers. They state that they cannot afford to have them away for a long time. They have back-up on many of the less expensive instruments but not on the others. Therefore they consider it to be important that they get repaired or replaced very fast, they need direct repairs to have the instrument back without delay. An instrument that breaks down is an unplanned disturbance in the production could interrupt the production efficiency or stop production over all. An unplanned stop in production for a company like DAROS cost approximately 100 000 SEK/hour. Compared to renovating the instruments, which cost approximately 2800 SEK each.
• Lead times: was considered as very important. DAROS need short lead times because they cannot afford to have the instruments away for too long. Because if the instruments are away they have to decrease production level or even stop production. An unplanned stop in production cost approximately 100 000 SEK / hour.

If the different costs of not satisfying their different needs are calculated, the cost of purchasing the service from Mätcentrum will be insignificant in comparison. If this is done the customer’s decision will be made on the value they gain from the service rather than the cost of doing it. The customer-oriented focus on value pricing makes it suitable when the customers demand value and quality (Monroe, 1990). The perceived value of a product is the price the customer is willing to pay for the total bundle of benefits the product, or in this case service, delivers. The potential customers will balance the benefits derived from the product with its direct and implied costs (Gross, 1978; Monroe, 1990; Nagle 1987; Shapiro & Jackson, 1978).

**Research question 3: How successful will it be to sell the value-based service externally?**

The strongest threat to Mätcentrum is the suppliers as their potential customers are likely to purchase the metrology service along with the measurement instruments from the supplier. SKF sell a small amount of measurement instruments but it is not their main business. However it is not only the supplier’s that’s a great threat of success, the rivals in the market have strong positions too.

Many of the competitors are global leaders in metrology services and offer extensively more value than Mätcentrum as they are accredited in more areas and offer more services (Appendix F). From the main competitors those who do not offer more value than Mätcentrum have more or less the same value drivers and offers. There are also plenty of other companies on the market that are offering metrology services that are not accredited. That there are many services on the market offering more or less the same to the customers, make them more price sensitive (Porter, 2008). And with competitors such as SP who is the national metrology institute in Sweden it can be hard to compete. Mätcentrum have value drivers that the customer consider important such as accreditation, accuracy, direct repair and adjustment, measuring at facilities and short lead times. Although they do not offer more value than their main competitors or have any differentiation values. The main competitors and Mätcentrum have together some differentiation values from the
other companies as they are accredited. Differentiation value is the extra benefit that the company’s offering delivers to the customer that is above the competitive reference product (Nagle & Hogan, 2006). Due to the factors mentioned above it can be assumed that Mätcentrum’s metrology offers are not going to be more attractive to the customers than the offers that are already on the market. It will be hard to compete with the suppliers and with the competitors that can offer more to the customers.

As the metrology offers in today’s market don’t have a great difference and most of them are cost-based there is an opportunity of a successful positioning with a value-based offering. Though it all depends on how well the company manage to communicate the value in order for the service to stand out (Bradley & Swire 2006.) As mentioned previously Mätcentrum needs to adjust their offer individually to each potential customer and their value drivers for best result. It would be more time consuming to locate all the information, but in the end it could improve the effect of how the customers perceive Mätcentrum’s offer. They could for example perceive the offer as more unique and well suited for their organization. With a high-perceived value it increases the customers willingness to pay (Nagle & Hogan, 2006). If this is managed correctly while most of their competitors focuses on a cost based strategy there might be a greater chance for Mätcentrum to establish a competitive advantage on the market. By paying more attention to the client’s risk, the service provider gets the opportunity to achieve better rewards (Phifer, 2003). Still as mentioned above it all depend upon how the sales force can communicate the value of the service offering. The sales people need to have the right competence, the knowledge and be aware of how much their own offers are worth. In the pilot test where the offer was presented to two potential customers one of the customers neglected the offer and the other accepted it. It is hard to base a success rate with only two companies as responders, however the result can imply that there is an interest for new offers. Mätcentrum could have a chance of being profitable if they focus on their value drivers and in communicating them.
6 Conclusions

This chapter aims to answer the three research questions and conclude if it will be profitable to sell Mätcentrum’s services externally. It also discusses the academic and managerial implications of the research, how the research could be continued further and what limitations there were to the study.

The conclusion of the research was that metrology offerings could most certainly be value-based. Most of the customers on the market choose to focus on value drivers such as accreditation and accuracy rather than on price. The values that the manufacturing companies considered most important were accreditation, accuracy and quality, measurement at facilities, and short lead-times. Value drivers that are important within the business sector are greater reliability, superior performance and reduced maintenance cost (Nagle & Hogan, 2006), which having an accredited company performing the service, quality and accuracy of measurement instruments gives. Those points ensure that the measurement or calibration is correct and the instrument is within the tolerance level, that the quality is optimized of the measurement instrument leading to optimized instruments in turn. With optimized instruments the performance and productivity is increased which is an important step towards WCM (Bunday et al. 2007).

The offer was created based on the values that were emphasized in the interviews. For the explanation and persuasion of why they should choose Mätcentrum’s metrology offer the points that were outlined were traceability, accuracy, ensured quality and meet customer requirements. Traceability is a need within the metrology industry since all the calibrations and measurements need to be traceable to national and international standards. Accuracy and quality are two important value drivers as explained above. They are also needs within the industry due to that the requirements of product quality are continuously increasing as the customers on the market are becoming more and more price sensitive (Bunday et al. 2007). Another point that was highlighted in the offer was that by using metrology services you receive a higher quality of measurement
instruments and products. This was because “to ensure the quality of the instruments and products” and “to have correct instruments” were the purpose of metrology for most of the companies. The meet customer requirements point was included as many of the companies needed quality and accuracy or certifications because their customers were requiring it (Interviews, Appendix C-D). It is a need for the manufacturing industries to meet their customer’s requirements to be able to create long-term relationships with them. If it is a need for the customer it is a value driver of Mätcentrum and thereby it was included in the offer. Other points that were also needs and value drivers were the accreditation, measurement at facilities and direct repairs and adjustments. These were all included into the value-based offer as well but as features and characteristics of the offer instead of reasons to why you should purchase it.

Concerning how successful it will be to sell the value-based service externally it can be concluded that it can be profitable if they focus on adjusting and customizing the offer, quantifying the value drivers of the potential customer and manage to communicate them. Communicating value is critical in increasing the customer’s willingness to pay. The same monetary amount of price, in return for the same amount of value, can give an entire different effect depending on how the customer perceives it (Nagle & Hogan, 2006).

If they do not manage to customize the offer and communicate the value the metrology service will not be successful. There are already so many metrology services on the market and they have eight main competitors in the western region of Sweden that are also accredited in length. It can definitely be stated that the competition in the market is tough with the high bargaining power of suppliers and highly positioned competitors. There is a low chance of persuading the customers of choosing Mätcentrum’s metrology offer rather than suppliers who they are already familiar with. However, even with the hard competition it can be profitable, as Mätcentrum would use the value-based strategy instead of the cost-based as many of the competitors. Then the customers would perceive Mätcentrum as the better solution due to that the focus would be on satisfying their needs rather than reducing price. But this definitely requires that they can communicate the value properly to the customers as when it comes to value-based pricing it all depends how effectively the sales force can communicate the value to the customer. Regardless of the product category, it is the customers' perception of value that will determine which vendor gets their business. For this reason,
it is important for companies who produce and price product or service on value that they understand how much their offers are worth (Bradley & Swire 2006).

6.1 Implications

The research presented in this thesis has implications both for the academic world and for management. Bunday et al. (2007) emphasize the importance of metrology as a vital step towards having WCM. But there seems to be a lack of theory related to metrology services, which implies that there is a need for theories concerning value-based metrology services. To the authors knowledge there has not been another study conducted in this research area to this date. The mixed but mostly qualitative approach of the research was so that it would give a deep insight into the factors and values of the metrology market. But there was a quantitative approach as well so there could be a generalisation of all the manufacturing companies in the western region of Sweden.

6.1.1 Academic implications

In this part the contribution of the research to theory is presented. The research supports some of the theories related to metrology but also contributes with new information regarding value-based metrology services.

One of the theories concerning metrology states that it is a very important point of production, which the research supports. The interviewed manufacturing companies considered metrology as an important point to ensure correct instruments and products. However another one of the theories concerning metrology declares the perception of the importance differed in between companies and that this was normally connected to the quality of their metrology. The findings showed that the importance differed among companies and within different parts of the company. But this was more related to the purpose of the measurement or calibration than the quality of the metrology thus the theory was not supported by our research.
This study suggests that there are certain values related to the metrology market and that the customers search for when purchasing metrology externally. The values that the manufacturing companies considered most important were accreditation, accuracy and quality, measurement at facilities and short lead-times. Based on this finding it can be implied that metrology services could be based upon value drivers instead of costs even though it is a highly technical service. Although the research does not indicate that a value-based offer is a more successful strategy, as the findings did not imply either way.

6.1.2 Managerial Implications

In addition to the theoretical implications the research gives a practical contribution, it should be of interest to managers in the manufacturing industry within the western region of Sweden.

The result of the research showed that metrology services could be value-based as the manufacturing companies focus mostly on value drivers, such as accuracy and quality over cost-based points, such as price. The perceived value of a product is the price the customer is willing to pay for the total benefits the service delivers (Gross, 1978; Monroe, 1990; Shapiro & Jackson, 1978). Therefore all the benefits the companies can offer to their potential customers should be emphasized. The companies should discover the needs of the customers; such as that they need to have the measurement service at the facilities, because they cannot move their products. The customer will balance the benefits of the offering with the direct and implied costs (Gross, 1978; Monroe, 1990; Shapiro & Jackson, 1978). If the benefits of the offering are more than the direct and implied costs the customer will not see the purchase as an obligation but as a valuable solution.

When determining price the companies must understand value from the customer’s point of view to be able to meet demands from industrial customers (Shapiro & Jackson, 1978). It is also essential that the person acquire the ability to transform values into numbers and to communicate those values into a strategic question to the customer. A customer that is fully informed about the market and seeks the best value would be willing to pay the total economic value (Nagle & Hogan, 2006). For example when selling the metrology services it could be essential to have the production manager or anyone with knowledge about technical issues related to the service together with the
sales person. This will be necessary if the customers ask too technical or specific questions regarding the service. It can be of great importance as it can be hard for the sales personnel that might be unaware of the values of accuracy within metrology to sell it as a valuable point.

Regardless of the product category, it is the customers’ perception of value that will determine which vendor gets their business. For this reason, it is important for companies who produce and price product or service to understand how much their offers are worth (Bradley & Swire 2006). The interviews showed that the manufacturing companies felt very similar on many value drivers such as accreditation and ensure quality, the companies should investigate exactly what points that are of importance to the potential customer so that they know how much their offer is worth to the potential customer. See the example of Daros piston rings under chapter 5.5 Summary of findings.

Even though many value drivers where the same all manufacturing companies have their own strategies and needs. For the best possible outcome companies should adjust their offer individually to each potential customer and match their value drivers. The same strategy should be addressed when it comes to pricing. The price should be customized based upon the companies and the value offered to them. Nagle & Hogan (2006) explains that when using value as a pricing strategy it requires that the company communicate the value they offer to target customers as they each have different needs and perceive the value differently from one another. If the value is not communicated properly it can result in high price-sensitivity and more price negotiations (Nagle & Hogan 2006). Companies communicate value so that the customers are aware of the value they receive and the company can justify the extra price charged for it. Value communication include advertising, personal sales, trial offers, endorsement, guarantees and other tools that raise the customers willingness to pay to the same level as better informed and experienced customers (Nagle & Hogan, 2006). Personal selling is definitely a good way to sell metrology services value-based as it will be easier to find out the needs of the potential customer in person.

The value communication could happen through other ways besides the company communicating it themselves. An option would be to use reference customers to increase the outcome of word of mouth. As Ying (2006) states, customers are more sensitive with purchase of services as they are intangible and harder to compare. This is why reference customers could be of great importance. According to several companies that were interviewed (see appendix C-D) the manufacturing companies often had some sort of connection to each other. This could have an impact when it
comes to how information spreads among companies regarding new services. If possible it would be an advantage to have at least one reference customer in each segment so the customers could compare at the same conditions. A reference customer works as a guarantee of the quality of the service and can be a vital point in persuading a potential customer to purchase the service.

For an accredited company that is just entering the metrology market it would be possible to take advantage of the importance of accreditation when it comes to metrology services. By paying more attention to the client’s risk, the service provider gets the opportunity to achieve better rewards (Phifer, 2003). The requirements of product quality are continuously increasing due to more sensitive customers on the market. This is one of the reasons why the metrology is becoming more important for manufacturing firms (Bunday et al. 2007). Because of the quality requirement and accreditation as a main value driver among manufacturing companies (see appendix C-D) companies offering metrology services should also focus on the manufacturing companies that purchase their calibration and measuring services from companies that are not accredited. By focusing on companies that use non accredited services the companies have a differentiation value and offer more value to the customer than their current service provider.

6.2 Limitations

Every thesis has some limitations even though every measure is taken to prevent it. This thesis also had limitations, which will be explained below.

The e-mail suggesting that the companies would reply about an interview date only attracted two companies, the remaining seven interviews were contacted over the phone. This implies that the e-mail was not clear or interesting enough for the companies to reply. And when the companies were called only nine out of the original twenty companies agreed to an interview, which is less than half of the potential customers. The reasons for this was due to that some of them had outsourced production and some were just not interested in participating in the study.
The interviews were collected by a convenience sampling, which might have limited the generalization of the study. A random sampling would have been preferred as then the reliability of the generalizations would be more valid. Another limitation was that it was not always the most appropriate person answering the interview questions, which might also have affected the generalization and validity of the study.

The interview questions for the manufacturing companies were not based on peer-reviewed articles from journals, which might have affected the validity of the study. Another thing was that not all of the questions from the interview guide were answered which affects the generalizations from the answers and the reliability.

The research aimed at making it easier and convenient for the interviewees by having the interview in Swedish instead of English as it would be possible to have it in either language. However it not possible to rule out that the questions or answers in the interviews have been translated differently and thereby misinterpreted.

Time was another issue of limitations that came to affect the development of the study in the market, internal and competitor sections. With more time deeper and richer information could have been gathered and investigated.

There were also some limitations related to the acceptance-rate of the offer, as it was only answered by two companies it could affect the reliability of the rating. Especially since there was one positive answer and one negative, it does not imply success or failure of the value-based offer.

6.3 Further research

In the field of this study there are plenty of directions for further research. The suggestions will be presented in the section below.

When it comes to the market research there is a possibility to make a research of all the manufacturing companies of the entire Sweden, instead of just the Gothenburg region. It would
then be a quantitative study and give a more general but broader result. A mixed method approach with both interviews and surveys could also be a possibility to get the deep, broad information and the general perspective.

Another option is to go one step further and select markets in Europe, for example to compare the differences in between the Swedish market with the German market when it comes to metrology offers and the value drivers.

For market research one could also add external value drivers into the research, such as brand names and include brand perception theory. This could be investigated by adding questions in the interview guide regarding external values and how it could affect the customer’s perception of the offering. An example would be if Mätcentrum would be perceived more positive or negative if associated with SKF and their brand reputation.

Another direction would be to develop the competitor analysis. The competitor information could expand with the purpose to get a deeper insight and more information. The information could be used to develop Porters competitor response profile with the strategies, capabilities, assumptions and future goals. More and deeper information would improve the reliability when comparing the offers and the reference value.
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Brandén, Jonas: Market manager Olda innovation, interview 2012-04-16

Carlsson, Jan: Production Manager Bodycote, interview 2012-04-12

Fridholm, Mikael: Application engineer Adigo drives, interview 2012-04-12

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Appendix A – interview questions in Swedish

Interview questions to the manager of Mätcentrum

Hur ser er nuvarande strategi ut gällande Mätcentrum?

