CHALMERS

Service Development

A New Business Opportunity

Master of Science Thesis

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Abstract

As a consequence of changing market conditions, manufacturers are searching for new business opportunities. Hence, traditional product supplier investigates the possibilities of becoming, or extending, their role as service providers. Service offers are expected to result in an increased competitive advantage as well as in improved customer loyalty. This thesis concerns how Volvo Construction Equipment can take advantage of this development.

By merging several theoretical fields as New Service Development, Lean Thinking and strategies for service pricing several business opportunities are identified within the business segment of quarries and aggregates. Hence, this approach creates an overall understanding of the challenges connected to service development and further contributes with comprehensive insights into the business segment of quarries and aggregates.

The purpose of this master thesis was to; based on the business operations of the construction equipment segment quarries and aggregates; formulate a site performance improvement consultancy service inspired by lean thinking. In addition, a pricing strategy for the service is investigated.

By interviewing experts of service development as well as interviewing quarry site specialists, combined with site observations an Energy Efficiency consultancy service is developed. A full service offer is specified together with a pricing strategy aimed to support a commercialization strategy. The thesis concludes that the Energy Efficiency consultancy service is a suitable starting point for developing the service portfolio into advisory services, even if the current customer base at the Swedish market is limited.

Keywords; *Service, New Service Development, Quarries and Aggregates*

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1. Introduction

Today's globalization and fast paced technological development have changed the preconditions of competition for manufacturing companies. This has driven producing companies to review their business models and move their sole product focus to include also services. This thesis investigates how Volvo Construction Equipment (Volvo CE), which today is a rather product oriented company, can reap competitive advantage by changing orientation towards services. However, the application area for construction equipment is broad and hence, the scope is limited and concerns the customer segment of quarries and aggregates. This chapter approaches the research area by further outlining the problem area, provide the contextual background, define purpose as well as areas of investigation and finally present an overview of the structure of the report.

The thesis is initiated by Volvo Technology (VTEC), which is Volvo's internal innovation unit. VTEC has a record of successful service transitions for other Volvo companies. Furthermore, the project is conducted together with Chalmers University of Technology where the thesis serves as the final assignment of the Master Program Supply Chain Management.

1.1 Problem Area

There is and has been an increasing competition among product centric companies due to the increasing globalization. Producing companies in western parts of the world cannot compete on price against products manufactured in low-cost countries such as India or China. Therefore, the western manufactures have developed new grounds for competitive advantage and one superior method is product differentiation by service offers. Most commonly the service is combined with the tangible core product and the customer is offered not just a product but a solution. This solution corresponds to the customers' need, which is the reason for buying the tangible product in the first place. One example of this development is today's offers from truck manufactures, which to an increasing extent regard transports solutions instead of stand-alone vehicles (Witell et al., 2009).

However, there are several challenges to overcome for producing companies to move towards service provision and obtain service infusion. Providing services in comparison to providing products require different views in regard to the organizational set up as well as in regard to the need of competencies and type of business models (Olivia & Kallenberg, 2003). Nevertheless, SKF and Atlas Copco are successful examples of product centric companies that have accomplished their transition into services. Today, these two companies get 30-50% of their revenue from services. Further on, SKF and Atlas Copco managed the recession during 2008 better than corresponding product centric companies (Witell et al., 2009).

Furthermore, the advantages for a product centric company to obtain service infusion have been recognized and found appealing by the CEO of the Volvo Group, Leif Johansson. The Volvo Group has therefore declared that *"profitable growth of soft products is now a top priority of the Volvo Group"* (Volvo Technology Corporation, 2010, p. 4). Soft products are defined as *"all products and services sold to a customer that enhances the customer's experience and satisfaction other than the new vehicles/*

equipment/ engines" (Volvo Technology Corporation, 2010, p. 4). Consequently, in general services are to define as soft products. Hence, hard products are for example new vehicles, machines and engines.

In 2007 Leif Johansson set a common target for all Volvo companies; 50% of Volvo's revenue should be generated from soft product sales by year 2015 (Witell et al., 2009). This means that a larger part of the revenues should come from sales of other offerings than the hard products. Each business area within the Volvo Corporation is responsible to outline its own strategy to achieve the soft product sales target (Volvo, 2011).

To Volvo CE, Leif Johansson's target is a great challenge. At current state Volvo CE can trace only a small amount of their total revenues to soft products. On the other hand, the low sales of soft products is related to the rather product centric portfolio of Volvo CE (Volvo, 2011). This is suggesting that Volvo CE has a large but unexplored business potential in service and/ or solution offerings. To conclude, Volvo CE is exposed to external pressure from increasing competition and internal pressure from the companywide target of soft product sales. Hence, Volvo CE needs to investigate and develop its potential business opportunity in moving towards service infusion.

1.2 Project Background

This section provides the contextual background of the report by presenting the Volvo Group along with Volvo Technology as the thesis initiator and Volvo CE as the project customer.

1.2.1 The Volvo Group

The Volvo Group has a goal of increasing revenues generated from sales of soft products. The goal of increasing the sales is planned to be reached by selling a soft product together with every second "hard" product (Volvo, 2011). This objective can be seen as an action for improving the competitiveness, since a good service offer can ensure a strong position in the product market through differentiation. Consequently, the possibilities of launching services are further investigated within the Volvo Group. However, the target of increasing the sales is more challenging within some business areas, both due to different progresses in the field of services development as well as due to different market conditions. Still, the target affects the strategies and business development within all the business areas of the company.

1.2.2 Volvo Technology

Volvo Technology (VTEC) is the centre of innovation within the Volvo Group (Volvo, 2011). Due to former experience within the field of service development, the competences and knowledge within VTEC is a natural point of departure in future projects of service development. This master thesis project was initiated by VTEC since possibilities to expand the service offers of soft products within the business area of Volvo CE was identified.

However, developing soft products for Volvo CE is a great challenge since the difference especially regarding the product range and diversity in usage of the products is considerable among the customers, compared to for example the business area of Volvo Trucks were a service project; Hauler Development Service (HDS) is piloted. The HDS program is developed by VTEC and offers consultancy services, aimed at increase efficiency within the business of the customers (Volvo, 2011). Consequently, VTEC explores the field of soft products within different business

areas of the Volvo Group. This thesis will contribute to service development within the business area of Volvo CE.

1.2.3 Volvo Construction Equipment

Volvo CE develops and manufactures equipment for construction related industries and is the second largest business unit within the Volvo Group. The company offers products worldwide by supplying more than 150 markets. Furthermore, Volvo CE offers a broad range of both products and services and is one of the leading suppliers for transport solutions for commercialized use (Volvo, 2011). A selection of some products offered by Volvo CE is visualized in figure 1. However, the company is still far from fulfilling the soft products sales target set by Leif Johansson.

The interest of Volvo CE to expand its portfolio of soft products can be seen as an extension of the strategy of the Volvo Group. Furthermore, the strategy combined with the former experience of VTEC forms a robust background for initiating this project.

However, as earlier addressed, the service development within this area is challenged by the various environments and applications of the products. However, in addition to the wide product range, Volvo CE today offers complete solutions for financing, leasing and used equipment sales, which are services that are closely connected to the hard product (Volvo, 2011).

Figure 1 Selection of products from Volvo CE (Volvo, 2011)

1.3 The Purpose of the Thesis

The purpose of this thesis is to; based on the business operations of the construction equipment segment quarries and aggregates, formulate a site performance improvement consultancy service inspired by lean thinking, in addition, investigating a pricing strategy.

1.4 The Overall Project Purpose

This thesis is a part of a larger project, Contractor Development Service (CDS), which is aiming at; *investigate the business potential in developing and commercializing a site performance improvement service, to apply within the construction equipment business from a lean perspective"*. The project scope is large covering several aspects as service conceptualization, realization and commercialization. Consequently, two parallel master theses are contributing to the findings of the project. The theses together will provide the project goal as the final result. The development of the service offer i.e. the service conceptualization is a joint interest of both theses whiles the in parallel ongoing master thesis further focuses technical aspects of needed tools and methodologies for realizing the service concept. This thesis will additionally contribute to the answers of what is needed to realize the service in terms of competencies and material resources as well as a pricing strategy.

1.5 Areas of Investigation

The following areas are considered in order to further clarify as well as provide fulfillment of the purpose of this thesis. Thereby, the investigation areas direct the work of the researcher and guide the reader.

Investigation Area 1, Service Conceptualization

Which service solution provides a business opportunity to Volvo CE?

The transformation of focus from hard products to soft products as services has been ongoing in other business areas for several years. Therefore, the extension of service offers within the construction business also could be seen as a business opportunity. To get a strategic advantage of the ongoing change of the market structure it is fundamental to identify the new business opportunities to face the future in the most efficient manner. This initial area of investigation will provide the answer in terms of a suggestion of what service concept to go for.

Investigation Area 2, Service Realization

Which resources and competences are needed in order to realize the identified service solution?

When the service concept is set, this following step focus which activities and what resources in terms of competences and materials resources that are needed for realization. Consequently, this area highlights the "building blocks" that are constituting the service offer.

Investigation Area 3, Pricing Strategy

What pricing strategy should be used to commercialize the service?

The third area of investigation addresses a suitable price strategy for the developed service offer. The price strategy is of great importance since the pricing strategy is the key to finical success. A suitable pricing strategy optimizes profit by effectively balance price towards demand. Finally, the most favorable pricing strategy in regard to the developed service is proposed.

1.6 Limitations

- The organizational aspects of services.

The organizational aspect of service development is generally regarded as a fundamental success factor. This thesis do not elaborate the organizational needs of the firm, however, this aspect should not be underestimated and is strongly recommended to be considered in contexts of service development.

- The Concerned market.

The report is founded in Swedish firms and quarry sites; it is of importance to keep the possibility of different market structures in mind. A generalization is advised to be made with caution.

1.7 The Structure of the Report

To visualize and simplify the correlation between the areas of investigation as well as of the overall structure of this report, this section presents the applied framework along with motives for the chosen structure.

As can be seen in figure 2, the problem area, the background as well as the project purpose, are presented in the introductory chapter of the report. Those subjects are covered to provide fundamental information concerning the contextual frame of the thesis as well as constitute the foundation for the continuing approach in the report. The initial chapter is followed by an elaboration of service theory in general; the chapter provides the reader with a basic understanding of the service concept as well as introduces different service categories. Those general aspects of services support the overall understanding of the project. The following chapter also has a general character as elaborating the overall methodology and presents the methods that are generally applied within the three areas of investigation. The three chapters which are following the third, each deal with one of the investigation areas and are structured likewise. Every chapter of the three is introduced with a presentation of valid literature, followed by a description of the area specific method and lastly finalized with the result. To the end, chapter seven and eight cover a final discussion in regard to the findings which is supplemented by conclusions and recommendations of further work.

The structure of dealing with the three investigation areas as separate units may not be the intuitive order of chapters in a thesis work. However, for this work the structure is considered to better facilitate the relation between applied theories and methods as well as how these are related to the empirical findings. That is in turn, believed to increase understanding and absorption of the thesis as a whole and in particular for the results.