Marknaden:

1. Vilken bransch/marknad är det ni jobbar i, mer specifikt än tillverkningsindustri?
2. Vilka branscher/marknader ligger era nuvarande och potentiella kunder i?
3. Använder sig företagen som SKF normalt säljer till sig av mätsystem?
4. Vilken typ av barriärer/hinder finns det som hindrar andra företag från att komma in i marknaden?
5. Vilka är era huvudkonkurrenter?
6. Finns det något annat sätt att mäta/kalibrera förutom att köpa det externt eller göra det internt? Eller är göra det internt det enda substitutet?
7. Använder ni er av någon form av leverantörer? (suppliers)
8. Har dessa stark position i marknaden? Levererar de till många andra?
9. Skulle du säga att det är stor skillnad mellan erbjudandena som ligger på marknaden när det kommer till mätsystem?
10. Anser du att kunderna är priskänsliga?
11. Anser du att marknaden inom mätsystem har potential att växa?
12. Anser du att marknaden inom mätsystem kan konstateras vara lönsam?

Internt:

13. Har ni någon garanti?
14. Vem betalar för transportkostnaden när mätinstrumenten skickas till er och tillbaka till företaget?
15. Vem står för kostnaden när ni åker dit och mäter med handmätdon?
16. Vad ligger kostnaden för att utföra en mätning eller en kalibrering för er?
17. Vad är det nuvarande priset för era tjänster?(80-90/ h)
18. Vad skulle ni vilja att priset låg runt i framtiden även om det kommer att variera?
19. Hur hade ni tänkt marknadsföra(promota) tjänsten?
20. Ni tänkte jobba med personlig försäljning?
21. Vilka kommer vara inblandade i försäljningen av tjänsterna, både från mätcentrum, leverantörer, försäljningsavdelning etc. – hur många?
22. Med tanke på att en tjänst inte kan jämföras på samma sätt som en produkt, har ni något sätt ni skulle kunna bevisa för kunderna att de kommer få det de vill ha? (ackreditering, certifiering?)

23. Kommer processen se ut likadant som innan?
24. Vilka tycker du är det största fördelarna med er mätnings respektive kalibreringstjänst?
25. Om du skulle köpa tjänsten externt, vad skulle du fokusera på?

**Konkurrent:**

26. Vilka fördelar och nackdelar har era huvudkonkurrenter, individuellt som ni inte har?
27. Vilken position i marknaden har dem?
28. Vad är det era huvudkonkurrenter specifikt använder som strategi för att få kunder, vad ”tävlar” dem på?
Intervju guide – Mätsystem för tillverkningsföretagen

1) I vilket syfte mäter eller kalibrerar ni era mätinstrument?

2) Hur viktigt är det för er att mätningen eller kalibreringen är noggrann?

   Väldigt viktigt O   Viktigt O   Någorlunda viktigt O   Inte viktigt O

3) Vad är de absolut viktigaste faktorerna med mätning och kalibrering enligt er?

   Noggrannhet O
   Att det sker kontinuerligt O
   Kvalitén O
   Att verkstaden är ackrediterad/certifierad O
   Annan… O

4) Mäter och kalibrerar ni era mätdon internet eller externt?

   Endast internt O   Endast Externt O   Båda O
Om externt:

5 ) Av vilka anledningar valde ni att köpa tjänsten?

6 ) Vilka faktorer med att köpa det externt övervägde att göra det internt?

Det kostar mindre O
Vi har inte expertisen som krävs O
Vi har inte utrustningen som krävs O
Det är inte en huvud kompetens O
Annan..... O

7) Varför valde ni den firman ni arbetar med, vilka var huvudfaktorerna när ni valde att arbeta med denna firma?

8) Vilka är de mest positiva aspekterna med det företaget ni arbetar med?

9) Vad skulle kunna förbättras?

10) Skickar ni era mätdon till fler än ett ställe för mätning och kalibrering?

11) Hur viktigt är det för er att ni kan mäta alla era mätinstrument på samma ställe?
12) Hur viktigt är det för er att ha möjlighet till direkt reparation/justering om mätdonet ej är godkänt?

Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

13) Hur viktigt är det att verkstaden har den senaste teknologin?

Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

14) Hur högt värderar ni att mätningen kan ske på plats på ert företag med hand-mätdon?

Väldigt högt O Högt O Någorlunda högt O Värderar det ganska lågt O

15) Hur viktigt är det att företaget ni jobbar med kan erbjuda korta ledtider?

Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Om internt:
Varför har ni valt att arbeta med det själva istället för att köpa det externt?

För att ha 100% kontroll  O
För att det kostar mindre  O
För att vi har expertisen  O
För att vi har utrustningen O
För att det är en huvudkompetens O
Annan…. O

Vilka faktorer med att ha det internt övervägde att köpa det externt?

Vilka faktorer skulle ha högst inverkan om ni istället valde att köpa tjänsten externt?

Säljer ni själva era tjänster externt?

Ja O    Nej O
Appendix B – interview questions in English

Interview questions for manufacturing companies

1. For what purpose do you measure or calibrate your instruments?

2. How important is it for you that the measurement or calibration is accurate?

   Very important O  Important O  Somewhat important O  Not important  O

3. What do you consider to be the most important factors when it comes to measurement and calibration?

   Accuracy O
   That it happens continuously O
   Quality O
   That the workshop is accredited/ has a certification O
   Other..O

4. Do you measure and/or calibrate internally or externally?

   Internally only O  Externally only   O  Both O

   **If externally:**

   5. For what reasons did you decide to purchase the service?

      It costs less  O
      Did not have the expertise   O
It is no a core competency  O

Other  O, if other please explain:

6. For what reasons did you choose to work with the company you are working with, which were the main factors?

7. What are the positive aspects of the service and the service provider?

8. What could be improved with the service from your point of view?

9. Do you send the measurement instruments to more than one company for measurement and/or calibration?

10. How important is it to be able to send all the measurement instruments to the same company instead of several?
    Very important O   Important O Somewhat important O  Not important  O

11. How important is it to have the possibility of direct reparation/ adjustment of an unapproved measurement instrument?
    Very important O   Important O Somewhat important O  Not important  O

12. How important is at that the service provider has the latest technology?
    Very important O   Important O Somewhat important O  Not important  O

13. How important is the possibility of having the measurement/calibration taking place at your own facilities?
    Very important O   Important O Somewhat important O  Not important  O

14. How important is it that the company offers short lead times?
    Very important O   Important O Somewhat important O  Not important  O

If internally:

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5. For which reasons did you choose to use it internally instead of purchasing it externally?

To have complete control  O
Because it cost less O
Because we have the expertise  O
We consider it to be a core competency  O
Because we have the equipment O
Other.. O

6. Which factors would have the highest influence if you were considering purchasing it externally?

7. Do you sell your measurement/calibration services externally?

Yes  O  No  O

If you were to purchase it externally:

8. Would it be an important factor if you were to purchase it externally to have the possibility of direct repair/adjustment of an unapproved measurement instrument?

9. Would it be an important factor if you were to purchase it externally that the service provider has the latest technology?

10. Would it be an important factor if you were to purchase it externally to have the possibility that the measurement/calibration could take place at your own facilities?

11. Would it be an important factor if you were to purchase it externally that the company would offer short lead times?

Interview questions for the manager of Mätcentrum
Market related

1. What industry do you work within?
2. What industries are your current and potential customers within?
3. What type of barriers are there to overcome for new entrants?
4. Are there any substitutes to purchase calibration externally?
5. Do you have any suppliers?
6. How strong position in the market do these suppliers have?
7. Would you say that there is a difference in between the offerings on the market when it comes to measurement and calibration?
8. Do you consider the customers within the market to be price sensitive?
9. Do you think there is potential for growth within the market of measurement systems?
10. Do you consider the market to be profitable?

Internally related

11. How much does it cost SKF Mätcentrum to perform a measurement and calibration?
12. What is the current price of your services?
13. Hypothetical, what would you like the future price to be?
14. How do you plan on promoting the service?
15. Who will be involved in the sales of the service?
16. Considering that a service cannot be compared in the same way as a product, how do you provide evidence of your service performance?
17. How does the processes look when it comes to measurement and calibration?
18. How would you consider the uniqueness of your service?

Competitor related

1. Who are your main competitors?
2. What benefits and disadvantages do your competitors have?
3. What position in the market do your competitors have?
4. What are the competitors competing on?
Appendix C - interview answers in Swedish

Intervju guide – Fixtur Laser

**ELOS Fixturlaser utvecklar, tillverkar och marknadsför laserbaserade mätinstrument.**
Fixturlaser har ett brett sortiment av uppriktning och positionering instrument. Vi har alltifrån bassystem för uppriktning av roterande maskiner och remdrifter till mätsystem för kontrollmätning vid tillverkningsprocesser, såsom t ex skeppsbyggnad och andra avancerade konstruktioner, där hög mätnoggrannhet krävs.

Mäter applikationer som finns ute i industrin. Tillverkat själv, eller köpt in. Måste lämnas in kalibrerings certifikat varje gång kund behöver kalibrering


Om systemen används så behövs mindre reservdelar och diverse, miljöperspektiv för Fixturlaser. Om de ser till så att allting fungerar så droppar de inte, drar inte mer energi då. Försöker ha olika teknik plattformar. Om en pump stannar i pappersbruk = 100 00 på tio minuter. Förebyggande underlag.

**I vilket syfte mäter eller kalibrerar ni era mätinstrument?**

Eftersom vi tillverkar och levererar ett mätsystem, måste vi veta att det mäter som det skall. Kunden måste också veta att vi levererar ett system som mäter som det skall. Om kunden gör en
uppriktning, om systemet visar fel så får han fel uppriktning och då kan han ta sönder saker. På ett skjutmått om jag mäter fem mm så måste det bli fem mm.


Hur viktigt är det för er att mätningen eller kalibreringen är noggrann?


Väldigt viktigt O   Viktigt O   Någorlunda viktigt O   Inte viktigt O

Vad är de absolut viktigaste faktorerna med mätning och kalibrering enligt er?

När vi vill ha våra system kontrollerade går vi på ackreditering och certifiering. Vi försöker gå på ackreditering och certifiering så långt det går. Laserinterfermotmeter, som är jättenoggrann den
Can metrology be value-based?

Noggrannhet O

Att det sker ofta  O

Kvalitén O

Att verkstaden är ackrediterad/certifierad O

Mäter och kalibrerar ni era mätdon internet eller externt?


Endast internt O    Endast Externt O
Båda O fast endast med distributörer som inte köper in det externt

Om externt:

Av vilka anledningar valde ni att köpa tjänsten?

Av praktiska själv, för att vi har en egen kunskap i huset med våra kontrollsystem och hur de fungerar. Vi vill göra det när det finns speciella tillfällen när vi inte producerar just då. Det har varit enklare att göra så. Vi har perioder då vi skickar ut referenser på spårbarhetskontroll, då gör vi inga egna kontroller så då kan vi styra verksamheten på ett helt annat sätt.

En person kommer med referenser och kollar allt på en dag, så får vi alla protokoll och allt. Fördelen är att vi inte blir av med allt i flera veckor. Kalibrerar vi små enkla saker, men inom industrin så kan det vara fasta installationer och det behövas ett företag som kan vara på plats.

Det kostar mindre O kan vara det också, men mer praktiska saker. Vi har expertis och utrustning.

Vi har inte expertisen som krävs O
Vi har inte utrustningen som krävs O
Det är inte en huvud kompetens O
Annan….. O

Varför valde ni den firman ni arbetar med, vilka var huvudfaktorerna när ni valde att arbeta med denna firma?

Vilka är de mest positiva aspekterna med det företaget ni arbetar med?

Att man kan lita på att de gör det dem sak göra, både med leveranstid, kvalité kunskap och tid.


Vad skulle kunna förbättras?

Ingenting. Ibland lite långa leveranstider, vi bokar tider.
Skickar ni era mätdon till fler än ett ställe för mätning och/eller kalibrering?

SP, Arios, Multical kommer hit

Hur viktigt är det för er att ni kan mäta alla era mätinstrument på samma ställe?

Många vill samla ihop och skicka iväg till samma, vi väljer vad som funkar bra prismässigt osv.

Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Hur viktigt är det för er att ha möjlighet till direkt reparation/justering om mätdonet inte är godkänt?


Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O kommunikationen är det viktigaste från företaget så att den kan skickas iväg.

Hur viktigt är det att verkstaden har den senaste teknologin?
Det viktigaste är att de löser uppgiften, bryr inte så mycket om teknologin. Så länge de löser uppgiften och har en spårbarhet som man kan lita på. Så hur ofta dem investerar i utrustning vartannat eller 5 år spelar ingen roll.

Väldigt viktigt O  Viktigt O  Någorlunda viktigt O  Inte viktigt O

**Hur högt värderar ni att mätningen kan ske på plats på ert företag med hand-mätdon?**


Väldigt högt O  Högt O  Någorlunda högt O  Värderar det ganska lågt O

**Hur viktigt är det att företaget ni jobbar med kan erbjuda korta ledtider?**

Kan det planeras in bär det ska ske så är det inte jätteviktigt. Det måste göras så att avbrottstiden är så kort som möjligt så är det okej. Överenskommna tider gäller, det är det viktigaste eftersom då behöver dem inte vara korta.

Väldigt viktigt O  Viktigt O  Någorlunda viktigt O  Inte viktigt O

**Om internt:**
Kalibrering och kontrollen av system och referensutrustning görs internt.

Kalibrering och kontroll av referensutrustning.

Varför har ni valt att arbeta med det själva istället för att köpa det externt?

Enklare eftersom vi har kunskapen, hade det bara varit ett tjänsteföretag så hade vi inte gjort det. Enklare smidigare, trygghet. Hade kunskapen, blev enklare i logistiken.

För att ha 100 % kontroll O

För att vi har expertisen, kunskapen O

För att vi har utrustningen O

För att det är en huvudkompetens O

Annan…. O

Vilka faktorer skulle ha högst inverkan om ni istället valde att köpa tjänsten externt?

Säljer ni själva era tjänster externt?

Ja O Nej O

Om ni istället skulle välja att köpa tjänsten externt:

Skulle det vara en viktig faktor att ha möjlighet till direkt reparation/justering om mätdonet inte är godkänt? (slippa skicka mätdonet fram och tillbaka, transportkostnad, tid…)

Skulle det vara en viktig faktor att den externa verkstaden hade den senaste teknologin om ni skulle köpa det extern? (garanterad noggrannhet..etc.)

Skulle det vara en viktig faktor ifall möjligheten fanns att mätningen kunde ske på plats på ert företag? (tid, transportkostnad…)
Intervju guide – Bodycote

Ni säljer alltså tjänster i form av värmebehandlingar, metall sammanbindning.. etc? producerar ni något också?


Hur använder ni er av mätinstrument i ert företag?


I vilket syfte mäter eller kalibrerar ni era mätinstrument?


Hur viktigt är det för er att mätningen eller kalibreringen är noggrann?

Vi har rutiner på hur det ska skötas, med ett schema. Det är lite olika på hur ofta vi gör det.


Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Vad är de absolut viktigaste faktorerna med mätning och kalibrering enligt er?


Noggrannhet O

Att det sker kontinuerligt O

Kvalitén O

Att verkstaden är ackrediterad/certifierad O

Mäter och kalibrerar ni era mätdon internet eller externt?


Endast internt O   Endast Externt O   Båda O

Om externt:

Av vilka anledningar valde ni att köpa tjänsten?


Det kostar mindre O

Vi hade inte expertisen som krävs O

Vi har inte utrustningen som krävs O

Det är inte en huvud kompetens O

Annan….. O
Varför valde ni den firman ni arbetar med, vilka var huvudfaktorerna när ni valde att arbeta med denna firma?


När det gäller vågarna så köpte vi vågen och det blev naturligt att vi köpte tjänsten av dem sedan. När de ändå har den tjänsten. Kändes onödigt att kolla runt och välja en annan firma om de nu erbjöd det.

Vilka är de mest positiva aspekterna med det företaget ni arbetar med?


Vad skulle kunna förbättras?

Inget, nej. Jag tycker det är bra.

Ibland kan man sporadiskt ringa och be en tjänst som inte ligger i ett intervall. Om man köper med intervall förutsätter man att de ringer när det är dags. Det är viktigt att intervallet fungerar som det ska, men det har det gjort.


Skickar ni era mätdon till fler än ett ställe för mätning och kalibrering?


Hur viktigt är det för er att ni kan mäta alla era mätinstrument på samma ställe?


Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Hur viktigt är det för er att ha möjlighet till direkt reparation/justering om mätdonet inte är godkänt?


Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O
**Hur viktigt är det att verkstaden har den senaste teknologin?**


Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

**Hur högt värderar ni att mätningen kan ske på plats på ert företag med hand-mätdon?**


Väldigt högt O Högt O Någorlunda högt O Värderar det ganska lågt O

**Hur viktigt är det att företaget ni jobbar med kan erbjuda korta ledtider?**


Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

**Om internt:**

Can metrology be value-based?
Varför har ni valt att arbeta med det själva istället för att köpa det externt?


_För att ha 100% kontroll  O_

För att vi har expertisen  O

För att vi har utrustningen O

För att det är en huvudkompetens O

_Annan…. O_

Vilka faktorer skulle ha högst inverkan om ni istället valde att köpa tjänsten externt?

-

Säljer ni själva era tjänster externt?

Nej

Ja O  Nej O

Om ni istället skulle välja att köpa tjänsten externt:

Skulle det vara en viktig faktor att ha möjlighet till direkt reparation/justering om mätdonet ej är godkänt? (slippa skicka mätdonet fram och tillbaka, transportkostnad, tid…)

Skulle det vara en viktig faktor att den externa verkstaden hade den senaste teknologin om ni skulle köpa det extern? (garanterad noggrannhet..etc.)
Skulle det vara en viktig faktor ifall möjligheten fanns att mätningen kunde ske på plats på ert företag? (tid, transportkostnad…)

Intervju guide – Adigo Drivers

Vad mäter och kalibrerar ni?
Vi använder mätsystem till 95% av produkterna och har leverantörer som levererar allting.

I vilket syfte mäter eller kalibrerar ni era mätinstrument?
Vi mäter för kvalitén först och främst. Nöjda kunder återkommer, allt har att göra med kvalitén. Det är nästan alltid mycket pengar inblandande så det är även för att spara på kostnader.

Hur viktigt är det för er att mätningen eller kalibreringen är noggrann?

Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O
Ström och spänning är mindre noggrant.

Vad är de absolut viktigaste faktorerna med mätning och kalibrering enligt er?

Noggrannhet O
Att det sker kontinuerligt O
Kvalitén O och kostnader
Att verkstaden är ackrediterad/certifierad O

Annan… O

Vi ställer höga krav på att beställningarna och att dem är av god kvalité, särskilt för motorerna.

Mäter och kalibrerar ni era mätdon internet eller externt?

Endast internt O  Endast Extern O  Båda O

Något enstaka själva.

Om externt:

Av vilka anledningar valde ni att köpa tjänsten?

Tid och kompetens.

Vilka faktorer med att köpa det externt övervägde att göra det internt?

Det kostar mindre O

Vi har inte expertisen som krävs O

Vi har inte utrustningen som krävs O

Det är inte en huvud kompetens O

Annan….. O

Varför valde ni den firman ni arbetar med, vilka var huvudfaktorerna när ni valde att arbeta med denna firma?
Vi arbetar med tre olika företag som alla ligger nära oss och arbetar med olika instrument. SP i Borås använder vi oss av för skjutmått samt mäta vikt moment. Exova Metech anlitar vi för våra multimetrar och innan kalibrerade vi internt, men sedan vi blev självständiga och inte längre är en del av detta företag hyr vi fortfarande tjänsten av dem.

**Vilka är de mest positiva aspekterna med det företaget ni arbetar med?**

Dem levererar de som förväntas.

**Vad skulle kunna förbättras?**

Det skulle kunna gå fortare. Tiden instrumenten är borta är jobbigt eftersom det är dyra uppsättningar.

**Skickar ni era mätdon till fler än ett ställe för mätning och kalibrering?**

Tre olika.

**Hur viktigt är det för er att ni kan mäta alla era mätinstrument på samma ställe?**

Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Det hade underlättat om det var på samma ställe.

**Hur viktigt är det för er att ha möjlighet till direkt reparation/justering om mätdonet ej är godkänt?**
Väldigt viktigt O   Viktigt O   Någorlunda viktigt O   Inte viktigt O

Exova Metech repararar med en gång och det är väldigt praktiskt.

**Hur viktigt är det att verkstaden har den senaste teknologin?**

Väldigt viktigt O   Viktigt O   Någorlunda viktigt O   Inte viktigt O

Det spelar ingen roll. Det viktigaste att det blir gjort och att det blir bra.

**Hur högt värderar ni att mätningen kan ske på plats på ert företag med hand-mätdon?**

Väldigt högt O   Högt O   Någorlunda högt O   Värderar det ganska lågt O

Väldigt smidigt att inte behöva skicka iväg dem. Det bästa är att mäta allting på en gång.

**Hur viktigt är det att företaget ni jobbar med kan erbjuda korta ledtider?**

Väldigt viktigt O   Viktigt O   Någorlunda viktigt O   Inte viktigt O

Jobbigt om det är iväg länge. Så viktigt med led tider.

**Om internt:**

Företag kommer hit eller gör det själva. Ingen kan komma och göra det på plats.
Spänning och ström mäts själv. Vi kalibrerar kräptänger. När vi tillhörde Specma Tools
kalibrerade vi två gånger per år, men nu när vi inte är en del av den gruppen gör vi det en gång per
år. Har även skickat iväg produkter till Mätcentrum, SKF.
Varför har ni valt att arbeta med det själva istället för att köpa det externt?

För att ha 100% kontroll  O
För att det kostar mindre  O
För att vi har expertisen  O
För att vi har utrustningen O
För att det är en huvudkompetens O
Annan…. O

Säljer ni själva era tjänster externt?

Om kunderna vill

Ja O  Nej O

Intervju guide – Specma

Specma producerar slang, kopplingar, packningar och tätningar. Hydraulik heter Specma AB. Specma Seals. Gör tillverkning och köp och sälj packningar och tätningar för tillverkningsindustrin, process industri. Mer inriktad mot eftermarknaden.
I vilket syfte mäter eller kalibrerar ni era mätinstrument?

I syftet för att säkerhetsställa kvalité. Det är oftast ett kundkrav sedan ställer vi krav på leverantörerna. Vi vänder oss till SP i Borås för kalibrering av mätdon, en standard med intervall, skjutmått en gång per år. SP kommer till oss och mäter vågarna.

Hur viktigt är det för er att mätningen eller kalibreringen är noggrann?

Vi har väldigt, våra produkter är kritiska i kundernas applikationer. Om vi levererar produkter som inte är som de borde vara så blir det väldigt stora konsekvenser.

Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Vad är de absolut viktigaste faktorerna med mätning och kalibrering enligt er?

I och med att dem är det så uppfylls dem andra kraven också.

Noggrannhet O

Att det sker kontinuerligt O

Kvalitén O

Att verkstaden är ackrediterad/certifierad O

Annan… O

Mäter och kalibrerar ni era mätdon internet eller externt?

Vi tillverkar en miljon packningar som ska mätas. En tillverknings order med olika operationer. Man ska kontrollmäta första och sista. Ingen certifiering till kunderna, men bara för intern skull. Vi kalibrerar mätningen hos SP.
Can metrology be value-based?

Endast internt O   Endast Externt O   Båda O

Om externt:

Av vilka anledningar valde ni att köpa tjänsten?

Visste att SP var duktiga på sin sak. Fick reda på det via nätet. Vi skötte det internt för några år sedan. Men när den anställda med kompetensen gick i pensionen så valde vi att lägga ut tjänsten externt.

Vilka faktorer med att köpa det externt övervägde att göra det internt?

Det kostar mindre O

Vi har inte expertisen som krävs O

Vi har inte utrustningen som krävs O

Det är inte en huvud kompetens O

Annan….. O

Varför valde ni den firman ni arbetar med, vilka var huvudfaktorerna när ni valde att arbeta med denna firma?

Vi ville ha någon som var erkänt duktig, för att lita på dem. Samt att slippa göra det själva.

Vilka är de mest positiva aspekterna med det företaget ni arbetar med?

De är väldigt noggranna, det går fort. Man skickar in mätdonen och så får man tillbaka det två dagar senare med snygga mät protokoll.
Vad skulle kunna förbättras?

Inte direkt, inte funderat i dem termerna. Vi är väldigt nöjda och har inga speciella synpunkter.

Skickar ni era mätdon till fler än ett ställe för mätning och kalibrering?

Vi skickar bara till SP, undantag vågarna som dem kommer hit för.

Hur viktigt är det för er att ni kan mäta alla era mätinstrument på samma ställe?

Det är enklare att ha en partner att jobba mot, vi strävar efter att ha så få leverantörer som möjligt. Det underlättar administrationen.

Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Hur viktigt är det för er att ha möjlighet till direkt reparation/justering om mätdonet ej är godkänt?


Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Hur viktigt är det att verkstaden har den senaste teknologin?

Det kanske är bra, men inte jätte viktigt.

Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O
Hur högt värderar ni att mätningen kan ske på plats på ert företag med hand-mätdon?


Väldigt högt O Högt O Någorlunda högt O Värderar det ganska lågt O

Hur viktigt är det att företaget ni jobbar med kan erbjuda korta ledtider?


Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Om internt:


Varför har ni valt att arbeta med det själva istället för att köpa det externt?

För att ha 100% kontroll O

För att det kostar mindre O

För att vi har expertisen O

För att vi har utrustningen O

För att det är en huvudkompetens O
Annan…. O

Vilka faktorer med att ha det internt övervägde att köpa det externt?

Vilka faktorer skulle ha högst inverkan om ni istället valde att köpa tjänsten externt?

Dokumentation, snabbhet.

Säljer ni själva era tjänster externt?


Ja O Nej O
Intervju guide – Företag X

Vi har förstått att ni tillverkar och säljer alltså olika typer av system, mestadels kommunikationssystem, men också larmsystem osv.?

Tillverkar telefoni och en del lösningar för sjukhus, kommunikation för sjuksköterskor, fängelser och hotell. Det får inte bli några bristningar i den kommunikation. Vi har tre produktionsorter, en i Z med lägre volymer men större variantflora och en mer avancerad tillverkning.

Till vilka av produkterna använder ni mätinstrument under tillverkningen?

Vi mäter allt som vi tillverkar, all elektronisk utrustning. Vi ska kunna mäta strömmen på telefonerna, mäta med spänningsreglementet. Vi bygger upp produkten så den kan testas i olika
system. Vi provar under processen, från funktion till hur mycket den drar på batterier. Radiomätningar, hur känslig den är, hur bra ljud den tar upp radiosignaler etc.


I vilket syfte mäter eller kalibrerar ni era mätinstrument?


Hur viktigt är det för er att mätningen eller kalibreringen är noggrann?


Finns en grad, beror på vad man mäter. Inte så noga ibland om det är jätte känsligt. Måste vara inom intervallet.
Väldigt viktigt O   Viktigt O   Någorlunda viktigt O   Inte viktigt O

Vad är de absolut viktigaste faktorerna med mätning och kalibrering enligt er?


Noggrannhet O

Att det sker kontinuerligt O

Kvalitén O

Att verkstaden är ackrediterad/certifierad O

Annan… O

Mäter och kalibrerar ni era mätdon internet eller externt?

Kalibrerar skruvdragare själva, har den utrustning som vi använder som sedan kalibreras av någon annan. Kalibrerar termometrar som sedan kalibreras hos leverantören. Både internt och externt, kalibrerar i organisationen plus att vi skickar ut för extern kalibrering och tar in externa partner till vår produktion för kalibrering.
I Härljunga kalibreras mellan 5-600 instrument per år som de kalibreras på plats hos dem. 150 skruvdragare som kalibreras internt, månadvis upp till 3 månaders intervall. Börjar med veckointervall för att samla på mätdata. Måste ha en justifikation på intervallet.

Endast internt O    Endast Externt O    Båda O

Om externt:

Av vilka anledningar valde ni att köpa tjänsten?


Vilka faktorer med att köpa det externt övervägde att göra det internt?


Det kostar mindre O

Vi har inte expertisen som krävs O

Vi har inte utrustningen som krävs O

Det är inte en huvud kompetens O
Annan..... O

Varför valde ni den firman ni arbetar med, vilka var huvudfaktorerna när ni valde att arbeta med denna firma?

Sen vi började kalibrera sen 90-talet, de kan våra instrument och känner till vår fabrik etc. Har varit nästan samma personer som kalibrerat hela tiden.

Vilka är de mest positiva aspekterna med det företaget ni arbetar med?

Att de är kända, haft en bra relation länge och vi känner varandra. Vi litar på att det dem för håller den klassen som vi vill ha.

Vad skulle kunna förbättras?


Skickar ni era mätdon till fler än ett ställe för mätning och kalibrering?

De kom och fixade det på företaget. En handfull instrument skickas till andra ställen. Dels saker som de inte kalibrerar och för att man har köpt ett instrument med ett upplägg på kalibrering.

Hur viktigt är det för er att ni kan mäta alla era mätinstrument på samma ställe?

Försöker köra så mycket som möjligt på samma ställe. Väldigt smidigt.

Mycket instrument som kostar väldigt mycket pengar, mycket som simulerar en telefon som ligger på runt 250-400 000. Själva kalibreringen ligger på runt 5000 spänn per tillfälle. Jobb på ungefär en till en och en halv timme.

Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O
Hur viktigt är det för er att ha möjlighet till direkt reparation/justering om mätdonet ej är godkänt?


Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Hur viktigt är det att verkstaden har den senaste teknologin?


Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Hur högt värderar ni att mätningen kan ske på plats på ert företag med hand-mätdon?


Väldigt högt O Högt O Någorlunda högt O Värderar det ganska lågt O

Hur viktigt är det att företaget ni jobbar med kan erbjuda korta ledtider?

Väldigt viktigt O  Viktigt O  Någorlunda viktigt O  Inte viktigt O

Om internt:

Varför har ni valt att arbeta med det själva istället för att köpa det externt?

Lite temperatur och moment själva, lite luftfuktighet.


Intervallet hade behövt bli högre och det hade kostat för mycket om någon annan skulle göra. Och vi har utrustningen så kostnaden blir itne så hög för oss.

För att ha 100% kontroll O

För att det kostar mindre O

För att vi har expertisen O

För att vi har utrustningen O

För att det är en huvudkompetens O

Annan…. O
Vilka faktorer med att ha det internt övervägde att köpa det externt?

-

Vilka faktorer skulle ha högst inverkan om ni istället valde att köpa tjänsten externt?


Säljer ni själva era tjänster externt?

Bara för eget bruk.

Ja O Nej O

Intervju guide – PMC

Tillverkar pumpar, motorer, transmissioner, växlar, ventiler, hydraulcylinder, hydrauliska styrenheter, filter, pumpaggregat, hydraulaggregat och ventillblock.

Ni utför mätning på hydrauliska tryck och flöden, i produktion och felsökning på fält skrev du till mig. Är det en tjänst ni erbjuder era kunder då?

Vi åker ut och gör felsökningar men säger inte att ”nu kalibrerar vi era grejer”.

7-162
Ni använder er då av en typ av mätinstrument för att mäta trycken och flödena?


När man kollar mätare, ligger mätaren i rätt viskositet.

I vilket syfte mäter eller kalibrerar ni era mätinstrument?