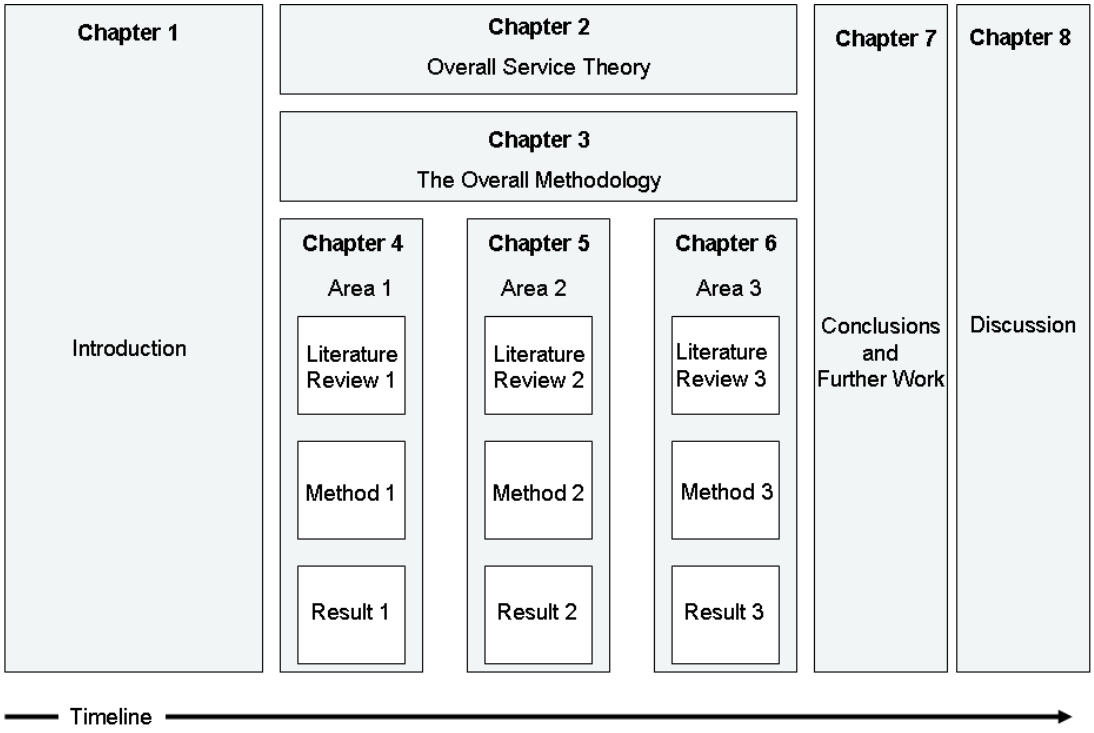

Figure 2 Areas Covered in the Report

2. Service Theory

The chapter deals with the service theory which is central throughout this thesis work. The section aims to serve as the theoretical frame of the report. Consequently, service literature is reviewed and dealt with from several aspects. In addition and for the reason of clarity the service concept is defined.

2.1 Service Definition

The service concept is widely applied and it has thereby evolved to be a multifaceted concept which has a number of interpretations and definitions. Several of the descriptions are rather similar and different interpretations often originate from diverse contexts (Araujo & Spring, 2006). The service concept is central to this thesis work and hence, the concept needs to be explicitly defined. However, service literature is reviewed prior the definition choice.

When reviewing service theory, it seems that the authors present their own interpretation of what a service is. However, most service definitions can be characterized according to one out of two dominating logics; the service is defined either by its differences in regard to a product, alternatively independent of external reference points.

There are several authors which are using product dependent service definitions. The product dependent definitions are commonly used in contexts where there is a need to differentiate between services and products. This need can for example occur in the context of the academia and a discussion that separates between product marketing and service marketing. Edvardsson (1996), Cowell (1993) along with Hutt and Speh (2007) define a service as four characteristics and these are distinguishing a service from a product. These service features are intangibility, inseparability, perishability and heterogeneity. Hutt and Speh (2007, p. 270) further explain the four characteristics: *"Services are intangible, products are tangible. Services are consumed at the time of production, but there is a time lag between the production and consumption of products. Services cannot be stored; products can. Services are highly variable; most products are highly standardized."*

The additional service definition logic is independent of reference points still, the logic is commonly applied. Hill (1977), Grönroos (2007) as well as Vargo and Lusch (2004) all define a service as independent of a product or other reference points. Moreover, these authors' definitions are not as aligned as the definitions which are applying the product related service definition. The independent definitions have nuances of dissimilarities and focus slightly different. Hill (1977, p. 318) describes a service as: "*..a change in the condition of a unit or a person, or of a good belonging to some economic unit, which is brought about as a result of the activity of some other economic unit, with the prior agreement of the former person or economic unit."* Hill stresses the interrelation between the service user and service provider and this by highlighting that the provider changes conditions at something which belongs to the customer.

Grönroos (2007) defines a service as: *"..an activity or series of activities of more or less intangible nature that normally, but not necessarily, take place in interaction between the customer and the service employees and/ or physical resources or goods and/ or systems of the service provider, which are provided as solutions to customer problems".* Thereby, Grönroos (2007) highlights the process perspective of a service,

that a service does not regard a particular outcome or one activity but an entity of activities. Grönroos (2008) in difference to Hill (1977) does not regard the provider-customer interaction as the main characteristic of a service.

Vargo and Lusch (2004, p. 326) interpret a service as: *"..application of specialized competences (skills and knowledge) through deeds, processes and performances for the benefit of another entity or the entity itself (self-service)"*. These authors are in line with Grönroos (2008) and regard the process perspective of service as the defining characteristic. Moreover, it is notable that the provider-customer interaction not is concerned in the definition.

In addition to the two defining service logics, there are authors that advocate that the service definition is rather uninteresting and hence, it is perceived to get far too much attention. For example Araujo and Spring (2006) argue that the research should not focus the differences as such but how products and services can complement each other to work together.

So, first logic is dependent on the definition of a product while the second stands alone. However, the definitions of the product related approach are highly agreeing, while the service definitions independent of a reference point are less aligned. Nevertheless, all presented definitions indicate that a service is durable in time and hence, that a service rather is a process than an outcome (Cowell, 1993). The product referring definitions appoints the durability of a service by characterizing services as inseparable. Whereas, some of the definitions independent of a reference point explicitly describe a service as a process.

Which service definition is then suitable to this thesis work? Some guidance to an appropriate definition can be derived from this thesis project's purpose along with the drivers of initiating this project. The project purpose directs to investigate, if service transition constitutes a business opportunity to Volvo CE. Thereby, the thesis purpose advocates a service definition that is simple and clear. This, in order to facilitate engagement in the implications of the thesis conclusions, provided that the thesis result is positive. The drivers of the project refer to a fairly new strategic direction to Volvo CE. Therefore, it is a symbolical choice to pick a definition which is independent in regard to products. Furthermore, due to reliability reasons there is of great importance that the chosen definition is firmly established in the literature.

There is one definition that better than the hereto presented definitions fulfills the requirements which have been derived from this project's purpose statement and drivers. The chosen definition for this thesis work is the definition used in Volvo's internal development program for services – the Service - Global Development Process (S-GDP). A service is defined as: *"an activity, or a series of activities, performed in interaction between a provider and a customer to fulfill a certain need"* (Volvo Technology Corporation, 2010, p. 4). Obviously, the definition is crisp and clear and moreover, it has a logic which is independent of the product definition. Furthermore, the definition expresses a process perspective and with it, it has high correspondence to the presented and quoted literature. Hence, the chosen service definition must be regarded as firmly established in the literature.

2.2 Service Categories

Services as a business opportunity to product centric companies are commonly differentiated into four categories, which is built around two dimensions. The first

dimension concerns the strategic intent of the service. The continuum of this dimension is product oriented services at one side and customer´s processes oriented services at the other side. Hence, this dimension elaborates on, if the service intends to defend and improve a tangible product or if the service intends to be sold independently and thereby expand the company's product portfolio. The second dimension deals with the source of competitive advantage. The characterizing opposites of this dimension are transaction-oriented services or economies of scale versus relationship-based services or economies of skills (Nilsson & Kindström, 2009). The dimensions, the categories they build up along with concrete examples of each category are provided in figure 2 (Olivia & Kallenberg, 2003). In this thesis the upper right corner of figure 3 is investigated.

	Product oriented services	**End-user's process oriented services**
Transaction-based services	*Basic installed base services* Documentation Transport to client Installation Product oriented training Hot Line/Help Desk Repairs/spare parts Product updates Recycling	*Professional services* Process oriented engineering Process oriented R&D Process oriented consulting Business oriented consulting
Relationship-based services	*Maintenance services* Preventive maintenance Conditions monitoring Spare parts management Full maintenance contracts	*Operational Services* Managing maintenance function Managing operations Outsourcing services

Figure 3 The service concept diversified into four categories (Olivia & Kallenberg, 2003)

2.3 Motives for Service Transition

There are three prominent motives for product centric companies to transform their business models by expanding their offers to include services. The first reason is financial and relates to the commoditization of products which results in lower product margins and a stagnant or lower demand for products. Furthermore, services generally incur lower costs of development and production assets than products (Nilsson & Kindström, 2009).

The second motive regards general market trends of today. It includes the need of companies to be agile to market conditions, however, delivering increasingly refined and sophisticated technologies. These market trends have resulted in that manufacturing companies focus their core competencies and specialize on these while additional needs are outsourced (Witell et al., 2009).

The third reason of service transition is strategic. Services are harder to copy than products and hence, services are a cost efficient mean for product differentiation and competitive advantage. Moreover, product centric companies in comparison to full service providers are competitive benefitted due to their superior product knowledge. In addition, a product centric company going into to services will have benefits in regard to other competing product centric firms, since, service provision establish valuable end-customer contacts (Olivia & Kallenberg, 2003).

Each of the three presented motives for product centric companies to go into services can be further defined into particular and concrete drivers. An example of this, along with some background explanations is given in table 1 (Nilsson & Kindström, 2009).

Table 1 Motives of service transition defined as concrete drivers (Nilsson & Kindström, 2009)

DRIVERS	**BACKGROUND**
INCREASED PROFITABILITY	Many offerings have a higher profit margin a lower need for investments.
CHARGING FOR SERVICES ALREADY PERFORMED	Increase and sustain revenue streams over time (i.e. between new sales).
CUSTOMER DEMANDS	Increase customer maturity.
GROWTH	Possibilities for growth in high market share markets. Less investments needs.
BETTER (DEEPER) CUSTOMER RELATIONSHIPS	Increased customer retention. Better knowledge of customer processes.
INCREASED COMPETITIVE ADVANTAGE	Increased differentiation and reduction of imitability. Create lock-in and lock-out effects.
EVEN OUT ECONOMIC CYCLES	Sustain revenue streams over cycles.
JUSTIFY A PREMIUM PRICE	Include more in offerings and move away from price competition.

3. The Overall Methodology

This chapter outlines the overall methodology of this thesis in order to secure its academic quality. As addressed in section 1.7 the following sections elaborates on methodology applied in all areas of investigation while further specified and detailed methods applied in the different areas of investigation is presented in connection to each area. The chapter starts by addressing and describing the abductive research strategy. Moreover, the chapter deals with methods for data collection and qualitative measures to evaluate the quality of the research results.

3.1 The Research Method

Bryman and Bell (2007) suggest business researchers to have either a deductive or an inductive approach to business research. The difference between the two strategies is their relation to theory. The deductive strategy is described to use theory as a starting point for research. The primarily purpose to study the reality is therefore, to confirm or reject propositions derived from the theory. The inductive approach instead views theory as the result of research. It means that theory is generated by collection and analysis of data. However, far from all conducted research can be defined into either being deductive or inductive. Some researches prefer to approach the relationship between theory and reality as two entities, which mainly should be developed in parallel. This third research strategy is commonly referred to as abductive. Dubois and Gadde (2002) refer to the parallel development of theory and reality studies as systematic combining and explain it as a further theory relying approach than the inductive, still, it is being far less theory dependent than the deductive approach. Systematic combing advocates an interdependent relation between the entities which constitute a research project, this relation is visualized in figure 4. Figure 5 adjusts the general model of systematic combing to better fit the context of this thesis work.