Syftet med att kalibrera är att vara säker på att vi levererar rätt produkt. Vara säker på att det är vad kunden vill ha. Och så står det ju i våra instruktioner att vi ska göra det.

Hur viktigt är det för er att mätningen eller kalibreringen är noggrann?


Ges ibland ut kalibreringscertifikat. SE märkning, att det är så säkert som kunden vill ha det. För marin kan ett ackrediteringsföretag komma och kolla sakerna. Kundkrav, marknadskrav och regler.
Det är viktigt att vi vet att det mäter rätt. 90% av kalibreringarna eller med så godkänns instrumentet.

**3% till 0,05 % noggrannhet.**

**Väldigt viktigt O  Viktigt O  Någorlunda viktigt O  Inte viktigt O**

**Vad är de absolut viktigaste faktorerna med mätning och kalibrering enligt er?**

Att verkstaden är certifierad eller ackrediterad är viktigt eftersom annars finns det kunder som inte vill ha med en att göra annars. I process instruktionerna står det hur ofta det ska ske med kalibrering.

Leverantören som kommer och mäter stora mätmaskiner. Men för att kunna bli ackrediterad behöver man noggrannhet och kontinuerlighet.

Noggrannhet O

Att det sker kontinuerligt  O

Kvalitén O

Att verkstaden är ackrediterad/certifierad O

Annan… O

**Mäter och kalibrerar ni era mätdon internet eller externt?**

Likare skickas iväg externt, i övrigt så är det externt.

Men maskinerna skickas iväg till leverantören för årlig kalibrering.
Om extern:

Av vilka anledningar valde ni att köpa tjänsten?


Likare som används för momentnycklarna skickas vart femte år. Vi håller på att kolla över intervallerna. Maskinen används mer med fler momentnycklar. Att varje bänk ska kalibreras varje morgon. Två mutterdragare som kalibreras, för volvoblocken. Det görs varannan morgon. Vi är konstant på jakt för bättre utrustning, för att få det mer noggrant i mätningen. 3 % till 0,05 % i noggrannhet på mätningarna just nu.

Det kostar mindre O

Vi har inte expertisen som krävs O

Vi har inte utrustningen som krävs O

Det är inte en huvud kompetens O

Annan….. O

Varför valde ni den firman ni arbetar med, vilka var huvufaktorerna när ni valde att arbeta med denna firma?

Can metrology be value-based?
Det är enklare med leverantörerna, det var en prisfråga.

**Vilka är de mest positiva aspekterna med det företaget ni arbetar med?**

Man väljer ett företag för pris, snabbhet och support. Man vill ha tillbaka sakerna fort.

**Vad skulle kunna förbättras?**

Tidsfrågan att det kan gå lite fortare.

**Skickar ni era mätdon till fler än ett ställe för mätning och kalibrering?**

Vi har en del olika leverantörer.

**Hur viktigt är det för er att ni kan mäta alla era mätinstrument på samma ställe?**


Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

**Hur viktigt är det för er att ha möjlighet till direkt reparation/justering om mätdonet ej är godkänt?**

Det underlättar, det man kan reparera är det bra att ha möjligheten till att göra det direkt, då går det snabbare. En partikelräknare tar ungefär en månad att göra, jobbigt om den är iväg så pass länge.
Can metrology be value-based?

Välldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Hur viktigt är det att verkstaden har den senaste teknologin?

Inte så noggrant, bara det kommer tillbaka rätt saker. Man kan snabbt se på ett företag om de levererar bra saker, är det snyggt och rent och hyfsat modernt så hänger det ihop.

Välldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Hur högt värderar ni att mätningen kan ske på plats på ert företag med hand-mätdon?


Välldigt högt O Högt O Någorlunda högt O Värderar det ganska lågt O

Hur viktigt är det att företaget ni jobbar med kan erbjuda korta ledtider?

Snabbhet är viktigt, kommer med korta ledtider. Beror lite på vad det är, likare är mindre viktigt. Partikelräknare mer viktigt.

Välldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O
Om internt:

Varför har ni valt att arbeta med det själva istället för att köpa det extern?

För att ka kontrollen.

För att ha 100% kontroll O

För att det kostar mindre O

För att vi har expertisen O

För att vi har utrustningen O

För att det är en huvudkompetens O

Annan…. O

Vilka faktorer med att ha det internt övervägde att köpa det extern?

Kontroll igen.

Vilka faktorer skulle ha högst inverkan om ni istället valde att köpa tjänsten extern?


Säljer ni själva era tjänster extern?

Kan finnas, indirekt i felsökningstjänsterna.
Om ni istället skulle välja att köpa tjänsten externt:

Skulle det vara en viktig faktor att ha möjlighet till direkt reparation/justering om mätdonet ej är godkänt? (slippa skicka mätdonet fram och tillbaka, transportkostnad, tid…)

Skulle det vara en viktig faktor att den externa verkstaden hade den senaste teknologin om ni skulle köpa det extern? (garanterad noggrannhet..etc.)

Skulle det vara en viktig faktor ifall möjligheten fanns att mätningen kunde ske på plats på ert företag? (tid, transportkostnad…)

Intervju guide – OLDA innovation

Till vilka av dessa produkter använder ni mätinstrument?

All produktion, många olika moment. I varje delmoment i tillverkning som mäts på olika sätt beroende på noggrannhet. Först beställer man materialet och kontrollerar det, mäter det alltså. Ifall man måste bearbeta ytan eller inte.

Manuell bearbetning, CNC bearbetning, svets och montering. Små processer i varje del måste man mäta upp det inkommande materialet efter de olika bearbetningarna och även en slutkontroll och eventuellt vid montering om där är flera detaljer. Eventuellt efter ytbehandling och värmebehandling.

I vilket syfte mäter eller kalibrerar ni era mätinstrument?


Hur viktigt är det för er att mätningen eller kalibreringen är noggrann?

Vi delar upp det lite, vi säger att kalibreringen är antingen iväg lämnad som skjutmått och mikrometrar etc.

Nu testar vi att kalibrera själva efter passbitar om det är inom en viss tolerans. Och där bedömer vi om det är godkänt.


Väldigt viktigt O  Viktigt O  Någorlunda viktigt O  Inte viktigt O
Vad är de absolut viktigaste faktorerna med mätning och kalibrering enligt er?


**Noggrannhet O**

Att det sker kontinuerligt O

Kvalitén O

Att verkstaden är ackrediterad/certifierad O

Annan… O

**Mäter och kalibrerar ni era mätdon internet eller externt?**

Vi gör nu allt internt. Har precis gjort listorna och börjat med mätningen. Innan skedde det externt.

**Endast internt O**  **Endast Externt O**  **Båda O**

**Om externt ( Förut):**

Av vilka anledningar valde ni att köpa tjänsten?
När vi köpte det externt var det dels för att uppfylla ISO kraven och för spårbarhet mot godkända toleranser, standarder och ackreditering. Fick intyg från varje instrument, mätvärden blev sparade etc. Sparade tid, och man slipper göra det själva.


Det kostar mindre O

Vi har inte expertisen som krävs O

Vi har inte utrustningen som krävs O

Det är inte en huvud kompetens O

Annan..... O

Varför valde ni den firman ni arbetar med, vilka var huvudfaktorerna när ni valde att arbeta med denna firma?

Pris, leveranstid, systemet om vi fick intyg om de lagrade, offert som gällde. Och själva systemet. Har haft två tre olika de senaste fyra, fem åren.

Vilka är de mest positiva aspekterna med det företaget ni arbetar med?

Gör det ju som sagt intern just nu

Vad skulle kunna förbättras?

Något gick i konkurs, någon hade för lång leveranstid etc.
Skickar ni era mätdon till fler än ett ställe för mätning och kalibrering?

Hela tiden ett företag åt gången.

Hur viktigt är det för er att ni kan mäta alla era mätinstrument på samma ställe?

Mest för att få ner fraktkostnad och administrationen. Få det presenterat på samma lista. Enklast så,

Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Om internt (Just nu):

Varför har ni valt att arbeta med det själva istället för att köpa det externt?

Mest vanliga skjutmått, mikrometrar och sådant. Så det handlade om kostnaden, leveranstiden och för att slippa skicka iväg dem.

För att ha 100% kontroll O

För att det kostar mindre O

För att vi har expertisen O

För att vi har utrustningen O

För att det är en huvudkompetens O

Annan…. O
Vilka faktorer skulle ha högst inverkan om ni istället valde att köpa tjänsten externt?

Pris och leveranstid. Att de uppfyller standarden och mät-noggrannheten. Vi hade nog valt ett företag som är ackrediterat.

Säljer ni själva era tjänster externt?

Bara för oss själva.

Ja O Nej O

Om ni istället skulle välja att köpa tjänsten externt:

Skulle det vara en viktig faktor att ha möjlighet till direkt reparation/justering om mätdonet ej är godkänt? (slippa skicka mätdonet fram och tillbaka, transportkostnad, tid…)


Skulle det vara en viktig faktor att den externa verkstaden hade den senaste teknologin om ni skulle köpa det extern? (garanterad noggrannhet..etc.)

Bara vi får intyg och det mäter efter rätt standard så är det inte viktigt.
Skulle det vara en viktig faktor ifall möjligheten fanns att mätningen kunde ske på plats på ert företag? (tid, transportkostnad…)

Det är små verktyg så är det lätt att skicka iväg så det är inte speciellt viktigt.

Skulle det vara en viktig faktor om företaget erbjöd korta ledtider?

Vissa mätverktyg har vi i begränsad upplaga så det är viktigt att få tillbaka dem fort. Men allt handlar om pris och leveranstid.

Intervju guide – Daros piston rings

Ni tillverkar alltså kolvringer som används i motorer?


Inom er tillverkning så använder ni mätinstrument för att mäta till exempel ytan på ringen då?

Man mäter på varje operation, kontroll och allt sådant. Specifikt för varje operation. Ingen slutkontroll.

I vilket syfte mäter eller kalibrerar ni era mätinstrument?

**Hur viktigt är det för er att mätningen eller kalibreringen är noggrann?**


Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

**Vad är de absolut viktigaste faktorerna med mätning och kalibrering enligt er?**


Noggrannhet O

Att det sker kontinuerligt O

Kvalitén O

Att verkstaden är ackrediterad/certifierad O

Annan… O
Mäter och kalibrerar ni era mätdon internet eller externt?

Intern: Bladmått, mikrometer, skjutmått, skikttjockleksmätare, errormätare, lära (nominella diameter, som vi kontrollerar öppningen mot) mikrometer stickmått, som mäter långt invändigt. Indikatorklockor. Det är väll det vi gör internt på det stora hela.

Extern: Mikrokatorklocka, passbitar, längdmätninginstrument som jag själv använder när jag kalibrerar.

Endast internt O  Endast Externt O  Båda O

Om externt:

Av vilka anledningar valde ni att köpa tjänsten?


Det kostar mindre att skicka iväg det än att investera i det väger tyngst. Att vi gör det i så liten utsträckning, så att upprätthålla det känns inte värt det. Vi kalibrerar det som vi använder frekvent, hela tiden.

Det kostar mindre O

Vi har inte expertisen som krävs O

Vi har inte utrustningen som krävs O

Det är inte en huvud kompetens O
Varför valde ni den firman ni arbetar med, vilka var huvudfaktorerna när ni valde att arbeta med denna firma?


Vilka är de mest positiva aspekterna med det företaget ni arbetar med?


Vad skulle kunna förbättras?

Skickar ni era mätdon till fler än ett ställe för mätning och kalibrering?


Hur viktigt är det för er att ni kan mäta alla era mätinstrument på samma ställe?


Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Hur viktigt är det för er att ha möjlighet till direkt reparation/justering om mätdonet inte är godkänt?


Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Hur viktigt är det att verkstaden har den senaste teknologin?

Det är egentligen inte viktigt så länge de uppfyller standardkraven. Bryr mig inte om de mäter för hand eller med mätmaskin. Egentligen ovidkommande bara man uppfyller kraven om vad som ska göras.

Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

Hur högt värderar ni att mätningen kan ske på plats på ert företag med hand-mätdon?

Can metrology be value-based?

de kom hit och gjorde mikrometrarna det blir en helt annan servicegrad på att vi utför det själva. Jag kan göra saker själv,


Väldigt högt O Högt O Någorlunda högt O Värderar det ganska lågt O

**Hur viktigt är det att företaget ni jobbar med kan erbjuda korta ledtider?**


Väldigt viktigt O Viktigt O Någorlunda viktigt O Inte viktigt O

**Om internt:**

**Varför har ni valt att arbeta med det själva istället för att köpa det externt?**

mikrometer som mäter tjocklek med större tolerans. Lite olika beroende på användningsområde. På vissa saker mäter vi ofta för att vara på den säkra sidan.


För att ha 100% kontroll  O
För att det kostar mindre  O

**För att vi har expertisen**  O

För att vi har utrustningen O
För att det är en huvudkompetens O
Annan…. O

**Vilka faktorer skulle ha högst inverkan om ni istället valde att köpa tjänsten externt?**


**Säljer ni själva era tjänster externt?**

Nej, har aldrig gjort. Det är inget jag tror vi vill göra heller.

Ja O Nej O
Can metrology be value-based?
Appendix D – Interview answers in English

Interview ELOS Fixturlaser

We measure the applications that are out there in industry. We must submit a calibration certificate every time a customer needs calibration.

We have 4 systems, 2 in Mölndal. We are number one or two in the world. We SEK 114 million last year. 2011th Do the structures of the systems themselves. Just own sales in Sweden. 70-80 countries represented in all countries. Production, purchasing and service. Repair of the systems in place. Larger distributors around the country so they can do the calibration. Products are characterized by ease of use, based on the person doing the job. 1 software with symbols rather than language. Pumps in paper mills, power plants. Process industry. Buys a bag with everything needed for measuring. Driver's own development, to generate profits to drive development. Number of systems manufactured 5000 of the different variants, the largest number of an individual product 1-1500

If the systems are used then less spare parts are needed and repairs. Things don’t drop are take up unnecessary energy.

If a pump brakes down in a paperfactory unexpected = 100 000 in costs over ten minutes.

1. For what purpose do you measure or calibrate your instruments?

As we manufacture and deliver a measurement system we need to know that it will measure what it intends to measure. The client also needs to know that the measurement system measures what it intends to measure. If a client uses a measurement instrument or system that shows the wrong numbers it could potentially break the products. There is an aftermarket, since we recommend that
you calibrate yearly it needs to be turned in to ensure the quality. And many clients want that too, often you have a quality system within the company where you control the requirements and you need to have a standardised measurement then. The measurement instrument needs to be checked according to the ISO certification. When they come to check if you uphold the calibrations for the certification they see if you have calibrated regularly. If the instruments have been used regularly they need to be calibrated more often. The distributors do the calibration locally. And for Fixtur it eventually leads to more sales as we can calibrate for our customers.

2. How important is it for you that the measurement or calibration is accurate?

For us it is very important. Since the measurement is taken in micrometre and needs to be very accurate. Technically it is measured in hundredths but the measurement will show thousandths as well and the customer can require a measuring of thousandths. There has been some debates on why you would have a measurement that would measure thousandths, but when the purchasers decide they rather choose one that can measure thousandths. But there are applications that require a measurement of thousandths. And thousandths is also a proof that you have accurate equipment. We need accurate measurement systems.

**Very important**  Important  Somewhat important  Not important

3. What do you consider to be the most important factors when it comes to measurement and calibration?

When we want our systems controlled we go after accreditation and calibration. We try to use an accredited company as much as we can. From the supplier such as SP you receive a protocol that is related to an international standard and that has traceability. You receive a measurement protocol that shows everything you need. We refer to SPs protocol when our clients ask about our traceability. Accreditation gives a sense of security and trust. It is also important that we can give our customers a certification of the calibration and relate it to the calibration made by SP. We don’t check if the information received by SP is correct we trust that it is due to there accreditation the same way our clients trust as because we are ISO certified.