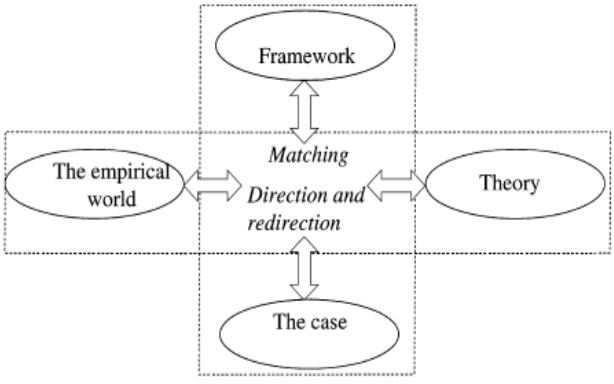

Figure 4 Model for systematic combining (Dubois & Lars-Erik, 2002)

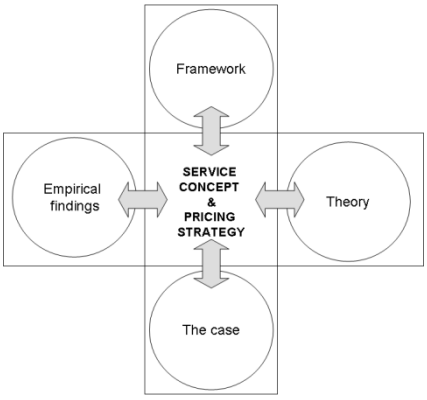

Figure 5 Model for systematic combining adjusted to the context of this thesis

Dubois and Gadde (2002) advocate systematic combing because it is regarded to increase flexibility of the research process which commonly results in valuable cross-fertilizations between theory and practice. This is obtained because theoretical and practical findings are allowed to become highly synchronized. In consequence, systematic combing aims to refine existing theory, rather than developing new. The refined theory adds clarity and logic to the original.

Moreover, the nature of systematic combing brings some aspects which need to be taken into consideration in order to reap the benefits of this research strategy. The parallel development of theory and practice put the final structure of the report at risk. This is since, it could be hard to present the findings in a structured way when the research phases have been intertwined and is lacking clear cuts. Additionally, the researcher needs to make sure that the research process really is conducted in parallel. According to Dubois and Gadde (2002) the parallel approach is threatened if the theoretical framework of the study is defined too early and too narrowly because then the flexibility of systematic combing becomes restricted.

3.2 Data Collection

The data collection regards primary and secondary data. The primary data consist of interviews and observations. The secondary data consider reviews of relevant and mainly scientific literature.

3.2.1 Collection of Theoretical Data

According to Bryman and Bell (2007) the literature review aims to provide an understanding for the main ideas and research relating to the study field of the thesis. The authors also recommend the researcher to focus on "*framing a written discourse of the literature which may be established as a component of a thesis...*" (2007, p. 96). Thereby, it is important to assure that that studied literature is in line with the purpose and research questions of the thesis. Moreover, critical reviewing is advocated and with it, drawn conclusions along with used references and theories should be questioned.

The literature that have been studied is to greatest extent possible unbiased and of academic type. However, if academic literature is unavailable, non-scientific references is used as substitution. Examples of non-scientific and biased references are information retrieved from internal web pages and articles in newspapers (Bryman & Bell, 2007).

3.2.2 Collection of Empirical Data

Bryman and Bell (2007) differentiate between qualitative and quantitative studies by the structure of the study. Qualitative studies need to meet the requirement of replicability, meaning that if to repeat the study in corresponding context to the first study, there is a requirement that the generated result has high similarity to the outcome of the first study. This requirement demands a structured approach to the collection of empirical data. Qualitative studies on the other hand, mostly investigate context specific areas and therefore they are not possible to replicate. Hence, qualitative studies can be more unstructured when approaching the research topic. This thesis takes a qualitative approach to the collection of empirical data.

According to Bryman and Bell (2007) there are several types of case studies, the major difference between the types are its suitability for either a qualitative or a quantitative research approach. This thesis applies a type of case study which is referred to as representative or typical. The typical case study *"... seeks to explore a case that exemplifies an everyday situation or form of organization"* (Bryman & Bell, 2007, p. 64). Typical case studies advocate in-depth studies and hence, provide outcomes that are explanatory strong. However, according to Wendelin (2004) case studies are not always the appropriate tool for investigation because there is a risk that the outcome becomes too situation specific. Furthermore, repeatedly mentioned concerns about the appropriateness of conducting case studies as research method are

that the studies become too descriptive but not explanatory enough, that the results are generalized even if it is statistically incorrect and that the explanatory strength of the study is too weak to be useful within the taken research path – resulting in non-value adding quasi-results (Bryman and Bell, 2007). Questioning of the usefulness of case studies seem to be connected to when case studies are claimed to have greater general or explanatory level than what could be scientifically justified. Dubois and Gadde (2002) express the usefulness of a case study as a trade-off, they are suggesting that given a limited set of resources it is possible to obtain methodical correct results that allows for either general conclusions or in-depth explanations. The general conclusions require a multiple case study, while the in-depth explanatory case study requires one or two narrowly studied and analyzed cases. This thesis prioritizes an in-depth approach in favor of generally applicable results. This since, the relations that are investigated are considered to be too complex to be explained by the shallower multiple case examinations.

Access is another aspect, highly relevant when collecting empirical data. Access regards the ability to get close to the studied object. A successful collection of empirical data is dependent on the access to the right competencies and companies. Access is traditionally a bottle neck to researchers and hence, often become time consuming. Moreover, it is preferable to have continuously access throughout the research project and not only initially. Continually access is especially important to this thesis since the taken research strategy is systematic combining.

3.2.3 Interviews

If the study applies a qualitative or a quantitative approach is decisive for how to conduct the interviews. Qualitative interviews are held with the aim of investigating the viewpoint of the interviewee while, quantitative interviews focus on answer the questions of the researcher. With it, the qualitative interview needs to be more open, in order to retrieve as much information as possible from the interviewee. Nevertheless, some structure is advocated because too loose structure risks more information than what can be efficiently dealt with and also than what can be considered as relevant (Bryman & Bell, 2007). Wendelin (2004) uses the funnel technique for his interviews, it suggests that the large and open questions are put forward at first and these questions are then further specified if needed. This technique secures that the same topics are covered in interviews which answers are to be compared. Still, the structure is open enough not to limit the interviewee. The funnel technique is also applied in this thesis project.

Moreover, Bryman and Bell (2007) recommend that interviews should be booked in advance and preferably in a meeting room where the door can be closed. This is in order to limit the impacts of surrounding distractions. Documentation of the interviews also needs to be considered, methods to choose from is either taking notes or record and later transcript the interview. The methods have different pros and cons, however, they are complementing each other and hence, a combination of the methods is to prefer. Therefore, interviews for this thesis are documented in notes and recorded when it is possible; and that is dependent upon confidentially matters. Transcriptions of the recorded material are made by the researchers of this thesis. One major advantage of taking notes is that it is easy to reflect upon aspects of the atmosphere which cannot be cached if solely recording. However, taking notes may distract the researcher who is conducting the interview and also there is a risk that information is lost. However, all interviews within this project have been conducted

of the two authors in cooperation, in order to capture as much of the given information as possible.

3.2.4 Observations

Interviews are complemented with observations. Observations are conducted in order to increase understanding of the processes at the quarry site. However, observation is mainly focused during the early phases of this thesis project, i.e. during the development of the service concept.

3.3 Reliability, Replication and Validity

Reliability, replication and validity together constitute a set of measures used to assess quality of research within business and management. However, when the research is conducted as a case study there is a disagreement in the literature, weather this set of measures are appropriate for evaluation or not (Yin, 1984).

3.3.1 Reliability

Reliability regards repeatability of the research results and it is especially concerned in quantitative studies (Bryman & Bell, 2007). Repeatability indicates if a measure generates consistent results. Reliability and consistency have three prominent factors; stability, internal reliability and inter-observer consistency. This thesis, since it applies a qualitative case study uses the inter-observer consistency measure in order to assess reliability.

Inter-observer consistency is the reliability measure which is most relevant for qualitative case studies. This evaluation measure regards consistency between interpretations of different observers within a common study. There are a number of methods to secure and assess inter-observer consistency. The securing methods all aim to increase the awareness about the risk of inconsistencies, along with encourage the researchers to build and formulate a common set of references – a foundation for interpretation. A systematic approach should be applied also during transcription of interviews. The assessment of inter-observer consistency is dealt with by triangulation methods. One example of a triangulation method is to asses that interview objects with similar competencies express similar descriptions of the studied problem area (Wendelin, 2004).

3.3.2 Replication

Replication is especially stressed within the positivistic view of science. This measure of quality refers to that a study must be replicable and that it is most often obtained as long as the conduction of the study is described accurately (Bryman & Bell, 2007).

3.3.3 Validity

Validity concerns if used measurements are accurate to explain the studied topic. The assessment of valid measurements can be conducted by the use of internal, external and/or ecological validity. Furthermore, the validity perspective advocates systematic investigation during case studies because justification of validity to the external reviewer requires that it is possible to follow the taken research path.

Internal validity regards causality which means that the relation between cause and effect needs to be certain. Thereby, internal validity is assessed when it can be shown or made sure that the independent variable cause changes in the dependent variable (Bryman & Bell, 2007). One aspect of internal validity in regard to case studies is that

the chosen companies are representative for the phenomenon which is to be investigated.

External validity expresses if the research results can be generalized to concern similar phenomenon as the studied, however, beyond the contextual settings of the study. Thereby, external validity primarily concerns quantitative studies where it is reasonable to use representative samples. Qualitative case studies rarely fulfill the requirement of external validity, since the purpose of a qualitative case study is to make use of the uniqueness of each studied case (Bryman & Bell, 2007).

Ecological validity considers the applicability of the results in the common settings of everyday life. If a result is ecologically invalid then the findings refer to situations that are unnatural. This is important to keep in mind when conducting observations and especially interviews. For example, if the interview is held in an unnatural context to the interview object, it may affect its answers and hence, the findings become ecological invalid (Bryman & Bell, 2007).

3.3.4 Relation between Reliability and Validity

According to Bryman and Bell (2007) most measures could be assessed rather simply, nevertheless, it is rare that testing takes place at all. However, testing of reliability can be simplified by taking advantage of the relation between reliability and validity: validity assumes reliability. The relation between reliability and validity becomes apparent if reviewing the definitions of reliability and validity. Reliability measures the consistency between explaining variables and the measured outcome or concept. Validity refers to that the measured outcome really indicates the intended purpose of the study. Hence, validity requires strong reliability but reliability may be strong though, the outcome is invalid. Therefore, this thesis focuses on evaluate and justify the validity of the studies that are conducted.

4. Service Conceptualization

This section aims at provide a service concept that constitute a business opportunity to Volvo CE. Based in literature studies, mainly concerning New Service Development (NSD) and Lean Thinking, but also empirical studies based on investigations of the customer, several business opportunities which departures from the customer's site are identified. Furthermore, the applied methods and procedures are presented. The section is finalized by presenting the conclusive service concept. The structure of this chapter is literature review, methods description and presentation of the empirical results.

4.1 Literature Review Service Conceptualization

As addressed, this chapter aims to deliver a service concept that constitutes a business opportunity for Volvo CE. Thereby, this area of investigation takeoff in NSD and its step by step structure. Additional theory use is complementing NSD and is presented in each accurate step.

In 1994 Edgett and Parkinson stated that the research field of NSD had recently begun. The authors explained this by the fact that the different needs of services and products in regard to marketing and development were recognized first in the 80's. Until then, needs of products and services were not differentiated, the academia focused on products. Due to the longer history of new product development it is much more sophisticated than NSD. Bullinger et al. (2003) highlight the consequences and results of today's insufficient NSD guidance; necessary content of the service are not clear neither are processes or resources which results in implementation and quality problems. Menor et al. (2002) express frustration about that several large companies do not apply a structured NSD processes. This is because these companies regard NSD as something that just happens and cannot be planned or controlled. The lack of a NSD road map is recognized within academia and among practitioners, however, the field is becoming more extensive. Yet, the reviewed literature is highly agreeing and taken together a fairly rough and aggregated roadmap of NSD can be outlined.

NSD can partly be complemented with product development theory. Edgett and Parkinson (1994), Alam and Perry (2002) and Bullinger et al. (2003) argue that NSD and new product development is inherently different, still, there are parts of the process that are similar. In regard to these similarities product development theory could be utilized, since it is generally much further developed. One example of such similarities is the way a product and a service may be differentiated. Bullinger et al. (2003) give the insurance industry as example, where one highly standardized product, a basic offer is bundled with different add-ons and by combining different add-ons to the standard offer the service is customized. This approach impact the development work and the example confirms a suggestion of Alam and Perry (2002); that new product development theory can be applied as far as the characteristic of services and products could be regarded as similar. These similarities are generally accountable to the result of the service, i.e. what the service does. On the other hand, the process or how the service is done commonly differs considerably. This is mainly because the customer most often has an active role as co-creator during service delivery and thereby, it is much more contact intensive than product production (Bullinger et al., 2003).