Accuracy

That it happens continuously

Quality

**That the workshop is accredited/ has a certification**
4. Do you measure and/or calibrate internally or externally?

Both. We have a person working with checking the systems that also checks our measurement instruments when we can do it ourselves. Then we have some measurement instruments that we send away to get the traceability to international and national standards and ensure the accuracy. For example the length measurement instruments that we then use to check our own rigs. It gets send away to be controlled every 6 months They get send away to SP and Arios, but we also have a person from Multical that come to our facility and check the instruments with references.. The rest we do internally. Either we do it here at Fixtur or the distributors out in the different countries. The distributors put up a service station.

Internally only

Externally only

Both

Externally:

5. For what reasons did you decide to purchase the service?

From practical reasons, we have the knowledge and competence in the company with our control systems and how they work. We want to do it on special occasions when we are not producing. It is easier to do it that way. During the periods when we are not producing we send the references away to get the traceability, as we don’t need to check our instruments during that time. It allows us to control the activities in a certain way. We have a person coming with his references to check everything on one day, giving us all the protocols and papers. That is an advantage as we don’t need to send everything away for weeks. Practical reasons as explained above. It was also due to that it cost less, but mostly because of the practical reasons. We have the expertise and the equipment.

It costs less

Did not have the expertise

It is no a core competency

Other, if other please explain
6. For what reasons did you choose to work with the company you are working with, which were the main factors?

SP is where all calibration comes from in Sweden basically. It is where it started and it is where the national and international standards are set. They had monopoly on the references from the beginning. We also send our lasers to SP to get them classified to the correct level, they are the only ones that can do that. We need to have them classifies as class 2 as class 3 is illegal. And Multical was given a trial a couple of years back and proved that they were reliable and its convenient that he comes and does it all on the same day. We also send a couple of things to Arios.

7. What are the positive aspects of the service and the service provider?

That they are trustworthy and do what they are supposed to do. They have a good delivery time, they have the quality, they have the knowledge and time. Sometimes you have to try new things. We tried Mutlical a couple of years back and have continued. We normally try with new suppliers, it doesn’t have to be SP, there are so many good suppliers in Sweden. You have to try if you think it works good and evaluate.

8. What could be improved with the service from your point of view?

Nothing, sometimes the delivery time is a bit long only. But we book appointments.

9. Do you send the measurement instruments to more than one company for measurement and/or calibration?

Yes, to two different: SP and Arios and then Multical come to us

10. How important is it to be able to send all the measurement instruments to the same company instead of several?

Many companies want to collect all their instruments and send to the same company, but not us. We choose what works for us, both practically and when it comes to price. Therefore it is not that important if they all are sent to the same place.

Very important O Important O Somewhat important O Not important O

11. How important is it to have the possibility of direct reparation/adjustment of an unapproved measurement instrument?
Normally our instruments and systems don’t need to be adjusted or repaired so it is not an important issue. It could have been important if the calibration was very unique. The communication from the supplier if anything is wrong with the instrument is the most important part. Normally it works all the way, it is very rare that anything brakes down. If it brakes down it is put as inactive and get sent to the supplier.

Very important O  Important O Somewhat important O  Not important  O

12. How important is at that the service provider has the latest technology?

The most important thing is that they solve the task, not how they do it. They need to do what they are supposed to and have traceability in it. How often they invest in new equipment does not matter it can be every other or every fifth year.

Very important O  Important O Somewhat important O  Not important  O

13. How important is the possibility of having the measurement/calibration taking place at your own facilities?

When Multical comes he does 20-30 units at the same day, otherwise we wouldn’t have a measurement instrument on the facility if we had to send them away. Therefore it is very important.

Very important O  Important O Somewhat important O  Not important  O

14. How important is it that the company offers short lead times?

If the calibration is scheduled after interval it is not very important that they have short lead times. It should be scheduled so the time the instrument is away is as short as possible. There has to be an agreement of the times so that the time where the measurement instrument is not working is as short as possible.

Very important O  Important O Somewhat important O  Not important  O

Internally:
15. For which reasons did you choose to use it internally instead of purchasing it externally?

The calibration and control of the systems and the reference equipment is made internally. And it is easier to do internally as we have the knowledge, it is more flexible when it comes to the logistics and feels safer. If we were only a sales company we would probably only purchase it externally.

To have complete control
Because it cost less
**Because we have the expertise**
We consider it to be a core competency
Because we have the equipment
Other…

16. Which factors would have the highest influence if you were considering purchasing it externally?

- 

17. Do you sell your measurement/calibration services externally?

We used to sell our services externally but it was hard with the schedule as it needed to be done over weekends and nights. So we chose to shut down that part of the business.

*Question 9-12 of the internal part were not asked as they were answered in the external part*
Interview guide Poseidon

For our products we measure components. Measuring is a part of the process. We measure during the manufacturing process, in the end of the process as a control or testing and also for product development.

For what purpose do you measure or calibrate your instruments?

We calibrate for the purpose to know if the instruments are correct.

We measure for the purpose to control and handle processes, to verify and receive a good and accepted test result for documentation.

How important is it for you that the measurement or calibration is accurate?

This depends on the different products. Sometimes it has to be very accurate and sometimes not. We have measurement analysis for this. It is still important is that you can trust the outcome of the measurement result to 100%.

Very important O Important O Somewhat important O Not important O

What do you consider to be the most important factors when it comes to measurement and calibration?

The workshop has to be accredited if we are going to use it.

Accuracy O
That there is continuous O
The quality O
The workshop is accredited / certified O
Other ... O
Do you measure and/or calibrate internally or externally?

Endast internt O  Endast Externt O  Båda O

Omr externt:

For what reasons did you decide to purchase the service?

For traceability reasons and to know that everything is working correct.

Which factors of purchasing it outweighed the option to use it internally?

We need it for traceability reasons

For what reasons did you choose to work with the company you are working with, which were the main factors?

We send our geometry parts to SP. The other measurement tools are usually sent to the supplier.

What are the positive aspects of the service and the service provider?

The have the knowledge of the instruments that we use. We think that SP have good lead times and are easy to work with. They are price worthy. Normally to choose from references or from what you know.

What could be improved?

Everything can have better price and be quicker, but we are satisfied.
Do you send the measurement instruments to more than one company for measurement and/or calibration?

We send to three suppliers, from where we originally purchased the tools from and also to SP.

How important is it to be able to send all the measurement instruments to the same company instead of several?

Very important O Important O Somewhat important O Not important O

How important is it to have the possibility of direct reparation/adjustment of an unapproved measurement instrument?

Very important O Important O Somewhat important O Not important O

How important is it that the service provider has the latest technology?

For us and for our kind of instrument it is not of great importance

Very important O Important O Somewhat important O Not important O

How high do you value that the measurement can be done on site at your company with hand gauges?

For some of our instruments it is crucial, for the scales as an example. There is no other way to measure them, as you risk damaging them during the transportation. For some other instrument is completely unnecessary.

Very important O Important O Somewhat important O Not important O

How important is it that the company offers short lead times?
It is not that important if you have a successful calibration planning

Very important O  Important O  Somewhat important O  Not important  O

If internally:

For which reasons did you choose to use it internally instead of purchasing it externally?

The instruments gives the accuracy that we require and it becomes more pricy to send them of frequently. It was the most simple option and less to handle to do it ourselves.

To have complete control  O

Have the expertise  O

We consider it to be a core competency  O

It costs less O

Other O

Which factors would have the highest influence if you were considering purchasing it externally?

We have already made our strategy so I can’t think of it that way. The choice is made.

Do you sell your measurement/calibration services externally

Yes O  Nej O
Interview guide Bodycote

Bodycote is the world’s largest and most respected provider of thermal processing services. These services are a vital part of any manufacturing process and include: Heat Treatments, Metal Joining, Hot Isostatic Pressing, Metallic, Ceramic, Cermet and Organic Coatings.

1. **For what purpose do you measure or calibrate your instruments?**
   You calibrate to get the correct value of the instruments that you use. Both for us and for the customers. A calibration is a guarantee that what you sell is correct. For one part that is to know that they process choice is right as it needs to be calibrated several times a day. It is done to ensure the quality. It is our responsibility that we have the right quality and that it is at the correct PH level.

2. **How important is it for you that the measurement or calibration is accurate?**
   It is very important. If you don’t handle the calibration part correctly you change the base value. The base value need to be corrected as it changes when you use the instrument often. We have a schedule of how to handle that. We calibrate the PH on the process selections before every PH measurement is done. So it is important that everything is correct and that we can be ensured of that.

3. **What do you consider to be the most important factors when it comes to measurement and calibration?**
   Everything ends up in quality as it is what we want and what the customers want. Bodycote is ahead in Sweden and I think that has something to do with that we measure and calibrate a lot and that it is accurate. Accuracy is also important and the measurement and calibrations made at Bodycote need to be accurate. However everything has a price and often the companies cut quality to save money.
4. **Do you measure and/or calibrate internally or externally?**

   We mostly measure and calibrate internally. We have people coming in sometimes to do the base calibration to ensure the accuracy. But that is not for the daily calibration. It is an authorised company that comes and does a measurement or calibration and makes sure that the values of the instruments are correct, it happens about once a year. But we can handle most of the instruments on our own as they are simple. The PH gauges get old and get replaced. It is only the large measurement machines that need external help.

**Externally**

5. **For what reasons did you decide to purchase the service?**

   We can do the daily calibrations on our own. But if we do the calibration on our own it doesn’t mean that it is correct. The instrument can be incorrect. It is to ensure the accuracy of the instrument. Some instruments have mechanical parts that need to function, they are not all electrical. It is basically to ensure the function.

6. **For what reasons did you choose to work with the company you are working with, which were the main factors?**

   It was because we purchased it from the company and it felt naturally to use their service afterwards. Both when it comes to the spectrophotometer and the scale. We made an agreement that included calibration. It felt unnecessary to look for another firm when the supplier offered the calibration.

7. **What are the positive aspects of the service and the service provider?**
We do not understand the result of the calibration. But we receive a measurement protocol, it means that it is reliable. You assume that they know what they do. That they have a clear protocol so that you can easily read what the status of the instrument you measured were and that it was inside the tolerance level.

8. **What could be improved with the service from your point of view?**

Nothing really. At this service we can sometimes sporadically call about a service that is not in an interval. If you purchase the service with intervals you assume that they will call when it is time. And then it is important that the interval works correctly, but that has worked well for us.

There are many things that need to be checked according to the law, with Conveyors. It has happened that it has not been uphold, that the period have expired. A lot of the machines have an interval of a year and it is not always so that we put them out. It is pretty serious when the things you use are not functioning. Some check ups expires which leaves the machines just standing. But the check ups are not that important for small instruments, it’s more of a routine job because we want to.

9. **Do you send the measurement instruments to more than one company for measurement and/or calibration?**

For the scale they come to our company and measure, with different weights that they compare to what the scale says. For the other thins we use the same company for all.

10. **How important is it to be able to send all the measurement instruments to the same company instead of several?**

It would definitely not be a disadvantage or a drawback as you have a certain dialog and knowledge. If you have too many you don’t get that closeness. But we don’t have that many things that we send out for external calibration so it doesn’t matter that much to us.
11. How important is it to have the possibility of direct reparation/adjustment of an unapproved measurement instrument?

We hardly notice if something would be wrong with the instrument, it would be if we get a strange number on something we measure a lot, something that would be unrealistic. It depends on what you measure, we don’t measure tenths so it doesn’t matter if there is a difference in half a tenth. But sometimes the PH can run odd, then you troubleshoot and check and make sure that it is correct again.

12. How important is at that the service provider has the latest technology?

It is not that important. There is a certain technology for the measurement instrument that you use. You don’t need a new technology just for the calibration. The development of that instrument makes the technology develop further. You can notice that on some measurement machines that have been there for ten years. As the machine is that old they cannot adjust it anymore, they can measure but not adjust it.

13. How important is the possibility of having the measurement/calibration taking place at your own facilities?

It’s a clear advantage that it can be done at the facilities. Most of it is done here, it saves a lot of resources and instruments that are sensitive don’t get hurt during transportation. If there is the possibility to have it done here we prefer it.

14. How important is it that the company offers short lead times?

It is not that important for us. We have a good planning a head when it comes to calibration, it has to be taken into account in good time. In all industries speed is something good, it is a competitive factor for a company. But it is not so important when it comes to measurement instruments and calibration.
Internally:

5. For which reasons did you choose to use it internally instead of purchasing it externally?

It happens continuously with easy methods. There is not a large degree of difficulty in doing it on our own. We don’t need external help with it. The more you can do on your own the better and cheaper it gets. And it is easier to do it on your own, then you can control it in a completely different way and you know the results.

6. Which factors would have the highest influence if you were considering purchasing it externally?

–

7. Do you sell your measurement/calibration services externally?

No
Interview guide – Adigo drives

1) For what purpose do you measure or calibrate your instruments?

The main reason is to ensure the quality standard. That it delivers the right expected quality to our customers which results in customer satisfaction and future work. Other reason is to save potential reclamation costs.

2) How important is it for you that the measurement or calibration is accurate?

Very important O Important O Somewhat important O Not important O

We have no need of measurement accurate to micrometres. Regarding measure of voltage and power it does not have to be extremely accurate.

3) What do you consider to be the most important factors when it comes to measurement and calibration?

The calibration is related to quality and costs. We also demand high quality standard from our own distributors. If we receive an order after 8-12 weeks and if the product is not correct it will result in high cost. Therefore the main issue is the quality of what we offer.

Accuracy O
That it happens continuously O

Quality O
That the workshop is accredited/ has a certification O
Other..O

4) Do you measure and/or calibrate internally or externally?
Almost all calibration is carried out externally, but not all. What we have the capacity and competence for we do ourselves.

Internally only  O  Externally only  O  Both  O

If externally:

5) For what reasons did you decide to purchase the service?

For lack of competence and to save time.

It costs less  O

Did not have the expertise  O

It is no a core competency  O

Other  O, if other please explain:

6) Which factors of purchasing it outweighed the option to use it internally?

Lack of competence and time issue.

7) For what reasons did you choose to work with the company you are working with, which were the main factors?

We work with three different companies that carry out calibration. They are all near by and carries out different sort of calibration. SP – Borås calibrates but they do not offer multimeters for example so for this service we are working with Exova Metch Before we did calibration internally but when Adigo drivers became an individual company we still choose to use this calibration service from this company.
8) What are the positive aspects of the service and the service provider?

That they do what we ask for and deliver what we expect.

9) What could be improved with the service from your point of view?

It could go faster. We are a small businesses, many of the instruments are expensive and when it is sent, it must go fast.

10) Skickar ni era mätdon till fler än ett ställe för mätning och kalibrering?

Three different companies.

11) How important is it to be able to send all the measurement instruments to the same company instead of several?

It would have been convinient to send all the instruments to one place.

Very important O Important O Somewhat important O Not important O

12) How important is it to have the possibility of direct reparation/ adjustment of an unapproved measurement instrument?

This would be very appreciated and convenient as it would result in less work for us. Excova metch does this and it is very practical.
13) How important is it that the service provider has the latest technology?

This is not important. As long as it reaches up to our expected standard I don’t care about what technology that is used.

14) How important is the possibility of having the measurement/calibration taking place at your own facilities?

For some parts it would really make a big difference and it is always easier to calibrate at our own facilities.

15) How important is it that the company offers short lead times?

It becomes an issue if it takes to long time.

Interview Guide - SPECMA
We measures the incoming products and the flow. Uses primarily calipers and rulers. Hardness gauge metal packaging.

**For what purpose do you measure or calibrate your instruments?**

We use it to ensure quality. We have a certain tolerance range and it is essential that we meet our customers demand. Then we also have our own requirements from our suppliers. We are working with SP for calibration of measuring instruments. There is a standard range and we generally do calibration once per year. SP is coming to our facilities to measure the big scales.