Gustafsson et al. (1999), Alam and Perry (2002), Menor et al. (2002) as well as Bullinger et al. (2003) present frameworks consisting of different phases which together are constituting the full NSD process. Overall, the four suggested frameworks are highly similar in its suggested activities. However, with slightly different phrasing the four referred frameworks include phases of strategic planning, problem identification, idea generation, idea screening, concept development and business analysis in their roadmap for service conceptualization.

Furthermore, the different phases can be conducted in different order, either in sequence or in parallel. By advocating formalization Edgett and Parkinson (1994) also advocate a sequential NSD path. A sequential NSD process structures the process and clarifies areas of responsibility. Furthermore, each phase has in the end an apparent outcome. However, the NSD process may as well be conducted in parallel. Concurrently ongoing development phases bring two main advantages; firstly flexibility is maintained through the process, since a previous phase is not set when the next is started. Secondly, the total development time could be shortened since different development phases are conducted simultaneously (Bullingeret al., 2003). According to Alam and Perry (2002) is taking the sequential or parallel approach a matter of project context. Smaller and short projects are recommended to take the sequential path. Moreover, the authors open up for a third set up; a mix of the sequential and parallel set up. Yet, this thesis takes an approach more towards the sequential than the concurrent development path. However, the overall research strategy is abductive and hence, the parallel path cannot be fully neglected.

Figure 6 presents a NSD roadmap illustrating the areas referred to in the literature. However, there is a lack of further detailing of the suggested development phases. Bullinger et al. (2003) appoints the insufficient level of detail and stress that concrete activities need to be set before the NSD process is executed. Edgett and Parkinson (1994) agree and point out the need for further detailing by stressing that a formalized NSD process is a success factor. Therefore, based in additional literature guided by the NSD process, an attempt is conducted to clarify each processes step directed in figure 6.

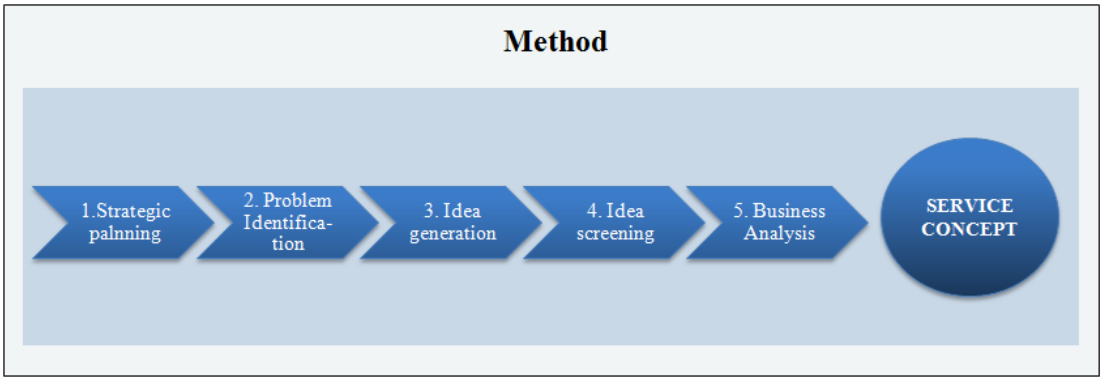

Figure 6 Service concept development model

4.1.1 Strategic Planning

The strategic planning contributes to the service conceptualization by creating understandings for the business area as well as appoints the target customer and further highlights the characteristics of the target customer. Edgett and Parkinson (1994) emphasize the need of this phase by showing that market assessment, clear understanding of incentives and de-motivators along with needs and wants of the

target customers all are key points in successful NSD processes and this is further stressed by Foote et al. (2001), who also highlights the needs of understanding the operations of the customers. Furthermore, as the service definition implies (see 2.1), the customer focus is fundamental which Kumar et al., 2004 also supports in his statement that cooperation with the customers, is crucial in service development. Additionally, the importance of the cooperation is further supported by the different characteristics of the customers; geographical locations as well as the different applications of the products influence the requirements of the service.

4.1.2 Problem Identification

The problem identification aims to specify the problems of the customer and hence, potential areas for Volvo CE to offer solving solutions. To identify which problem areas to focus further as well as the underlying cause of them, support and inspiration is taken from the Toyota Production System (TPS) or more precisely from Lean Thinking which in turn is referring to the techniques and ideas of the TPS.

There are five main principles of Lean Thinking, which are as follows, the elimination of waste, the identification of the value stream, the achievement of the flow through the value process, the pacing by pull and finally, the continuous pursuit of perfection, see figure 7 (Bendell, 2006).

Bergman and Klevsjö (2010) further highlight the principle of eliminating all forms of waste as well as having the focus on generating customer value. Furthermore, to be able to perform an accurate assessment of the operational waste, it is fundamental to identify the value stream of the activities creating the operations (Bergman & Klefsjö, 2010). Consequently, an identification of the value stream followed by an initial understanding of what waste can be seen as the starting point in problem identification (King, 2009). Therefore, the identification of the value stream as well as the elimination of waste is the initial activities in Lean Thinking are further outlined in this section. Additionally they assist the requirements of identifying customer problems and their underlying root causes.

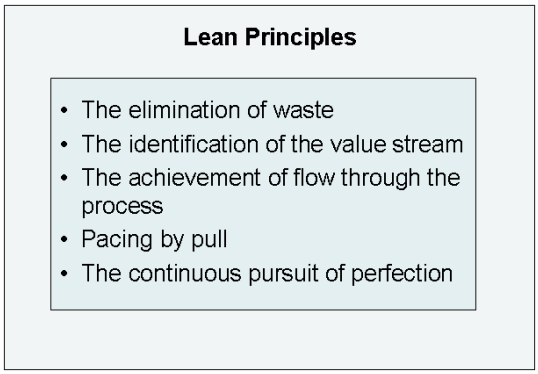

Figure 7 The Principles of Lean Thinking (Womack & Jones, 2003)

Value stream mapping is a basic step in the process towards problem identification. There are three main parameters in the value stream map i.e. the material flow, the information flow and a time line. Those parameters together results in a visualization of the operational bottlenecks, the inventories as well as of the product flow. The mapping facilitates the visualizations when capitalize the situation in a comprehensive way (King, 2009). The value stream mapping further aims at visualizes areas beyond waste, as the sources creating the non-value adding activities. It is also a useful tool to

apply when communicating and comparing different operational processes. Furthermore, the value stream map is useful foundation for future implementation plans (Rother & Shook, 2003). However, the value stream map should be an overall view of the process, but still give enough information to identify waste and production flow. Accordingly, there is a need to balance the information given in the map with the complexity it would create if too many facts are included (King, 2009).

According to King (2009) the customer value must be identified and defined before an identification of waste can be made. This is further stressed by Womack and Jones (2003) who state that the critical starting point of lean thinking is value. The continuation of Lean Thinking is to apply, only the value creating actions, in the most optimal sequence, and thereafter conduct the process with increased efficiency. Consequently, the Lean Thinking aims at providing the customer with exactly what the customer wants but by fewer resources by eliminating waste (Womack & Jones, 2003; King, 2009). Figure 8 illustrates the seven categories of waste originally applied within Toyota, however, today there are several additional suggestions, as for example the waste of human potential and creativity (King, 2009). This additional waste will be considered along with the initial seven. However, the seven categories presented in figure 8 are further specified in the sections below since they highlight the most relevant aspects within the context of this report.

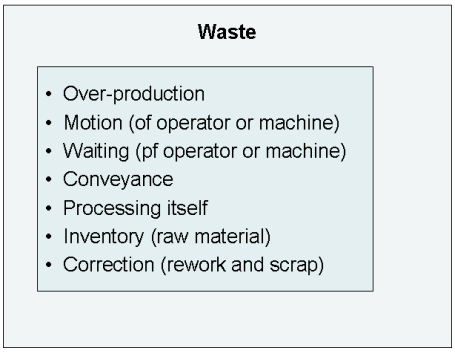

Figure 8 Waste according to Lean Thinking (King, 2009)

Over-production occurs when the outcome of the production exceeds the demand of the internal process customers as well as the demand of external customers. A possible reason for over-production can be an unreliable process. A low capability to maintain a specific production can result in an over-production of each product to secure the future availability. However, there are generally several different route causes for over-production, often based in the specific production. However, irrespective of the underlying reason, all of them result in larger inventories (King, 2009; Slack, Chambers, & Johnston, 2007; Seddon, 2005; Glodsby & Martichnko, 2005).

Motion; often industries operates in large areas which causes waste in terms of operators moving from one area or machine to another. In areas were the operations are conducted in several different levels, the movement can also be vertical which increases the waste of motion. However, since this waste often not affect an increase of other waste categories, it is often down prioritized (King, 2009; Slack, Chambers, & Johnston, 2007; Seddon, 2005; Glodsby & Martichnko, 2005).

Waiting focuses the waste connected to the time spent by the process operators waiting for material needed in the continuation of the process but it can also be waste

caused by waiting for a machine to finish work (King, 2009; Slack, Chambers, & Johnston, 2007; Seddon, 2005; Glodsby & Martichnko, 2005).

Conveyance affects the waste level of the processes considerable since it concerns transportation for all parts within the operations. Often there is a large potential for improvement within this category. The transports may be the result of the use of storages and inventories diversified from the main process line or due to a disconnected production line. Independent the root causes for transportations, resources is used in non-value adding activities (King, 2009; Slack, Chambers, & Johnston, 2007; Seddon, 2005; Glodsby & Martichnko, 2005).

Processing itself is waste connected to activities of including more value into the product than what the customer actually demand. It could be made by including characteristics which have no value to the customer or by packaging and delivering the product in a non-value adding way. Furthermore, this waste can also be caused by activities applied to identify defects as well as the activities needed for improvement (King, 2009; Slack, Chambers, & Johnston, 2007; Seddon, 2005; Glodsby & Martichnko, 2005).

Inventory is created due to several reasons. To avoid or limit the inventory level the processes need to be balanced in terms of meeting customer demand by having a responsive internal material flow. However, often there is room for improvement due to inventories generated to protect operational bottlenecks, inventories generated by long sequences of production or due to capacity differences of the internal activities et cetera. However, it is of importance to find the balance between the inventory and the operation to avoid production loss due to lack of material within the production (King, 2009; Slack, Chambers, & Johnston, 2007; Seddon, 2005; Glodsby & Martichnko, 2005).

Correction is connected to waste of different defections, as for products with parameters outside specifications or products diversified from customer expectations. Additionally, products often have several parameters to fulfill which makes it more difficult to remain within all the specifications. The root cause to the waste "correction" may differ but can, for example, be a result of worn tools or incorrect activity set up, nerveless, it can also be a result of random variation. Due to the many possible origins as well as the challenge in improving the source of this waste, a lot of efforts have generally been put in this area (King, 2009; Slack, Chambers, & Johnston, 2007; Seddon, 2005; Glodsby & Martichnko, 2005).

4.1.3 Idea Generation

In the idea generation phase the identified problems are translated into possible service concept. The service concept aims to correspond to the problems and thereby constitute possible business opportunities for Volvo CE. Moreover, within the idea generating phase, a further specification of the service concept is conducted to clarify the role of each concept. However, to make the generated concepts equivalent, the central aspects of a service concept need to be clarified.

Service conceptualization requires definition of a service concept. Unfortunately, the service concept is not a unified term with a sole definition. Instead different interpretations are applied interchangeably. Goldstein et al. (2002) presents a literature review in order to get an overview of the existing and applied service concept definitions. According to Goldstein et al. (2002), Heskett defines a service

concept as the way in which the *"organizations would like to have its services perceived by its customers, employees, shareholders and leaders"* (Goldstein et al., 2002, p. 123). Moreover, Collier's service concept definition is quoted; he describes the service concept as the *"customer benefit package"* (Goldstein et al., 2002, p. 123). However, there are also a number of authors which breaks down the service concept into artifacts that highlights the "what" and "how" of the service concept. The "what" regards what the customer demand that the service intends to fulfill, whiles the "how" aims to direct how the service is conducted (Edvardsson & Olsson, 1996; Lovelock & Wright, 1999).