**How important is it for you that the measurement or calibration is accurate?**

Accuracy is very important! Our products are very critical in customer applications. If we deliver products that are not in the right level of standard that it should be, there will be major consequence.

**Very important O  Important O Somewhat important O  Not important  O**

**What do you consider to be the most important factors when it comes to measurement and calibration?**

Accuracy O
That there is continuous O
The quality O
The workshop is accredited / certified O
Other ... O

With accredited and certified workshop the other obligations should be fulfilled too.

**Do you measure and/or calibrate internally or externally?**
We manufacturer of one million seals that are to be measured. We have no certification to customers, only for internal reasons. Calibration of the measurementsystem is done by SP.

Internal only O Only External O Both O

For what reasons did you decide to purchase the service?

We knew that they did a good job. We found out this via the internet. We used to do in internal before but when our employee retired and we didn’t find anyone else with the expertise we found it easier to do it external.

It costs less O

Did not have the expertise O

It is no a core competency O

Other O, if other please explain:

Which factors of purchasing it outweighed the option to use it internally?

For what reasons did you choose to work with the company you are working with, which were the main factors?

We wanted to work with someone with strong proven knowleadge and be able to trust them.

What are the positive aspects of the service and the service provider?

They are very accurate and it goes fast. We send the measuring instrument and get it back two days later with nice measurement protocols.

What could be improved with the service from your point of view?
Not that I can think of.

**Do you send the measurement instruments to more than one company for measurement and/or calibration?**

Only to SP, and they are coming here for calibration of the scales.

**How important is it to be able to send all the measurement instruments to the same company instead of several?**

It is not that important, but of course it results in less administration work and it is easier to work with one organization.

Very important O  Important O Somewhat important O  **Not important**  O

**How important is it to have the possibility of direct reparation/adjustment of an unapproved measurement instrument?**

It would have been good. Most of the instruments breakdown before we recalibrate them.

Very important O  **Important** O Somewhat important O  Not important  O

**How important is at that the service provider has the latest technology?**

Very important O  Important O **Somewhat important** O  Not important  O

It might be useful but not that important.
How high do you value that the measurement can be done on site at your company with hand gauges?

It's really important. The scales can not be damaged along the way. We can not be without them.

**Very high O High O Moderately high O Values are quite low O**

How important is it that the company offers short lead times?

It is very important. SP is good at short lead times. It is enough to call book a time and they fix them there in two days.

**Very important O Important O Somewhat important O Not important O**

If internally:

For which reasons did you choose to use it internally instead of purchasing it externally?

To have complete control  O
Have the expertise  O
We consider it to be a core competency  O
It costs less O
**Other O**

Because it is necessary has it is needed frequently in the production.
Which factors would have the highest influence if you were considering purchasing it externally?

Good documentation and short lead times.

Do you sell your measurement/calibration services externally?

Yes   O   No   O

Company X

As we understand that you manufactures and sells different types of systems, mostly communication, as well as alarm systems, etc.?

We sell tele options, some solutions for hospitals, communication for nurses occurs, we also sell communication options for prisons and hotels. There can’t be anu lack in the communication. We have three production sites, one in Z with lower volumes, but greater variety of flora, a more advanced manufacturing. We also have production sites in China and Thailand.

To which of the products you use measuring devices during the manufacturing process?

We measure everything we manufacture, all electronic equipment. We should be able to measure the current on the phones, measure the voltage regulations. We build up the product so it can be tested in different systems. Trying out during the process, from function to how much it draws on...
the batteries. Radio Measurements, how sensitive it is, how good sound it picks up radio signals, etc.

Voltage, current, power, decibels. Calibrates some alone time, mechanical calibration themselves. Pneumatic Screwdrivers, important that the screws are tightened with same torque every time. Requirements on how much it will measure and set screwdrivers. ISO 9000 and 14 000 and 2000. Medical Directive 485, harder than ISO. You should be able to prove that the measurement made is true and correct. One must be able to show that it is linked to the international standard.

A provider of calibration services which are located in Gothenburg, which come and calibrate in place. Can not have down time where the instruments are gone. Planning in driving so that it will not affect production. The signal generators, radio tester, calibrate also a part of the LF equipment is around 250 khertz, multimeters.

1) For what purpose do you measure or calibrate your instruments?

We measure for to be able to deliver what the customer expects. The customer is always the focus for us. When we manufacture telephones we must be able to prove that it meets the standrd what we say it should. There are limits for what is acceptable when we measure, we must ensure that the product is approved of a certain standard and shows the right measurement. To summarize, we have to calibrate to know that we meet and reach a certain standard, we also want to be sure that the measurements are consistent.

2) How important is it for you that the measurement or calibration is accurate?

Some instruments are more accurate than what we need. We calibrate for performance test that we get from the supplier, instruments specification. When it is not enough, we use our own factors in the measurement as we must meet our requirements.

Very important O Important O Somewhat important O Not important O
3) What do you consider to be the most important factors when it comes to measurement and calibration?

The workshop must be accredited. All factors are woven into each other. If you want accuracy, you have to calibrate it within a certain range. Standard 1 year. For large orders you should be calibrated before and after the ordering. Still we don’t do this due to that everything has worked out fine.

The most important thing that you can be sure that the work properly done. That we can be sure that the instrument is accurate when it was sent off. Is the quality good, it will meet the specification on their calibration.

Accuracy O
That there is continuous O
The quality O
The workshop is accredited / certified O
Other ... O

4) Do you measure and/or calibrate internally or externally?

We do both. We calibrating screwdrivers ourselves, the equipment that we use are then calibrated by someone else. We calibrate both internally and externally. We calibrate within the organization, and we send out for external calibration and engage external partners to our production for calibration.

Internal only O Only External O Both O
5) For what reasons did you decide to purchase the service?

It is an convenience if the external party could be responsible and handle the calibration and all the administration related to it. The company we have chosen to work with have been working for us for many years. They know our organization and instrument very well and everything has been working out to our expectations. Another reason is that we have chosen to focus on other areas and if we would calibrate everything ourselves it will take up to much time.

It costs less  O
Did not have the expertise  O
It is no a core competency  O

Other  O, if other please explain:

6) Which factors of purchasing it outweighed the option to use it internally?

The cost is not the major problem. It is more of an issue to keep track of everything and to store all the information related. The pros did overweigh the cons in this case.

7) For what reasons did you choose to work with the company you are working with, which were the main factors?

They have been with us for a long time and know our instruments, organization and facilities. It has also been the same people who has been carrying out the calibration.

8) What are the positive aspects of the service and the service provider?

We trust them because they always deliver what we expect. The relationship has developed through the years.

9) What could be improved with the service from your point of view?
We always work with constant improvements but at the moment we are satisfied part from the fact that the company could have accreditation that they are missing.

10) **Do you send the measurement instruments to more than one company for measurement and/or calibration?**

No they are coming out facilities. A few instrument are sent to other companies for the reason that they do not calibrate those instrument and for the reason that the instrument were purchased with a certain arrangement of calibration carried out with just that specific company that we purchased the instrument from.

11) **How important is it to be able to send all the measurement instruments to the same company instead of several?**

*Very important* O  Important O Somewhat important O  Not important  O

We are trying to do as much calibration as possible with the same company as it is the simplest and less time consuming option.

12) **How important is it to have the possibility of direct reparation/ adjustment of an unapproved measurement instrument?**

It is important and why we work with this company. They can repair at a component level but they can’t offer total reparation at place.

*Very important* O  Important O Somewhat important O  Not important  O

13) **How important is at that the service provider has the latest technology?**
It is not that important. Still we need what is required for our products to meet a certain standard. Some of our products are new and some are old so we need a mix of newness of technology.

14) How important is the possibility of having the measurement/calibration taking place at your own facilities?

This is absolutely necessary for us as we can’t stand still in our production. We could never hire a company that did not offer the opportunity to do calibration at our facilities.

15) How important is it that the company offers short lead times?

The lead time of the calibration need to be quite good. But as the company are coming to our facilities this is not an issue for us.

If internally:

For which reasons did you choose to use it internally instead of purchasing it externally?

To have complete control  O
Have the expertise  O
We consider it to be a core competency  O
It costs less  O

The screwdrivers need to be calibrated every three months and it would be to expensive it send them away frequently. There are also some measurement tools that need to stay at our facilities and for those that we have the equipment we have chosen to do it internal as it also keeps the costs down.
Do you sell your measurement/calibration services externally?
Yes  O  No  O

Interview guide PMC

1. **For what purpose do you measure or calibrate your instruments?**
   The purpose with calibration is to ensure that we deliver the correct products. To be sure that that is what the customers want. Because it says that we are supposed to do it.

2. **How important is it for you that the measurement or calibration is accurate?**
   Depends on the purpose of the measurement, every instrument has its own tolerance level. You can calibrate and adjust the things, but normally either it is good or it is not good and you have to purchase a new one. It is more to check if it is somewhat correct. But it is important that we know that what we measure it correct, we have from 3% to 0,05 % of accuracy.
3. **What do you consider to be the most important factors when it comes to measurement and calibration?**

That the workshop is certified or accredited is very important as there are customers that doesn’t want anything to do with you if you aren’t or calibrate at someone who is. But to be able to be accredited or certified you need accuracy and you need to do it regularly. In the process instructions it says how often you need to calibrate.

4. **Do you measure and/or calibrate internally or externally?**

Standard measurement sends away externally, the rest is handled internally. However the machines are sent away to their suppliers yearly for calibration.

**Externally**

5. **For what reasons did you decide to purchase the service?**

Standard measurements need a reference to ensure that they are correct. The reference has the supplier or SP. Where we send our things depend on the delivery time. When it comes to the measurement of particles we’ve recently purchased the equipment to do it internally, before it was done externally.

6. **For what reasons did you choose to work with the company you are working with, which were the main factors?**

It is easier to use the suppliers, it was also a question of price.

7. **What are the positive aspects of the service and the service provider?**

You choose a company based on price, speed and support. You want the things to come back as fast as possible.

8. **What could be improved with the service from your point of view?**
9. Do you send the measurement instruments to more than one company for measurement and/or calibration?
We have several different suppliers yes. We send some things to SP in borås, some to Hydac in Germany, some to Atos in Italy, some to Bodycote in Gothenburg and some to Keller in Germany. Normally to the manufacturer as they are specialists.

10. How important is it to be able to send all the measurement instruments to the same company instead of several?
The effect of Coordination and the possibility of receiving better prices if you send it all to the same place is important. But as we send our things to different places it doesn’t seem to be that important for us right now.

11. How important is it to have the possibility of direct reparation/ adjustment of an unapproved measurement instrument?
It helps, if it can be repaired it would be good to have the possibility to have it done directly, it would be faster. It would be annoying if the instruments had to be away for a month.

12. How important is at that the service provider has the latest technology?
It is not that important as long as the correct stuff comes back. You can see very easily on a company if they deliver good stuff, if it is nice and clean and somewhat modern they normally are.

13. How important is the possibility of having the measurement/calibration taking place at your own facilities?
Price over speed. If it costs less to send it away it is worth more. But it also depends, if you have a more expensive instrument that you can’t have two of then it is more important that
they can come and fix it. When it comes to the (likare) you know when you have to send them away but when it comes to the machines that are too large to move it is important. It interrupts the production however if they come to fix the things.

14. How important is it that the company offers short lead times?

Speed is important and it comes with short lead times. Depends a little but on what it is, normal less important, particle measurement more important.

Internally

5. For which reasons did you choose to use it internally instead of purchasing it externally?

To be in control of our processes and things.

6. Which factors would have the highest influence if you were considering purchasing it externally?

Price. Calibration takes away a little bit of the core business which can be a problem. IT is an interruption that someone takes away the caliper from production to calibrate it.

7. Do you sell your measurement/calibration services externally?

Not really but indirectly with the troubleshooting services.
Can metrology be value-based?
We are a mechanical Workshop. We design, develop and produce prototypes, special tools and machines and door hardware. Initially the business was only developing, but later also design special tools and equipment for customers such as Volvo Car Corporation, SKF and others. In the early 90's, also started a venture on their own developed architectural hardware. This has contributed to that we have acquired a good knowledge of prototyping and production of smaller series. We have also got a good understanding of market and government demands for fabricated metal products.

1. **For what purpose do you measure or calibrate your instruments?**

   We are ISO certified in environment and quality. It is to meet customer requirements after designs or what is agreed with the client. It can also be after the function, for example to solve a problem they have. We test it and measure it after a certain measurement. So basically due to function and customer requirements.

2. **How important is it for you that the measurement or calibration is accurate?**

   There is a big difference from project to project how important the accuracy is. Generally the requirements for the tolerance level are not that hard. But sometimes we have small details and then it is more important than for the large welding machines. Currently we test on our own after gauge blocks if the instrument is within a certain tolerance level and asses if it is approved or not.

3. **What do you consider to be the most important factors when it comes to measurement and calibration?**

   It is hard to say as everything is connected to each other. We no longer use an accredited company that does it externally but it is important for us as a certified company within
quality that it happens regularly and that it is accurate. It says in the ISO certification that you have to do it regularly. It is the customer requirements that are the most important, that it should be accurate.

4. **Do you measure and/or calibrate internally or externally?**
   We used to send it away externally but we just started doing everything internally.

   **Externally (before)**

   5. *When we purchased it externally it was to meet the requirement of the ISO certification. We had an external consultant that took care of that part. We got a certificate for every instrument, the rates were saved etc. I’m not quite sure why we chose to do it externally, partly because we didn’t have the expertise or equipment.*

   6. *It was due to price, delivery time, the system that they used. We got a certificate that they stored. We chose them based in the offer they gave us. We had around two-three different companies in the past four to five years.*

   7. *Don’t work with the company currently*

   8. 
   9. –
   10. -
   11. *We always had one company at a time*
12. We chose to send all of our instrument to one company to lower the delivery cost and administration. Then we would get all the instruments on the same list, it was the easiest way.

Internally - Currently:

5. For which reasons did you choose to use it internally instead of purchasing it externally?

Most normal callipers, micrometres etc. It is about the price, delivery time, to not have to send them away

6. Which factors would have the highest influence if you were considering purchasing it externally?

Definitely price and delivery time. That they attain the standards and that they are accurate in their measurements. We would probably choose a company that is accredited.

7. Do you sell your measurement/calibration services externally?

No, it is only for our own production.

8. Would it be an important factor if you were to purchase it externally to have the possibility of direct repair/adjustment of an unapproved measurement instrument?

Our instruments are not that expensive so normally we just replace them. It is the micrometres that you can adjust. But otherwise it is not that important.
9. Would it be an important factor if you were to purchase it externally that the service provider has the latest technology?
Not important as long as we get the certification and it is measured after the correct standard.

10. Would it be an important factor if you were to purchase it externally to have the possibility that the measurement/calibration could take place at your own facilities?
The instruments are so small that they are easy to send away.

11. Would it be an important factor if you were to purchase it externally that the company would offer short lead times?
Some of the instruments we have in a limited edition so it was important that we would get them back fast.
Interview guide – Daros piston rings

Federal-Mogul’s Daros-brand piston rings is one of the world’s leading suppliers of piston rings for large bore engines. We supply quality rings from our state of the art factory in Mölnlycke, just outside Gothenburg, Sweden and can deliver to any port in the world. Daros works in close cooperation with leading engine manufacturers (OEM) to develop new rings for modern diesel engines.

- Standard ring pack provides a normal time between overhaul (TBO)
- Heavy-duty ring pack ensures long time between overhaul and high scuffing resistance.
- Quick running-in ring pack provides a fast sealing, reducing time to full load.

Ring groove wear resistant ring pack ensures prolonged lifetime for the piston crown grooves.

1. **For what purpose do you measure or calibrate your instruments?**

   To ensure that the instruments are correct. That they uphold the requirements that they are created for and that we have to measure from. There is a rule saying that if you are supposed to measure hundredths the instrument should be able to measure 10% more, so thousandths in this case. The instrument should be able to measure thousandths so that you know that you are in the correct measurement stability. You should lower 10% to ensure that what you measure is correct and that the instrument is better than what you are going to verify in the end. So if you measure hundredths the measurement instrument should be able to show thousandths.

2. **How important is it for you that the measurement or calibration is accurate?**

   It is everything. We measure different qualities of the rings. The lowest tolerance level we have is for the height measurement, 2,5 hundredths. Thousandths are essential. It is when it comes to measuring thousandths that it is very important that it is accurate. If you measure
Can metrology be value-based?

another quality like diameter, then thousandths doesn’t matter. So it depends on what characteristic that you are going to check. But in general it is very important.

3. **What do you consider to be the most important factors when it comes to measurement and calibration?**

You can’t take away any of the factors. But the accuracy is the most important, as it determines if the instrument can handle measuring the characteristic/quality that it is supposed to measure.

4. **Do you measure and/or calibrate internally or externally?**

Internally we measure: feeler gauges, micrometres, callipers, film thickness gauges, micrometre gauges, dial indicators etc.

Externally we measure gauge blocks, special indicators called Mikrokatkorklocka, length measuring instrument etc.

**Externally:**

5. **For what reasons did you decide to purchase the service?**

Partly because we have sent it away for a long time. It requires a lot of equipment, we don’t have the equipment that it requires. And we don’t consider that we need it, to have a machine that measures gauge blocks is extremely expensive. And as we don’t use it in that extent it is not worth it, it is too expensive. It costs less to send away the instruments than to invest in the equipment. We do it in such little extent that maintaining it would not be worth it. We calibrate what we use frequently, constantly.
6. **For what reasons did you choose to work with the company you are working with, which were the main factors?**

From the beginning we used SKF as there was an cooperation with them, but then it closed so we found another firm that fulfil Swedacs requirements and of course the price. It is a matter of price, we say what we want and then the purchasers find the ones fulfilling the requirements. We have got a good cooperation with them, they are positioned in Eskilstuna, Kalibreringscentrum I Eskilstuna.

7. **What are the positive aspects of the service and the service provider?**

The open relationship that we have with them. It is very good, we don’t really know what type of instruments and machines that they use we just know that they are certified and approved by Swedac. But when we questioned something they came down and explained it to us. That is very positive as we cannot travel to them. It is good that we have a good relationship.

8. **What could be improved with the service from your point of view?**

I cant really say that I have anything I think could be improved. I think it works well. We have an agreement so that if something is not working they replace it and send a new one. They don’t send it back to us. It really doesn’t matter that they aren’t in Gothenburg. We send the instruments in special boxes. There has been one occasion when it would have been nice if they were in Gothenburg in stead and that was when we found an error. That has been the only case as long as I have worked here, in the past twelve years.

9. **Do you send the measurement instruments to more than one company for measurement and/or calibration?**

We send it to Kalibreringscentrum I Eskilstuna. The measurement machine Mitytoyo comes and measure at our facilities as we bought it from them. The rest is sent to Eskilstuna. You cannot send the measurement machine, you just use the supplier of it to calibrate it.
10. How important is it to be able to send all the measurement instruments to the same company instead of several?

It is really not that important. Everyone have instructions for calibration that they need to follow when it comes to which way it is done and the tolerance level. What is important is the continuously and that the protocols need to look similar so that they can easily be interpreted. In that way it is important. Some companies report differently and then the administration can become a problem. I have never been in contact with anyone ells but I can imagine that it can become a problem. So it is important that I can easily see if something is wrong and compare to past protocols.

11. How important is it to have the possibility of direct reparation/adjustment of an unapproved measurement instrument?

I think that is important as otherwise it will take longer time. We have back-up instruments but not so that we can afford to have them away for a very long time. We don’t have that large of storage of measurement instruments. It is important that they get repaired or replaced reasonably fast. We send it to the supplier for repair or adjustments. Some thing could be repaired but the damage is not that vital so we use them anyway. If the gauge blocks are bad we purchase another one that is fully calibrated.

We constantly experience situations when we have to repair the instruments. Different instruments of course, therefore we have investigated which instruments we need back-up for. We have back-up on the instruments that we use the most and that aren’t that expensive to have many of. We have a certain amount of instruments that just lay and wait to be used. For example we have back up for the micrometres, if we purchase a new one we normally purchase four more. We don’t have things for 5-20 000 SEK in storage just the things that always need to be there. But a micrometre we use all the time, there is at least six measurements per piston ring with a micrometre.
12. How important is that the service provider has the latest technology?

Not so important as long as they uphold the standard requirements. We don’t care if they measure by hand or by machine. It is irrelevant as long as they uphold the requirements of what they are supposed to do.

13. How important is the possibility of having the measurement/calibration taking place at your own facilities?

We do it with some things. We don’t value it that highly as it is such a small part of our measurement instruments that need to be measured at our facilities, the scales and the machine. We would not be able to send away the measuring machine. If you compare it like that we value it higher. It depends on the number of instruments, the size and interval of the calibration. It would not have been better if they came here and did the things that we send away. It doesn’t matter, it is good they way we have it. I believe that it would not be very good if they came here and measured. We have evaluated that option but it have not been of interest.

14. How important is it that the company offers short lead times?

Very important, it is about our storage. What we need to function and be able to produce. As short as possible in all aspects. That is what you aim for in everything.

Internally:

15. For which reasons did you choose to use it internally instead of purchasing it externally?

Easy access, the degree of service, the equipment that you need. If someone drops a micrometre it needs to be checked immediately or if you believe something is incorrect it needs to be checked and it is easier to do that on our own than to send it away. The
instrument can become bad in between the intervals and then they need to be checked immediately. We decided to do it like this many years ago, we have done it for about 20 years and we have the expertise. If we started it today we would probably purchase it, but we chose a long time ago to do it on our own.

16. Which factors would have the highest influence if you were considering purchasing it externally?

It would be as with everything else, delivery dependability, that we receive what we want. Short lead times. We ask the same demands that we have for ourselves. That would be the absolute minimum requirements with lead times and precision etc.

17. Do you sell your measurement/calibration services externally?
No, we have never done that no. And I don’t think it is something we will do in the future either.
Appendix E – Value charts

What do you consider to be the most important factors when it comes to measurement and calibration:

- Accuracy
- That it happens continuously
- Quality of the work
- That the workshop is accredited/certified
- Other

How important is it for you that the measurement or calibration is accurate?

- Very important
- Important
- Somewhat important
- Not important
Can metrology be value-based?

**Do you measure and/or calibrate internally or externally?**

- **Internally**: 1 company
- **Externally**: 8 companies
- **Both**: 0 companies

**Which factors of purchasing it outweighed using it internally?**

- **Costs less**: 2 companies
- **Don't have the expertise**: 1 company
- **Don't have the equipment**: 1 company
- **Not a main competence**: 0 companies
- **Other**: 5 companies
How important is it to be able to send all the measurement instruments to the same company instead of several?

How important is it to have the possibility of direct repair/adjustment of unapproved instruments?
How important is it that the service provider has the latest technology

How important is the possibility of having the measurement/calibration taking place at your own facilities

Can metrology be value-based?
How important is it that the company offers short lead times

Companies

Very important  Important  Somewhat important  Not important

0  1  2  3  4

For which reasons did you choose to use it internally instead of purchasing it externally

Companies

To have complete control  Costs less  Because we have the expertise  We consider it to be a core competence  Because we have the equipment  Other

0  1  2  3  4
Do you sell your services externally?

<table>
<thead>
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<td>2</td>
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<tr>
<td>1</td>
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<tr>
<td>0</td>
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</table>

Yes  | No
---|---
| | 8
Appendix F – Competitor information

Elastocon AB

Future goal

Stated in the website of Elastocon AB (http://www.elastocon.se/) it has its background in testing and laboratory. Elastocon AB’s future goal is to develop the test assignment part of their business, their current goal is to offer instruments with high precision that give a correct result.

Strategy

Their current strategy is to align themselves with Exova Metech AB and Leax Quality and offering a solution for all the customers instruments with only one contact. They focus on enhancing the cost of calibration and how the customer can save money by having all their calibrations taking place at the same company. They also give a discount if the customer let them have all the instrument depending on how many instruments it is. Elastocon also enhance the as an argument to why the customers should use their service. They are currently investing in assignment testing of rubber and plastic materials. Besides the material testing they give consultation when it comes to choice of material, specifications of material, quality systems, PLC and education. Their range consist of their own instruments and they are resellers of several other manufacturer of instruments.

Capabilities

They manufacture and sell instruments for testing rubber and plastic material. They also offer instruments from existing testing methods and develop instruments for new testing methods. Their offerings consist of: Instruments, calibration and testing. Elastocon also offers repairs and adjustments of the instruments. When it comes to calibration it is done with traceability to international standards. After calibration a certificate with results, traceability and uncertainty is given. Besides what they are accredited in they also offer calibration of Gloss and Small gas flows.
Exova Metech AB

Future Goal
According to the website of Exova Metech AB, (http://www.exovametech.com/sv/) they provide calibration and full service in metrology. They help their customers achieve optimum on time instrument access at the right quality level. The future goals of Exova Metech as a part of the Exova group is to be the best, they strive to improve their people and processes.

Strategy
Their current strategy is to be a full-service provider with everything from requirement analysis to divestment and disposal. They try to make the customers outsource the calibration and measurement to Exova Metech AB so that they can focus on their “core business”.

Capabilities
Exova Metech AB claims that they have Europe’s widest capability when it comes to calibration and accredited calibration. They say that they are one of the leading third party suppliers of calibration services in Europe and the leader of calibration and independent measurement services. One strength is that they can perform the calibration at the customer’s facilities another is that they offer repairs and adjustments, the accreditation is a strength as well. However they do not speak of lead times in their offers. Exova Metech provides traceable and ISO/IEC 17025 accredited calibration of measurement instruments in Electrical, Dimensional and Physical parameters as Torque, Pressure, Temperature, Humidity, Optical, Flow, Acoustics and more. They are as said above a full-service provider, vendor-independent and able to support all manufacturers and instrument types. The accredited calibration services can also be performed on-site at company’s facilities or on the production line, to increase instrument utilization and reduce production disturbance or downtime.
Calibration capabilities

Table 11 Exova metech Calibration capabilities

<table>
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<tr>
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<th>Accredited calibration*</th>
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Source: www.exovametech.com (Collected 2012-04-24)

Typical instrument types

- Calliper
- Micrometre
- Plain Ring Gauge
- Plain Ring Plug
- Thread Ring Gauge
- Thread Ring Plug
- Dial Indicator
- Gauge Block
- Inspection Plate
- Optical Flat
- Measuring Rule
- Measuring Tape
- Height Gauge
- Length Transducer
- Measuring Machine
- Profile Projector
- Surface Roughness Tester
MTS Systems Nordic AB

Future Goal

According to the MTS System Corporation (http://www.mts.com) MTS Systems Nordic belongs to the MTS - Group. When it comes to future goals they say:

“We will transform our core capabilities into more essential solutions for more customers, in more markets. In Sensors, the establishment of a new MTS Sensors Research & Development Center in Germany will facilitate the development of new applications with greater frequency for enhancing industrial machine productivity and automating mobile hydraulic equipment. In Test, we will continue to apply industry-leading MTS expertise and technology leadership to help customers meet new standards and compete on a global scale. We will capitalize on demands created by trends in energy, the environment and globalization. We will also continue to apply our test and simulation expertise across multiple markets and regions, anticipating customer needs and developing applications to meet them (Annual Report MTS, 2011, p. 7.”

Strategy

Capabilities

The MTS Group provides accredited calibration and metrology services and has been doing it for more than four decades. All their calibration is compliant with national and international standards. The test system expertise at the MTS group offers true-to-end system calibrations. The MTS software provides the industry’s fastest and most efficient calibration. The proven automated process ensures that the calibration is done correctly the first time. MTS also offers calibration on site at the customers facilities. According to the MTS systems Nordic website (http://www.mts.com/norden/) the MTS Systems Nordic AB have 21 employees. They are ISO
9001:2000 certified and have 100 Hz Fatigue testing systems, Aero materials testing, custom designed systems, road simulator with six degrees of freedom, advanced engineering solutions, dynamic kinematic and compliance testing. They perform Load and Strain calibrations but also perform traceable calibrations for displacement, torque and angle. They have a Value Payment Plan with discounts on all services.

The values they give themselves: Industry-leading software, test system calibration expertise, a deep understanding of your test equipment and the latest industry standards and calibration equipment traceable through National Metrology Institutes.

**Assumptions**

MTS Systems Nordic AB state, that they are uniquely equipped to help their customers adapt to change, anticipate new requirements and take on even the most difficult tasks with speed and confidence. When it comes to the industry they assume that in today’s competitive and cost-conscious marketplace, you need to generate accurate test data faster than ever before. And that nobody is more qualified to help you deliver consistent, verifiable results, test after test, in the most cost-efficient manner possible than MTS. They state when it comes to the industry that in today’s competitive and cost-conscious marketplace, you need to generate accurate test data faster than ever before. How quickly you can produce accurate results has a direct impact on your project’s success. That is why proper calibration is critical.

**Nyli Kvalitets & kontroll teknik AB**
Strategy
According to the website of Nyli Kvalitets & Kontrollteknik AB (http://www.nyli.se), Nyli offers technical measurement products and services for the Nordic manufacturing industry. Nyli offers a range of high quality- products such as CMM, measurement machines and hand tools, measuring services, inspection and calibration as well as consultation expertise within the area of measurement. Their strategy is to sell measuring instruments together with calibration and measurement services.

Capabilities
Nyli Kvalitets & Kontrollteknik AB offer calibration on 73 measurement instruments, for full list see Appendix C. They also offer particle measuring together with the company Cleanliness control. They are the only once in Sweden with a laboratory that enables them to make cleanliness measurement under optimized circumstances and thereby receive very accurate numbers. They are certified with ISO 17025:9001:2000 and 14000. Nyli also offer calibration on site at their customers facilities.

Assumptions
Nyli Kvalitets & Kontrollteknik AB state that they became a company known to many in the manufacturing industry due to their high quality and of products and services in the manufacturing industry. Industry wise they state that within more and more areas within the industry is has become important to ensure the cleanliness of technical systems and in the manufacturing process

SP- Technical Research institute of Sweden

Future goal
The website of SP (http://www.sp.se) explains that SP's mission is to contribute to growth and competitiveness of the industry as well as to safety, conservation of resources and a good environment in society. They want to become an international leading institute for research and innovation.
Strategy

SP is the national metrology institute of Sweden, which means hat they are responsible for the national standards for a number of quantities in the SI system. SP is a national body for verification of the measuring instruments in accordance with regulations stated by EU.

Capabilities

SP is the highest positioned in the Swedish market when it comes to calibration. They have 10 000 customers yearly and the customer ratings is 4.9 on a scale from 1-6, 2010. SP provides the widest rage of services in the Nordic countries when it comes to calibration. Most of the services they offer are accredited in accordance with the international requirements. Their services consist of calibration, verification and testing. SP has extensive knowledge in many areas including: weighing, volume/flow, length, pressure, temperature, electrical measuring instruments, force (torque spanners) and analyses and assay-marking of precious metals. SP are organised into three sectors:

- Field calibration.
- Adjustment of weighing instruments (scales) and petrol and diesel fuel pumps.
- Assaying of precious metals.