Moreover, Johnston and Clark (2001) have developed the "what" and the "how" further. The authors direct three service artifacts: service operation, service outcome and the value of the service. The service operation deals with the "how", i.e. how the service is conducted. The service outcome but also the service value is related to the "what" of the service concept. However, the service outcome refers to the actual result of the service. Service value, on the other hand, concerns the perceived customer value of the service. The perceived customer value evaluates the net benefit of the service hence, the sum of benefits minus the total costs incurred by the service. These service artifacts seem to be considered to provide a rather comprehensive picture of a service concept (Goldstein et al., 2002). Therefore, the three artifacts; service operation, service outcome and service value is used to define a service concept in this thesis work.

4.1.4 Idea Screening

An efficient and low cost solution to apply to decrease the number of service concepts, are to conduct a screening of the different options (Rochford, 1991). The screening supports the initial process of selecting which solution to add more resources on and accordingly develop further (Cooper, 1985; Rochford, 1991). The screening phase is rather comprehensive although, it is theoretical supported. Edgett and Parkinson (1994) argue that a robust screening process is a success factor to NSD. Furthermore, Alam and Perry (2002) appoint the screening phase as one of the more important phases during the entire NSD process.

It is of importance to be aware of the limited amount of available information in the screening stage (Cooper & de Brentani, 1984; Rochford, 1991). Therefore, it is fundamental to be aware of the function of the process, the screening is not aimed at providing exact data or analyses of each project idea but to, in a cost efficient manner, eliminate not value adding projects (Rochford, 1991). Furthermore, the initial lack of reliable information is also stressed by Cooper and de Brentani (1984) who states the screening as a critical, complex and difficult process. Due to the crucial role of available information and the significant importance of past experience of the one conducting the screening processes there will always be a fraction of uncertainty and objectivity involved (Rochford, 1991). Furthermore, this initial screening should be based on a large portion of the participants' intuition (Rochford, 1991; Cooper & de Brentani, 1984).

4.1.5 Business Analysis

There are several different methods and approaches suggesting how to conduct a business analysis. The numerous alternative methods may be the result of the lack of an aligned definition as well as of a standard business analysis process (Paul et al.,

2010). To provide the foundation for the business analysis approach in this thesis this section will discuss some literature findings concerning business analysis.

A business analysis generally considers the entire business area and is aimed to results in a complete picture of the current situation. The analysis is used as the foundation for the determination of how to proceed. However, despite the overall goal of the business analysis, the analysis can be used in several occasions with different objectives (Paul et al., 2010). In, for example, service development processes the business analysis can be applied to investigate the preconditions and future possibilities for the service offer. Aspects as the customers' willingness to pay, the service value and the expected return on investments are some parameters that could be covered in the business analysis (Malmqvist & Andersson, 2010). The financial data could, to a limited extend, be received from the customers (Alam & Perry, 2002).

Dependent on the context of where the business analysis is applied, different levels of detailed data is required. Consequently, the investigation area as well as the focus of the business analysis must be set before conducting further work of initiating the data collection. If the business analysis aims at provide an overall understanding of the investigation area, interviews, observations as well as workshops can used as an efficient method for data collection. However, if more detailed data and concrete answers are needed different verification strategies and questionnaires can be applied instead. Furthermore, in different stages of the business analysis, different approaches of data collection might be preferable (Paul et al., 2010).

4.2 Method - Service Conceptualization

This thesis applies a roadmap for service development in line with the one suggested in the literature. The conceptualization phases and their sequence are visualized in the previous section in figure 6.

4.2.1 Strategic Planning

The methods applied during the strategic planning phase were literature studies as well as interviews with Volvo internal and external competencies. The internal competencies are all experienced in service development. The external competencies included customers as well as equipment suppliers to the business area of quarry and aggregates, however, suppliers with a complementary product portfolio to Volvo CE. A list of interviewees is specified in appendix A.

4.2.2 Problem Identification

To conduct an overall value stream map of a quarry and thereby specify the problem of the customer, particular knowledge about their production processes was needed. The problem identification phase was conducted by site visits and observations in order to map the production process of the customers. The sites that were visited during the problem identification stage are presented in appendix B. Moreover, interviews with site managers along with literature studies provided information enough to successfully execute the problem identification stage. The interviewees are further presented in appendix C.

Based on the observations and the value stream map, the findings were processed and translated into actual problems or possible areas of improvement during a brainstorming session. The duration of the brainstorming was about one and a half hour and included the problem identification as well as a clustering of the problems into themes.

4.2.3 Idea Generation

The result of the idea generation stage is a number of potential service concepts all targeting one or several customer problems identified during the previous problem identification stage. The main activity during the idea generation was a brainstorming session. The brain storming session lasted for one and a half hour. Afterwards, the generated ideas were carefully clustered in order to limit the number of solutions, however, maintaining the initial number of aspects covered within the solutions.

Furthermore, the idea outcome was complemented by further development in accordance to the artifacts or building blocks of a service concept presented in section 3.1.3. The further development of the generated service concepts was done to the extent that the following process of screening was feasible.

4.2.4 Idea Screening

To support the challenge of distinguishing between the different service concepts the screening process includes several decision criteria which define the final selection of one or several solutions. The foundation of the screening applied in this thesis are found in S-GDP, which is the service development model applied within Volvo Technology. In this model, three key criteria are used as a foundation for further elaboration; the key criteria's are customer desirability, organizational feasibility and business viability. Those areas are used as the point of departure when conducting the frequency analysis.

Suitable criteria are identified by a frequency analysis of literature covering NSD in general and evaluation criteria of new services in particular. The source of information is a mix of criteria used in service development as well as in product development; this approach increases the availability of information. References that are used in the frequency analysis are specified in appendix D. However, it is important to highlight that a selective and objective approach has been necessary since the different criteria are explained and expressed differently based on the contextual environment of the source. Furthermore, criteria that are not clearly fulfilling the purpose of service screening have been left out.

To continue, the screening is conducted by a ranking method which results in an outcome of a pass or no pass answer. The solutions are judged according to how well they match the particular criteria. Hence, the method of this phase consists of literature study, primarily to identify suitable screening criteria. Thereby, the base for the screening is the detailed version of the service concepts as well as the achieved understanding of the business area and the target customers.

4.2.5 Business Analysis

The business analysis is the final phase of the conceptualization process and aims to appoint the service concept which holds the greatest potential for Volvo CE as a business opportunity.

According to the literature referred to in 4.1.5 the business analysis can be adjusted to the specific needs of the process. Hence the business analysis applied is adjusted to the context of NSD, which results in a business analysis which consists of three main steps; development and concretization, interviews and finally a second screening.

The development and concretization phase aims at further specify the remaining service concepts. This is done to facilitate the following activity, the interviews.

Interviews were conducted to get an overall understanding of the business opportunity each concept could constitute. Hence, the concepts were used as the foundation in the open interviews, however, mainly discussing the customer desirability as well as the business viability connected to the service concepts. Furthermore, the interviews were held both with internal VTEC and Volvo CE competencies as well as with external practitioners. A list of the competencies of the participating interviewees is given in appendix E. Finally, the extended and discussed concepts were screened, but now against the criteria of customer desirability and business viability. The criteria are reused from the idea screening phase. However, the result of this second screening is to a greater extent than the first screening based on facts, due to the information retrieved in the evaluating discussions and interviews.

4.3 Empirical Results of Service Conceptualization

This section presents the result of investigation area 1; i.e. which service solution provides a business opportunity to Volvo CE? The chapter follows the structure of the NSD model; consequently, the section initially is covering strategic planning, followed by problem identification, idea generation, idea screening and finally the business analysis before presenting the final service concept.

4.3.1 Strategic Planning

According to theory it is easy to understand that NSD needs to be directed towards a particular market segment. The focus of a specific market segment facilitate the understanding of the business area, direct the appointment of the target customers and is fundamental for the process of getting to know the characteristics of the particular business.

The quarry and aggregate industry produces crushed rock in different fraction sizes; these are to a large extent used for filling in construction projects and for production of concrete. In 2009, 57 million ton of aggregates were extracted in Sweden and with it aggregates is one of Sweden's most consumed industry products. On an average each citizen consumes almost 10 ton of aggregates each year. Moreover, the yearly revenue of Sweden's aggregate production is 6 billion SEK and the industry directly employs 3000 persons (Sveriges Bergmaterialindustri, 2011).

In total 2 310 sites are registered in Sweden, however, 1994 of those sites are primarily used for production of quarries and aggregates. Additionally, some of the sites are inactive implying they are not producing continuously. In year 2009, 1 589 of the quarry and aggregate sites were reported as active producers and almost half of them, 705 sites, had a production of 1 to 10 000 tons of material whiles 884 sites had a production that exceeded 10 000 tons of aggregates, the situation is illustrated in figure 9 (Norlin et al., 2010).

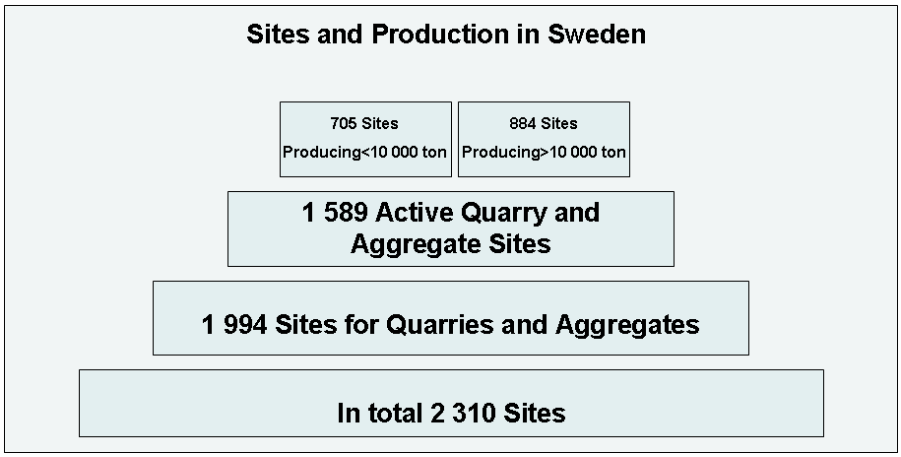

Figure 9 Number of sites and yearly production volumes in Sweden (Norlin et al., 2010)

Moreover, the Swedish construction market is dominated by a few major actors which own large parts of their value chain. This means that the major construction companies are dominating in operating and owning also quarry sites. Nationally five greater construction actors; Jehanders, Svevia, NCC, Peab and Skanska, produce more than 50 percent of all aggregates which are yearly extracted in Sweden (External_Interviewee, 2011; Norlin et al., 2010; Brinkhagen & Näsländer, 2007; Kjellgren & Klasson, 2008; Sveriges Bergmaterialindustri, 2011). However, divergence from the dominance of these companies may be apparent locally because the construction market in Sweden is strongly diversified into regions, e.g. a company which is dominating in one region may not even have presence in another. Also the major construction companies are different strong in different parts of Sweden. Nevertheless, all five actors have reasonably strong presence within and around larger cities because most construction projects are planned to be executed in these areas. Furthermore, a general tendency of the large players is that they prioritize in-house solutions; accordingly, they develop and test solutions within the company (External_Interviewee, 2011).

Furthermore, the business of quarries and aggregates is a relatively high margin industry. In general terms, the margins are about 30%. Consequently, there is traditionally no direct pressure to decrease costs or optimize processes. The internal business philosophy is more or less to carry on as always which indicates conservative tendencies of the business environment (External_Interviewee, 2011).

Generally, the production is strived towards a production target which is set on a yearly basis. Generally there is a small variation in the target level from one year to another. The target is formulated in number of extracted ton and reflects the estimated demand but also the permitted extraction amount as well as the economical aspect of making use of the production equipment. Furthermore, despite the fixed targets, there are large fluctuations in the demand of the products. The demand generally equals the aggregate usage of ongoing construction projects nearby (External_Interviewee, 2011).