SP offers support within these areas:

- Calibration and calibration strategies
- Method development
- Method validation
- Determination of the acceptable uncertainty of measurement
- Specifying requirements for measurement systems
- Measurement system analysis
- Evaluation of measurement data
- Training
- Development of measuring equipment and software
Trescal Sweden AB

Future Goal

Strategy

According to the Trescal Sweden AB website (http://www.trescal.se/) it is a part of Trescal, Air Liquide's international network of monitoring/measuring sites. Trescal is a global specialist in calibration services. They were the first company to be accredited besides the national laboratory. They have since then been Sweden’s leading company when it comes to measuring length, flats and angles. Their strategy when it comes to promoting their services is to focus on certain points: Cost savings, Worry free, Flexibility, Same Local Presence and Access to in depth expertise in measurement.

Capabilities

Performs calibration of the majority of commercially available measurement instruments, including instruments which are not part of the accreditation. Those results of these calibrations are reported in a calibration certificate, which is traceable to national and international standards. They offer accredited calibration of surface plates and rulers of straightness, Coordinate measuring, Provides measurement of the products / features of their CMMs. Trescal does everything from individual calibration tasks for a total management of the instruments in which they are committed to:

- Mark up the instruments
- Record instruments in the database
- Calibrate them
- Eventually repair / adjust / discard
- Status Notice
- Revoke the instruments in time to the next calibration time
They offer the sale of gauge blocks from their warehouse. Stock gauge blocks of steel from 0.1 mm <1000 mm and in carbide from 0.5 <100 mm in grades 0, 1 and 2 in all sizes. Accredited calibration of gauge blocks, they perform inspection and renovation. They have a guaranteed traceability to national and international standards.

Trescal states that this is its strengths: Branches across the world, A unique range of technical skills and services in the world: a “one-stop-shop” offer, Recognized experience in equipment management and in the world optimization, A position as leader and specialist in calibration independent of manufacturers, Real proximity to our customers thanks to our regional base, A culture of safety in the laboratory and on customer sites supported by a policy of occupational hazard prevention.

ZR Sverige AB

Future Goal

The ZR vision is to be best at quality. Their current goal is to provide their clients with the best possible quality when it comes to products, services and education. Their future goal is to provide all the solutions to the customers needs when it comes to material testing. ZR Sverige also strives for constant improvement.

Strategy

The ZR Sverige AB website (http://www.zrsverige.se) states that they are a leading supplier of test equipment of destructive and non-destructive testing. Their target customers are the industry and science laboratories in Sweden.

Capabilities

They offer services and calibration of material testing systems in the Nordic area, provides spare parts and holds education when it comes to material testing. They are certified with ISO 17025: for calibration of drag 600kN and pressure up to 2000kN force. ZR is also accredited after SS EN ISO 148-2: ASTME E23.
They offer services with high quality and accuracy; it is everything from installation, service, calibration and education to the customers. ZR is one of Europe’s leading manufacturer of products for material testing. Zwick/Roell has equipment for tensile, flexural, and pressure testing, torsion, fatigue testing, hardness testing, pendulum for impact resistance as well as systems for sample preparation. They offer service of all the products they sell themselves but also to other machines such as: Amsler, R&K, Instron, Galdabini, Shimadsu, MTS etc.

**MYLAB**

**Future Goal**

MYLAB strive to be flexible so that they can meet their customer’s wishes. They also strive for constant innovation and development for themselves and the programs they use.

**Strategy**

Their strategy is to focus on speed and correct results and to give extra information to the customers together with the service.

**Capabilities**

According to the website of MYLAB (http://www.mylab.se/eng_index.html) they carry out control measurement with accuracy and precision. They also construct client adapted measurement fixtures. MYLAB are specialized in measuring prototypes, outturn samples and process capability study. They are certified with ISO 9001:200 and AEROSPACE STD. AS/EN9001. MYLAB has the latest and most advanced measurement technique. MYLAB constructs measurement and control fixtures and delivers them with CMM programs and MSA studies. With broad knowledge and long experience with powerful software, they guarantee short delivery times and competitive prices for their services and products.

**Measurement services:**
Optical measurement
- Digitization of surfaces
- Reference sample
- Dimensional shape and position
- Product Audit
- Body Measuring
- 3D nufo / CAD
- Full Speed Tests
- Dmis IN-OUT

Assumptions

Assumptions about themselves are such as that their combined expertise, use of a variety of accurate CMMs in the climate stabilized space guarantees high quality of work done.

Hexagon Metrology Nordic AB

Future goal

Innovation is fundamental in Hexagon’s long-term strategy for growth and profitability. Hexagon invests more than 10 per cent of net sales in R&D and typically renews its product portfolio every 18 months. Since 2000, the Group has implemented 70 acquisitions and performed about 50 divestments of non-core activities. They also strive to have a fast decision making process and to be cost-efficient

Strategy

The strategy of Hexagon is to identify technology gaps in the product portfolio and compares the cost and benefits of developing the technology in-house with acquiring a company that can provide them with the technology needed

Capabilities
Hexagon Metrology Nordic AB describe in their website (http://hexagonmetrology.se) was that it was founded in 1975 and is a leading global provider of integrated design, measurement and visualisation technologies. They have over 12 000 employees in more than 40 countries. The values of Hexagon according to themselves are that they are profit driven, professional, customer focused, innovative, entrepreneurial and engaged. They have two business areas: Measurement Technologies and Other Operations. The Measurement Technologies business area have three areas: Geosystems, Metrology and Technology. They measure almost everything, details in 2D and 3D with CAD, laser scanning, either at the customers facility or at the workshop. They are Certified with ISO 9001: 2000 and have a long experience of measuring. Hexagon metrology has a wide product programme and over 1500 coordinating measurement machines in the Nordic area. There is also an after market organisation with over 40 employees. With four measurement centres in Sweden and a Network of seven agents they consider themselves the strongest supplier of advanced measurement solution Hexagon can measure from: 1 micrometre to 120 metres and up to 3.6 cubic metres when it comes to size.

Measurement services:

- Advanced Programing
- Measurement assignments
- Create measurement programs
- Measurement services
- Optical measuring equipment
- Altimeter
- Laser Scanning
- Mobile measurement tasks
- Laser Scanning
- Measurement advice and support
- Needs analysis, methodology and project management
- Measurement of individual parts, longer sequences
- Detailed programming for your CMM even in product projects and outcomes testing
- Consultation and advice
Assumptions

Assumptions about themselves are such as that their technologies measure with great precision and rapidly provide access to large amounts of complex data that is visualised via engineering and geospatial software, empowering their customers to create, manage and share information to increase productivity, improve quality and make better, faster operational decisions by exploiting multidimensional data.

Kalibreringscentrum i Eskilstuna AB

Strategy

Their mission is to keep an affordable calibration with short delivery times. The ambition is to carry out the process within five working days (excluding transport).

Capabilities

According to their website (http://www.kalibreringscentrum.se) they perform calibration of measurement instruments within length and angle. In addition to calibration are CMM, profile projectors and equipment for calibration of surface plates. All calibration is traceability to national or international standard. They are certified with ISO-9001: 2008.

Calibration services:

- Threaded interpreters, Thread Rings
- Check plug
- Gauge
- Call Interpreters, Setting Rings
- Outside Micrometer O
- Control Measure for outside micrometre
- Inner Micrometer
- Calliper
- Dial Gauge
Can metrology be value-based?

- Angles
- Talmetre
- Gauge Blocks
- Flat plates
- Altimeters
Appendix G – The metrology offer
Can metrology be value-based?
Människor, processer och teknik för att optimera mätinstrument inom tillverkning

Kraven på produkters kvalité ökar dagligen med känsligare och känsligare kunder på marknaden. Att få sina verktyg att uppnå sin fulla potential är ett stort steg på vägen mot att ha World Class Manufacturing. Mätning är viktig både för kunden och för företaget då båda parter behöver vara säkra på noggrannheten och trovärdigheten av mätningen. Behovet av noggrannhet varierar beroende på företag och produkt, trots att noggrannheten varierar är det viktigt att alltid kunna lita på mätresultatet.

Då marknaden inom tillverkningsindustrin är konkurrenskraftig är kvalité ett grundläggande element för att upprätthålla en bra position. För att säkerhetsställa kvalitén på mätinstrumenten är en noggrann och kontinuerlig kalibrering essentiell. För att kalibreringen och mätningen ska vara korrekt behöver den vara spärrbar till nationella och internationella normaler.


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Can metrology be value-based?

Spårbarhet

Både mätningen och kalibreringen utförs med
spårbarhet till nationella och internationella
normaler vilket garanterar en korrekt mätning
av produkten.

Säkerhetsställ kvalitén

Ett av de viktigaste syftena med mätning och
kalibrering är att säkerhetsställa kvalitén på
produkterna. Fler och fler företag har kvalité-
system och ISO certifikat är ett standardiserat
mått, säkra och kontrollerade produkter ett
krav på marknaden. Genom säkerhetsställt kva-
lité på produkterna minskar antalet felaktiga
produkter och därmed eventuella reklamations-
kostnader.

Noggranhet

Med nogran mätning och kalibrering optime-
ras produkterna till högsta möjliga standard,
med syftet att minska ledtider och extra kostna-
der.

Möt era kundkrav

Optimerade mätinstrument leder till högre
kvalitet på produkter vilket i sin tur kan leda till
nöjdare kunder. Ett inkorrekt instrument leder
till en felaktigt produkt vilket kan medföra stora
konsekvenser. Kunder kräver alltid omsorg
och certifiering, genom att köpa tjänsten
externa uppfyller du dessa krav.

Mätning & Kalibrering

Mätning

Mätcentrum utför mätupdrag för att säker-
hetställa kvalitén på produkter. Det genom-
förs bland annat genom utfallsprov. Mätningen
utförs med konkurrenskraftig utrustning.

Ackrediterad kalibrering

Med en ackrediterad verksamhet garanteras en
säker och noggrann kalibrering av ofta före-
kommande mätinstrument i industrin.
Mättjänster

Beskrivning


Mål

Fastställa avvikelse från normal kondition med mätning av dimension, formavvikelse på både raka och krökta ytor och ytmätning på raka och krökta ytor samt utfällspröver för att säkerhetsställa kvalitén på mätinstrument och produkter.

Syfte

Uppnå ökad livslängd och kvalité av mätinstrument och därigenom slutprodukter.

Tjänstens innehåll

Mätcentrum tillhandahåller erfarna tekniker för mätjänsten. Mätningen utförs av personal med goda kunskaper och erfarenhet. Vid svårriókta ställen finns möjlighet till att göra en avgjutning och genomföra mätningen på avgjutningen.

Genomförandebeskrivning

- Mätinstrumenten lämnas in för mätning
- Val av mätmetod beroende på noggrannhet
- Analys mot gällande specifikation
- Upprätta märrapport med arkivering i 10 år
- Underhållsrekommendationer
Mätområden

Referensmätning inom

- Dimension, upp till 1200 mm
- Form & Läge, tex. Rundhet, rätet, profilform och radie
- Ytstruktur, tex. ytjämnhet, vågighet och form på raka samt krokt ytor med både kontaktaade och optisk mätning
- Rullningslagervibration
- Restmagnetism

Mätcenrum utför mätning i CMM med modern produktvara Calypso, vilket ger möjlighet att mäta enligt GPS enligt ritning och/eller Cad-fil
Ackrediterade Kalibreringstjänster

Beskrivning

Att minimera osäkerheten och defekterna inom metrologi är viktigt för alla organisationer men dess roll har ökat med den konstanta ökningen av teknologi. Att säkerställa noggrannheten på instrumenten som används inom tillverkning är inget nytt i tillverkningsprocessen, det sker genom att periodiskt kalibrera dem mot en exakt bestämd standard. För att kunna utföra kalibreringen med gött resultat krävs god kunskap inom området och ändamålsenlig utrustning vilken en ackreditering garanterar.

Mål

Fastställa avvikelse från nationella eller internationella standarder på mätinstrument genom noggrann ackrediterad kalibrering.

Syfte

Uppnå ökad livslängd och kvalitet av mätinstrument och därigenom slutprodukter.

Tjänstens innehåll

Måtcenrum tillhandahåller erfarna tekniker för den ackrediterade kalibreringen. Kalibreringen är noggrann och kontrollerad med låg mätsäkerhet utifrån Swedacs krav på ackreditering. Vid behov kan justering och reparation av mätinstrument som inte godkänts erbjudas.

Genomförandebeskrivning

- Lämna mätdata för kalibrering
- Rengöring och kalibrering av mätinstrument
- Eventuell justering av felaktigheter
- Bedömning mot gällande standard/specifikation
- Upprättande av kalibreringsbevis med ackrediteringsstämpel

KALIBRERINGSBEVIS
utfärdat av ackredierat kalibreringslaboratorium
CALIBRATION CERTIFICATE issued by an Accredited Calibration Laboratory
ISO/IEC 17025
Kalibreringstjänster och mätdonsregistrering

Beskrivning

När mätinstrument används förändras deras nollbäde vilket kan leda till felaktiga mätningar och produkter. Därför behöver de regelbundet kalibreras för att hålla en god kvalitet och rätt standard. För företag som inte har kalibrering som en huvudkompetens kan det vara svårt att veta vad för kalibringsintervall ett visst mätinstrument behöver och vikten av att det kalibreras i tid. För att kunna utföra kalibreringen krävs god kunskap inom området och ändamålsenlig utrustning vilket Mätcentrum tillhandahåller.

Mål

Säkerhetsställa att mätinstrumenten kalibreras i rätt tid och fastställa avvikelser mot nationella och internationella standarder.

Syfte

Uppnå ökad livslängd och kvalité av mätinstrument och därigenom slutprodukter.

Tjänstens innehåll


Genomförandebeschrijving

- Den första arbetsdagen i månaden skickas ett mail med de mätinstrument som behöver kalibreras
- Mätinstrumenten lämnas på Mätcentrum för kalibrering
- De som mäts externt kan antingen skickas direkt till den externa verkstaden eller via Mätcentrum
- Remgöring och kalibrering av mätinstrument
- Bedömning mot gällande standard/specifikation
- Kalibringstejp och kalibreringsbevis tillgodoses
- Uppdatering av mätdonsregistret
Kalibreringsområden

Ackrediterad kalibrering

Den ackrediterade kalibreringen sker enligt SS EN ISO 17025 av:

Passbitar 0,5-600 mm

<table>
<thead>
<tr>
<th>Nom. längd mm</th>
<th>Mätosäkerhet μm</th>
</tr>
</thead>
<tbody>
<tr>
<td>över</td>
<td>t.o.m.</td>
</tr>
<tr>
<td>0,5</td>
<td>25</td>
</tr>
<tr>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>50</td>
<td>75</td>
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<td>75</td>
<td>100</td>
</tr>
<tr>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>150</td>
<td>175</td>
</tr>
</tbody>
</table>

Invändig mikrometerskrut med förlängare upp till 600 mm

Övrig kalibrering
ex:

- Passbitar
- Normalringar
- Tökar
- Skjutmått
- Invändiga och utvändiga mikrometrar
- Runhets- och ytnormaler
- Mikrokatorer
- Måttblockor
- Vlappindicatori
- Elektriska givare
- UU- apparater
Tilläggstjänster

Mätning på plats

I många situationer är det svårt att flytta produkt eller mätinstrument på grund av att man inte har möjlighet att stoppa produktionen samt att det finns risk att mätinstrumentet skadas i transporten. Mätcentrum erbjuder möjligheten till kalibrering och mätning på plats med handmätton och portabla mätutrustningar.

Direkt reparation och justering

Vid icke godkänt mätton ger Mätcentrum i många fall möjligheten till direkt reparation och justering.
Linnaeus University – a firm focus on quality and competence

On 1 January 2010 Växjö University and the University of Kalmar merged to form Linnaeus University. This new university is the product of a will to improve the quality, enhance the appeal and boost the development potential of teaching and research, at the same time as it plays a prominent role in working closely together with local society. Linnaeus University offers an attractive knowledge environment characterised by high quality and a competitive portfolio of skills.

Linnaeus University is a modern, international university with the emphasis on the desire for knowledge, creative thinking and practical innovations. For us, the focus is on proximity to our students, but also on the world around us and the future ahead.