Additional characteristics important to highlight is the price position of quarries and aggregates. It is low value products which result in a limited possibility to add activities as transportation before the added cost exceeds the cost of the product. The possible transportation distance is generally within 20-40 kilometers (Sveriges

bergmaterialindustri, 2004). Therefore, the production sites often are located close to the customers (External_Interviewee, 2011).

Furthermore, the production is rather complex and dependent of several external factors. To start with, heavy regulations, especially regulations regarding the environmental impact of the production process, are decisive to how the production process can be executed. Parameters as dust, noise and vibrations are factors affecting the context of production. Those parameters are also the ones which are regulated within a quarry's extraction permit, maximum levels are addressed. To continue, the production outcome is dependent on the quality of the extracted material – the rock. Rock quality affects the production pace as well as the quality of the aggregates. Harder stone material increase throughput time, especially in the crusher. While "softer" rock types result in a less qualitative aggregate product. Additionally, when extracting, ground water may appear which in turn obstruct the production. Furthermore, the production is also affected by season and weather conditions; warm summer days results in a harsh working environment due to dust, while cold winters result in raised fuel consumption. Fuel together with labor expenses constitutes the greatest variable costs at a quarry site (External_Interviewee, 2011; Site observation, 2011).

The production generally starts with blasting at the frontline of extraction; the process is further outlined in 4.3.2 Due to the ongoing extraction a quarry site is under continuous change. The changing environment is challenging since the site layout often consists of several fixed resources. Consequently, quarry sites need a lot of internal transports and often across different height levels. Still, the internal road conditions are rather unfavorable, the roads often lack asphalt coating and are rather narrow, which makes it hard for vehicles to meet.

4.3.2 Problem Identification

According to the literature referred to in 3.1.2 the initial step in Lean Thinking is to highlight the customer value. Therefore, this section is introduced by a short presentation of the customer value at a quarry site.

The general customer of a quarry site regards the price and the quality as important parameters when purchasing material; however, price is stated as the most important factor. Furthermore, the customers require a standardized product which they can rely on. The requirements are closely connected to the specific application of the product. Quarries used in a road construction project must, for example, be durable to heavy constant wear. Another important parameter valued by the customer, i.e. the aggregate user, is the location of the site. As addressed in 3.3.1 quarries and aggregates are low value products which decrease the possibilities to add additional costs as transportation. Consequently, the values can be summarized to consist of mainly three parameters, price, quality and the site location (External_Interviewee, 2011).

When departure in the above stated values the price is seen as the realistic parameter to focus and influence by a consultancy service provided by Volvo CE. The quality as well as the site location is parameters demanding either a great possibilities to influence in an early stage or an advanced expert knowledge. Therefore, the customer's value perception of price is expected to be the value supported by the consultancy service.

So, by taking departure in the customer value of price, a value stream map is conducted. However, before presenting a general value stream map of a quarry site the basic steps of the extraction process is introduced and further applied as a basic illustration supporting the value stream map. The processes of extraction, in terms of the number and order of refinement processes which are needed are similar between quarry sites. However, there is several ways to conduct these process steps and that diversify quarry sites from each other. The different ways refer to type of equipment and if the process is conducted in-house or if it is outsourced. However, the general steps of refinement are visualized in figure 10 (Site observations, 2011; External_Interviewee, 2011; Brinkhagen & Nässlander, 2007).

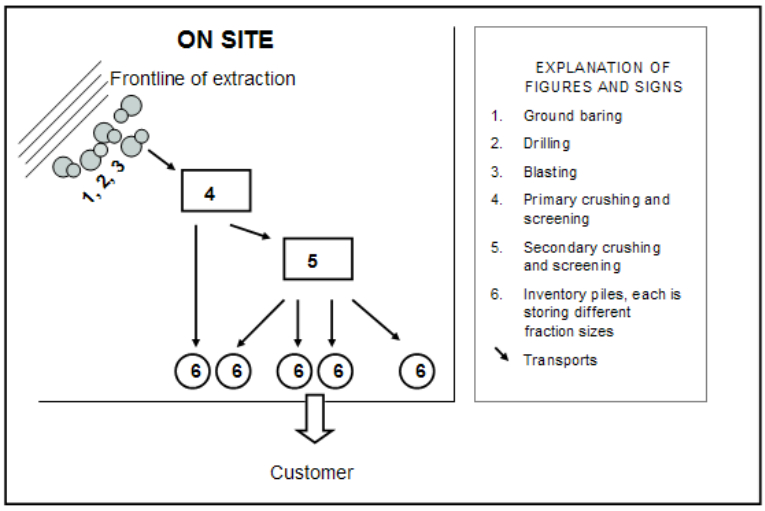

Figure 10 Map of the process steps of refinement during crushed rock production (Brinkhagen & Nässlander, 2007)

1. *Ground baring* which imply removing trees, earth, clay and other material covering the rock surface by excavating. The cost of ground baring is site dependent on the volume of material covering the ground. However, generally the baring is quite expensive due to high consumption of expensive resources as man hours and fuel.
2. *Drilling* is needed to enable the blasting of the rock. The numbers of drilled holes are dependent on requirements of the size of the blasted fractions, the area over which the fractions are spread and the vibration levels that are permitted. The permitted vibration levels cannot be affected and therefore the parameters of size and spread of fractions may be elaborated around from an optimization perspective. Larger fractions mean quicker loading to the crusher but less productive crushing, while smaller stones takes longer time to load but those allow the crusher work faster.
3. *Blasting*. The more holes, the less dynamite could be used in each hole and hence, the spread is limited. When the material is blasted it is collected by loaders and transported by haulers to proceeding process steps.
4. *Primary crusher and screening*. The blasted material is moved to the primary crusher which is loaded from the top. Depending on capacity and layout of the site the crushers are either fixed or mobile. Furthermore, there are different types of crushers in use, the choice of crusher is mainly dependent on the requirements on the end product in terms of shape and distribution of fraction sizes. Furthermore, the crusher is often the bottleneck of the production. While

the stone has been crushed the outcome is screened through several strainers with a decreasing mesh size.

5. *Secondary crusher and screening*. Fractions which need to be smaller than what is obtained in the primary crusher stays in production and is transported to a second round of crushing and screening in a secondary crusher.
6. *Inventory piles.* After crushing and screening the product is finalized and the outcome is stored until it is sold. Usually the aggregates are stored in inventory piles sorted by fraction size; however, some sites use silos instead. The set up and placing of inventory piles or silos is different between sites. Some sites have the entire inventory gathered in one place, where it also is easy for customers to come and fill their trucks. Other sites have their inventories dispersed over the site due to closeness to crushers or lack of space. Moreover, it is a common set up that the same fraction is gathered in several piles spread on the site; these piles are often moved around while the extraction continues. The extraction as a continuous process has great implications at site since the preconditions for the production are never fixed, e.g. the distances between a fixed place at site like the placing of a fixed crusher and the frontline of extraction is continuously elongated (External_Interviewee, 2011; Site observations, 2011; Sveriges Bergmaterialindustri, 2011; Brinkhagen & Nässlander, 2007).

The mapping of the production process provides an overall illustration of the processes that are undertaken at a quarry site. This insight is fundamental for the conduction of a value stream map. However, as addressed, the environment of every quarry site is unique which result in a requirement of a specific value stream map to analyze the situation at the site. Still, some general processes and activities are possible to illustrate and therefore use as a point of departure for further waste identification in non-value adding activities. Hence, the value stream map, in contrast to the process map, highlight value in connection to the production activities.

Figure 11 presents a general set up of a site with a yearly production of about 450 000 ton aggregates. However, the illustration differs from a traditional value stream map in terms of the use of diesel consumption per ton instead of using time consumed per piece or product. This set up is preferred due to two main reasons. Firstly, time is generally not a critical factor at a quarry site. Secondly, by highlighting the use of diesel, a comparison of the consumption in the value stream can be made. The calculations are further specified in appendix F.

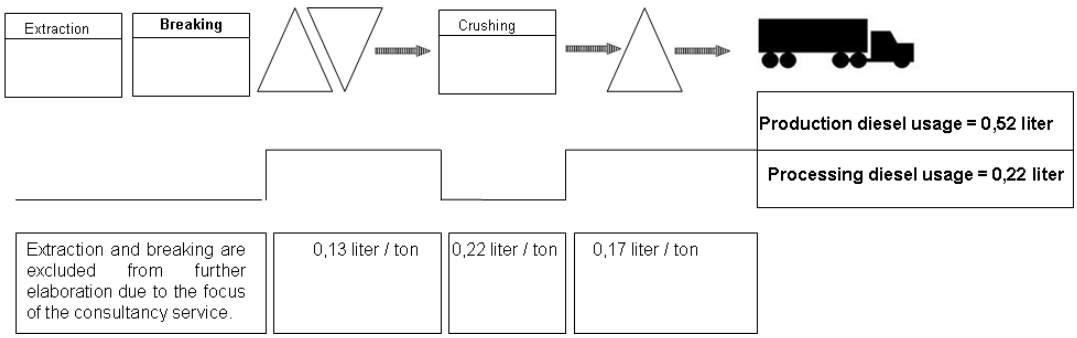

Figure 11 A general value stream map of the quarry operation

As addressed in figure 11, extraction, which includes ground clearing, drilling and blasting, as well as the process of breaking large blocks into smaller fractions are

excluded in the further elaboration of the value stream. Those activities are conducted to extract raw material and can be compared to a traditionally shipment and arrival of raw material to the production site. Consequently, the focus of the waste identification is initiated first after the primary inventory. From the inventory, the process is continued by a kanban system were a lamp indicates when to feed the crusher. However, the transportation is made independent the signals, in occasions of unfinished products in the crusher; the quarries are placed in a small inventory located next to the crusher. The crushing process includes both the primary as well as the secondary crushing activity. The activities are followed by transportation to different inventories dependent on the fractions of the end product. The value stream is finalized by the activity of loading material from the inventory into the customer vehicles.

The value stream highlights the total usage of diesel in the production as well as the diesel usage connected to the value adding activities. In total, about 42 % of the diesel consumed in the process is connected to value adding activities. However, a positive effect, both concerning cost as well as environmental issues, could be attained by improving the non-value adding activities.

So, by considering the production process together with the result of the value stream map and the additional knowledge concerning the characteristics of a quarry site, several improvement areas and problems at the customer site are indentified. In total, 27 different problems were identified at the customer site. To handle the findings in an efficient manner the problems is clustered into five different themes, i.e. planning, organization, business context, at site and lack of incentives. The five themes and the problems are illustrated in table 2.

Table 2 Identified Customer Problems

PROBLEMS				
Planning	**Organization**	**Business Context**	**At Site**	**Lack of incentives**
•Demand fluctuations •Lack of plans for the land where the material when extraction is finished	•Conservative organization of production •In-house solutions are prioritized •Little or no use of synchronization facilitators between the vehicles at site	Resources •Expensive equipment •Labor; expensive but important. •Fuel; expensive but important. •Fixed resources limits the possibilities to adapt the site to changes Employees •Low education level. •Not equipped with a business mindset Additional •Standardized customer requirements •Complex production, many parameters to take into consideration •Operations are weather and season dependent •The production is heavily regulated, especially environmental regulations	Quality of Rock •Decisive to production pace •Decisive to quality of finished product Logistics •Bad road quality •Long internal transportation roads •Lot of slops Environment •Site is continuously changing when the line of extraction is pushed forward. • A lot of dust – harsh working environment. • Water from ground affect productivity negatively. Additional •Crusher often bottleneck of production. •Inefficient handling of inventory.	•Lack of process measurements •An approach of "same procedure as last year".

Furthermore, according to the value stream of the quarry site, the largest areas of waste are identified in inventories and transportation. Those areas are also highlighted as waste areas within Lean Thinking. Inventory as well as conveyance are central

areas and should be eliminated or reduced as much as possible. However, a sufficient level of material in the inventories at a quarry site is necessary to maintain a reliable supply. It is important to have a good balance in the material flow to avoid interruptions caused by, for example, unpredictable accidents and machine wear. Furthermore, the inventories as such are not connected to any larger costs as long as they not influence the fuel consumption. Consequently, the costs emerge when inventories are removed to another location, which is identified as a waste caused by conveyance. Furthermore, transportation is also conducted between the processes as well in connection to the customers when loading their vehicles. Some internal transportation is needed; however, multiple handling of inventories as well as disconnected process steps has a negative impact on the level of waste.

There are also some indications of waste caused by waiting and motion. The waiting mainly occurs in connection to a bottleneck machine, however the process continues by placing the material next to the machine which results in extra handling of the material when later feeding the machine. This is an example of the interrelations between the activities and the effects the processes may have on each other. Furthermore, waste in terms of motion is mainly caused by the environmental context of a quarry site, the business generally operates in large areas which further increases along with the processes. The site is often in several levels due to the extraction process, which results in the need of movement in long distances as well as in vertical directions. However, the movement is mainly conducted by machines, resulting in an additional factor of waste in the area of conveyance.

Finally, the three remaining waste areas, over-production, processing itself and correction are not identified as urgent areas of waste at a quarry site. The production produces according to set action plans and the final products are placed in inventories. The only parameter limiting the inventory size is the availability of space. Furthermore, processing itself and correction is not a matter of waste since the process is conducted according to the requirement of the customer and, due to the characteristics of the products; any direct correction of the material is not conducted at site. So, the main areas to investigate are activities connected to conveyance, inventories, motion, and waiting.

4.3.3 Idea Generation

The idea generation was conducted to identify potential service concepts of interest to Volvo CE's customers. However, there are several different opinions of what a service concept should communicate and include (see chapter 4.1.3). The further specification of the concepts was based on the artifacts defined by a service concept. The artifacts are by the project group defined as customer value, service outcome and service operation. In total, 12 service concepts were the result of an idea generating brainstorming session. The service concepts are presented by names in figure 12. Moreover, the concepts are further specified in appendix G.

Figure 12 The 12 Service Concepts

4.3.4 Idea Screening

As illustrated in figure 12, the brainstorming session resulted in several service options. This demands a selective approach to conclude upon a limited number of possible service concepts. The need of decreasing the number of concepts for further development origins in the complexity in developing all of them as well as the need of resources in terms of time and cost associated with service development.

The criteria of the Volvo internal service development process, S-GDP, are comprehensive securing fundamental aspects of concept elaboration. However, as addressed earlier, there is a need of more specific criteria to decrease the level of uncertainty. Henceforth the three key criteria of S-GDP, customer desirability, business viability and technological and organizational feasibility are applied as a foundation for further elaboration in an analysis investigating the frequency of criteria used in different articles, books and reports. Customer desirability refers to the customers' desire for the service, whiles business viability cares for if the service is financially viable. Finally, technological and organizational feasibility considers the practicability of the service (Volvo Technology Corporation, 2010). Table 3 presents the findings of the frequency analysis.

Table 3 The Screening Criteria

Customer Desirability

	1	2	3	4	5	6	7	8
Customer willingness to pay	•	•				•		
Service fulfill customer needs		•		•			•	•
Service fulfill customer whishes		•	•	•			•	
Customer expectations		•						
Service meets customer behavior		•				•		
Implementation costs of the service						•		

Technological and Organizational Feasibility

	1	2	3	4	5	6	7	8
Access to right skills	•	•	•	•	•	•	•	•
Access to right technologies	•	•		•	•	•	•	•
Enough organizational capacity	•	•	•				•	•
Enough financial resources	•	•	•		•		•	•
Use existing service system		•						
Present distribution channels				•		•		
Level of dependency to other partners						•		
Feasible to deliver							•	

Business Viability

	1	2	3	4	5	6	7	8
Satisfactory financial return of service	•					•		•
In line with current business	•				•			•
Does service strengthen existing offer	•							
Customer willing to pay a price	•	•						
Fits into assortment		•						
Market conditions		•				•		•
Market size		•			•	•	•	•
Geographical diversity of the market				•				
Market development		•		•	•		•	•
Competition in the same trade		•		•	•	•	•	
Competition from "invaders"		•		•	•	•	•	
What could go wrong with the service			•					
Uniqueness of product (service)				•	•			•
Resistance to cyclical fluctuations				•			•	
Resistance to seasonal fluctuations				•			•	
Investment requirements								•

As seen in the above table in total 30 different criteria's is considered. To decrease this number only the criteria which obtained a frequency of three or more is considered, which constitute 50 % of the total number of criterions. Consequently the 15 criteria highlighted with a bold text are applied in the screening process.

The screening process aims at result in a limited number of possible service concepts. The screening results of the 12 concepts are presented in appendix H and the three initial "winners" of the first screening are given in figure 13.

Figure 13 The solutions passed the initial screening

4.3.5 Business Analysis

This section presents the outcome of each of the three processes of the business analysis as well as the result of the business analysis as a whole. Thereby, short descriptions of the developed concepts are presented and followed by a summary of the evaluating interviews along with the result of the second screening. Appendix I presents a more narrow description of the three service concepts and appendix J shows the result tables of the second screening.

In-service training consultancy service

The in-service training concept offers the customer to share Volvo CE knowledge and insights about quarry operations. The outcome of this competence improving education can be tailored to specific site conditions by merging Volvo CE knowledge with customer insights in interactive workshops. The education is given within three themes; environment/ sustainability, production economy and best practice. The in-service training can be adjusted to fit any target group within a company operating quarries, for example if management is intended, the teaching will focus a strategic and long-term perspective, while for operators the approach will focus the daily operations. The goal of the training is to equip the customer with knowledge and insights that will facilitate changes improving site performance, the improvements will be direct or indirect dependent on the target group within the customer organization.

Energy efficiency consultancy service

Based on long-term experience and knowledge of equipment energy consumption combined with sophisticated operator training skills, Volvo CE offers a site specific

energy consultancy service optimizing energy usage connected to operational work. The energy consultancy service will decrease cost associated with energy consumption by optimizing the use of equipment in combination with providing knowledge in how to set up the optimal site. In addition to cost savings environmental regulations stress the importance of increased energy consumption awareness which is fulfilled by a visualized set-up identifying the areas of energy usage. The created awareness results in more qualitative decisions based on facts.

Operational incremental improvement (OII) consultancy service

By the advantage of a well-founded knowledge and experience of construction equipment, Volvo CE offers an operational incremental improvement consultancy service aiming at optimizing the operational work at site. The service consists of two steps; the first step assesses the current productivity status of the site along with appointing possible areas of improvement. The second step identifies and describes performance improving undertakings. Suggested undertakings are founded on lean concepts and the specific preconditions at site. The service intends to optimize the customer's performance incrementally and thereby, provide advantages as ease of implementation and little need for new major investments.

The second step of the business analysis consists of an investigation of the practitioner's evaluation of the service concepts. This is further outlined in the following sections.

Customer desirability targets to evaluate the concepts in regard to the customers' willingness to pay as well as the concept's fit to customer needs and wishes. All of the interviewees, Volvo internals as well as externals agreed that the willingness to pay is mostly dependent on the cost savings that the service incurs. The Energy efficiency consultancy service is perceived as the service which has the strongest link to cost savings. After all, the suggested consultancy service intends to lower the diesel consumption and hence, expenses for diesel usage will be lowered. The in-service training service on the other hand is interpreted to facilitate especially soft values, which are harder to put in direct relation to cost savings. Still, the in-service training service seems to trigger a higher willingness to pay among external interviewees. The Volvo internal competencies believe that in-service training should be a constituting part of any of the two other services but the service is not viewed as an alternative standing alone. The standpoints between internal and external interviewees are also scattered concerning the OII service. Volvo internals see a great potential in lean methodologies and interpret the willingness to pay almost as high as in the case of the Energy efficiency consultancy service. The external competencies do not agree and the main motive for the disagreement is that they do not see the potential to apply lean methodologies at site, at least not in the near future. There is a general view among the external interviewees that their conditions of productions are to unique to fit in to the standardized processes which are required by a lean approach (External_Interviewee, 2011; Internal_Interviewee, 2011).

Generally Volvo internal and external competencies perceive all service concepts to fulfill customer needs. Still, there are some differences in the opinions of the urgency of the needs. Nevertheless, the Energy efficiency consultancy service is considered to address an important and current need of the customer. On the other hand, not any of the concepts are considered to fulfill current wishes of the customers. Because the

current wishes of the customers seem to focus on instant needs, hence, tangible equipment (External_Interviewee, 2011; Internal_Interviewee, 2011).

The business viability perspective has two focuses; competitors and service fit to market performance. Competition considerations cover the presence of competitors in the same trade and in others', as well as the availability of substitutes of the suggested services which are targeting the same needs but fulfill them differently. When evaluating each service fit to market performance the particular conditions of quarries and aggregates are taken into consideration; the increasing usage of aggregate products, the high margins within the business, the conservative attitude towards production and finally the strong urge to solve needs and problems in-house (External_Interviewee, 2011; Internal_Interviewee, 2011).

From a competitive perspective, the OII service seems to have least competition within as well as outside the trade. This view is shared by Volvo internals and externals. However, there are several firms working with services which focus to apply lean methodologies within different kind of production processes but these companies do not have any certain offers targeting quarries and aggregates. The reason is believed to be related to the quite particular business in combination to its rather limited market size. The in-service training service on the other hand seems to be exposed to rather fierce competition inside as well as outside the trade. Still, the degree of competition is recognized to vary over the three provided themes of training. Moving on to the service concept of the energy efficiency it is familiar to external and internal interviewees. Interviewees share the perception that there are actors within and outside the trade which are offering services targeting energy efficiency. The recognition mostly refers to the Eco Operator training services. These trainings are provided by Volvo, Caterpillar and third part providers. Furthermore, one external practitioner recognizes the Energy efficiency consultancy service concept as a whole and describes that Caterpillar already has a similar service and offers it for free to initiate purchase processes. Caterpillar focuses site logistics along with suitable machine choices (Caterpillar, 2011). However, internal as well as external interviewees believes that competition outside the trade will be limited to actors which for different reasons have a more comprehensive interest in the business area of quarries and aggregates. To Volvo CE the comprehensive interest corresponds to the opportunity of increasing sales of Volvo machines (External_Interviewee, 2011; Internal_Interviewee, 2011).

When evaluating the services in regard to business performance the Energy efficiency consultancy service stands out due to two reasons. First and foremost it is the service concept which derives most positive judgments throughout the interviews and furthermore, it is the service concept that creates the greatest alignment among Volvo internal and external competencies. The Energy efficiency consultancy service is the only concept among the suggested which is believed to derive sufficient return of investment and hence, constitute a business opportunity to Volvo CE. In addition, internal and external competencies with different backgrounds and experiences witness an increasing pull of the market for environmental performance improving products and services. The in-service training is generally not considered to trigger a willingness to pay which is high enough, while the OII service is not believed to attract sufficient business volumes. Especially the external practitioners believe that the service is of interest primarily to sites larger than the average and thereby, the potential business volume is too limited. Several of the external interviewees also

consider the OII service as too progressive since the readiness for lean methodologies is considered as fairly low (External_Interviewee, 2011; Internal_Interviewee, 2011).

However, neither of the service concepts seems to be particularly successful in terms of turning the not so favorable market conditions into an advantage. Therefore, it is advocated by Volvo internal as well as external competencies that any of the service concepts, if developed further needs to be marketed with a strong pilot case. The pilot needs to proof the theoretical benefits of the service. Moreover, several interviewees externals and internals comment that Volvo CE has greater credibility in providing the service concepts or elements of service concepts that are in line with Volvo CE's brand values; quality, efficiency and environmental performance. (External_Interviewee, 2011; Internal_Interviewee, 2011).

The final process of the business analysis consist of a second screening and as indicated during the interviews the Energy efficiency consultancy service concept is stronger advocated than the others and it was reflected also in the result of the second screening. The Energy efficiency consultancy service holds the greatest business potential to Volvo CE. Hence, the service will be continued to be developed within the scope of this thesis.

5. Service Realization

The second investigation area intends to appoint which resources and competencies that Volvo CE has to provide, in order to realize the Energy efficiency consultancy service. Specifying the needed resources for service delivery clarifies the cost structure and thereby, the incentives for Volvo CE to extend their businesses into services. The structure of this chapter is as follows; literature review, methods description and presentation of the empirical results.

5.1 Literature Review Service Realization

According to the NSD process, there is a need to further outline the service concept before or simultaneously to specification of resources (Bullinger, Fähnrich, & Meiren, 2003; Alam & Perry, 2002). Scheuing and Johnson (1989) express further outlining of the service concept as transforming it into concrete operational entities. Gummesson (1991) refers to this development as service design and describes it as detailing the service concept into drawings, flow charts and particular processes. Edvarsson and Olsson (1996) divide the development processes into two focus areas; the service process and the service system. The service process cover the elements of service activities needed to execute the service. The service system correspond to the competencies and resources needed to perform the activities which constitute the service process. The service process and the system together support the core of the service which is expressed in the service concept. Edvardsson's and Olsson's view of the relation between concept, process and system is visualized in figure 14.

Scheuing and Johnson (1989) as well as Alam and Perry (2002) advocate that customers to and personnel from the delivering organization should be actively involved in the overall concept development and particularly in case of the service process. Edvardsson and Olsson (1996) elaborate further on the participants taking part in the concept development work and present several motives which encourage the involvement. One motive, among others is that the internal personnel and the customers are creators of the service. Hence, they are both influencing service quality. In addition to customers' and personnel's insights Scheuing and Johnson (1989) recommend to use competitors' offers as a source of inspiration for service development.

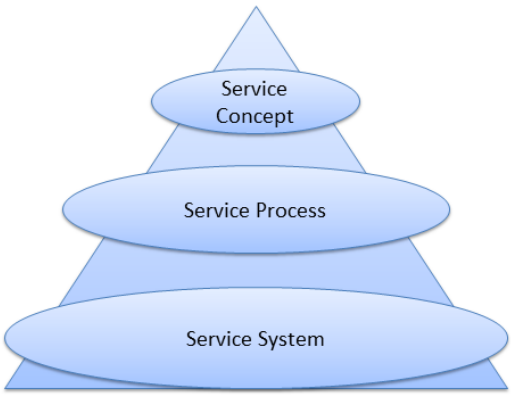

Figure 14 Relation between constituting parts of a service

5.1.1 Problems to Solve

The service processes as well as the service system need to be based in specific requirements to further address adequate areas. Hence, the specific problems aimed to be solved needs to be highlighted. Often, the problems are weakly defined, despite the underlying complexity and additional issues connected to the problem areas (Paul et al., 2010). The initial understanding of the problem area can be gained by meeting the customer; however, this is not enough to obtain the complete picture of relevant parameters connected to the problem area. It is important to understand why a problem actually is a problem (Gustavsson et al., 1999). Hence, deeper investigation is a fundamental starting point for the continuing work of going into possible options and solutions (Paul et al., 2010).

5.1.2 Service Processes

The service as a whole consists of several activities or processes. To develop these constituting parts of the service the supplying organization's means and methods for delivery need to be defined. Characterizing for the service processes is their dynamic nature – several activities are run through before service completion. The development should be guided by the service concept, since it is the customer value of the concept which is aimed to be fulfilled. Moreover, it is recommended to use visualization tools to secure that the entire service process is covered. Furthermore, a visualization of the entire service process defined in its constituting parts also describes the relations between the processes and appoints internal as well as external interaction points throughout the process (International Organization for Standardization, 2011).

5.1.3 Service Systems

The service system represents the resources needed to execute the service activities which are building up the service as a whole. The service system is static and in difference to the dynamic service process, it needs to be in place throughout service delivery. Edvardsson and Olsson (1996) suggest that the service system should be developed concurrently to the service process, since the availability or possibility to get hold of the material and competencies are constraining for service realization and success. Bullinger et al. (2003) mean that the service system should be designed in the same modular way as the service process, in several sub systems which together constitutes the system of material and competencies needed for the service activities. However, the modular system facilitates concurrent development of processes and systems. Alam and Perry (2002) stress the need of fit, not only between modules but also between the system and the processes of the service.

Bullinger et al. (2003) define the constituting parts of the system as competencies, material and immaterial resources. However this thesis focuses on the first two, since the study represents a pre study and resources which are immaterial today might be available for free tomorrow.

5.2 Method Service Realization

This section presents the approach to identify the needed resources and competencies in order to realize the Energy efficiency consultancy service. The steps ought to be taken in order to finalize this second area of investigation are summarized in figure 15.

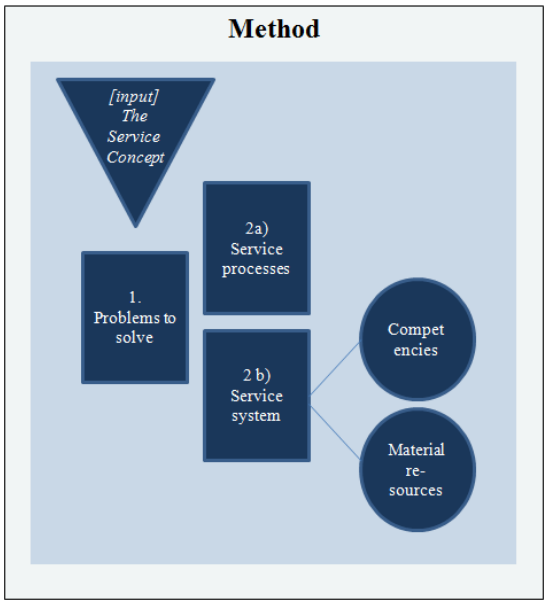

Figure 15 Visualization of the method for the second area of investigation

5.2.1 What Problems to Solve?

The first part of this second area of investigation is a continuation of the first area which identified problems related to the production processes of aggregates (section 4.3.1). However, this part appoints and further describes the problems which are intended to be solved by the Energy efficiency consultancy service. Thereby this part builds a foundation to the following sections which suggest how the appointed problems should be solved and moreover, what resources that are required to support the solving service process. This part, as the prior problem identification area, is based on interviews with competencies from the industry and site observations.

5.2.2 Service Processes

The expected outcome of defining service processes is a structure of activities, which together constitutes the service as a whole. In order to design a service which is possible to realize, the service structure is based on interviews with customers and distributers of Volvo's current product range. In addition, inspiration of service elements are gathered from competing offers, however, mostly from third part providers active in other industry segments than quarry and aggregates. Still, the end-result and service structure is discussed with practitioners – to secure reliability of the work.

5.2.3 Service System

The concrete methods to develop the specification of needed resources hence, the service system are studies of resource needs in similar services as well as studies of internal Volvo CE material. Similar services are studied module wise, which makes the study possible regardless of the lack of energy efficiency services within the segment of quarry and aggregates. The internal material is studied in order to understand the current availability of resources. Moreover, the material from Volvo CE is complemented with interviews of relevant competencies within the organization.

5.3 Empirical Result Service Realization

This section presents the result of investigation area 2; i.e. which material resources and competencies that are needed in order to realize the service solution. Initially the

problem areas are presented; these are followed by specifications of the service activities and the service system.

5.3.1 What Problems to Solve?

As the Energy efficiency consultancy services aims at decrease cost, improve the environmental impact as well as optimize operations, the question of how this will be done is fundamental and require a well-founded answer. Consequently, it is of importance to highlight what the service aims to improve. In section 4.3.2 several customer problems were identified, and by the applied value stream map and additional support from Lean Thinking a limited focus area of waste concerning waste in conveyance, inventories, motion, and waiting were identified. Those areas are further investigated and the customer problems connected to respectively waste are identified. The result of which customer problems that is further developed can be seen in figure 16 and the following sections outline the problems further.

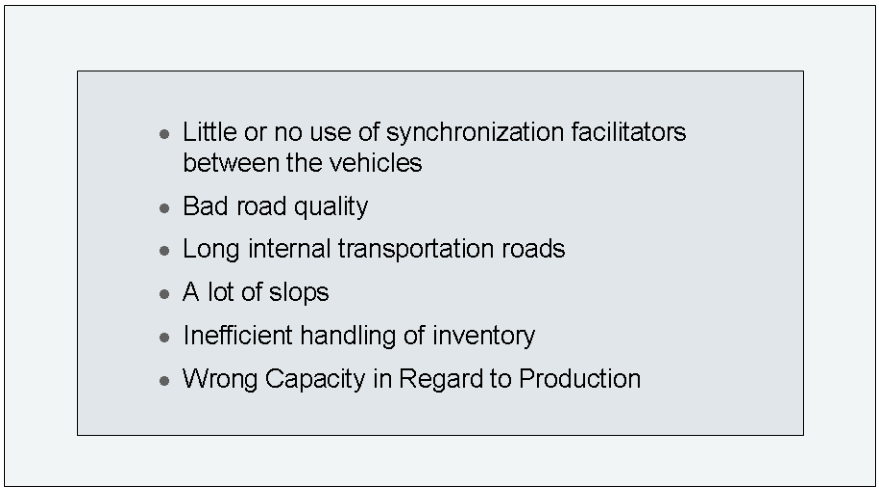

Figure 16 Identified problems to solve

Little or no use of synchronization facilitators between the vehicles. The improvement potential within this problem area is connected to an optimization of the internal logistic operations at site. Speeds and loads should be optimized facilitating a continuous work flow at site. By synchronizing vehicles, waste in terms of not value adding energy consumption is avoided. If the internal transports at site is functioning optimal, no waiting or unnecessary operations will be conducted, hence fuel connected to those operations is saved. The potential of savings are observed at sites were loading and transportation to the crusher is conducted faster than the crusher operates, hence vehicles end up queuing. Furthermore, a synchronization facilitator would also support the internal logistic in terms of visualizing oncoming vehicles. This assist logistics since the general road network at site limits the possibility for vehicles to meet, resulting in the need of reverse and waiting until the other vehicles has passed.

Bad road quality. Cost and energy consumption is connected to bad road quality in two different ways. First, the quality of the road affects the cycle time of the internal processes, hence insufficient maintenance of roads and the terrain will affect the strain of the vehicles resulting in a limitation of possible speed and optimal use of the road network. Secondly, bad roads will also wear out tires of the vehicles resulting in unnecessary cost which further increase transport related operating costs. Additionally, due to an insufficient quality of internal roads, customers generally

collect the products at fixed locations instead of carrying the internal cost of transportation by collecting the goods at the location of extraction.

Long internal transportation roads. Internal transport is necessary to move the products between different locations at site as from the area of extraction to the crusher, however, transportation is connected to cost in terms of fuel, wear of vehicles as well as of working hours. Additionally, the negative environmental impact of transportation is becoming an increasingly important parameter to consider. However, as the sites continuously are changing the prerequisites, the internal logistics is challenged. Furthermore, often fixed stations as inventory and crushing sets the site condition and affects activities as transportation. Consequently, as the site changes, activities need to adapt to the fixed resource resulting in long internal transportation roads.

Lot of slopes. Due to the characteristics of the quarry and aggregate business, different levels at site are a natural outcome of the extraction. However, transporting goods uphill towards a platform above the initial position costs in terms of fuel consumption. One example is when extracting in levels located lower than the level of the crushing activity resulting in the need of transporting a loaded vehicles up-hill while empty vehicles returns to the extraction area. Consequently, costs associated to fuel consumption increases as well as the negative environmental impact due to the slopes at site.

Inefficient handling of inventory. The production capacity are highly site dependent, however, the need of space dedicated for inventory placement is needed irrespectively of production pace. As addressed above, the site layout is continuously changing due to extraction. This challenges the assessment of deciding the location of optimal inventory placement. Furthermore, another parameter affecting the inventory placement is lack of available space. One location can be used temporarily due lack of options, however this often result in additional movement of finished goods, consequently, insufficient production planning is one important cause of inefficient handling of inventory. However, additional handling of finished goods decreases product margins as well as tie up resources that could be used in value adding activities facilitating optimal operations.

Wrong capacity in regard to production. Using the right equipment in each activity in terms of number vehicles and their capacity may seem fundamental; however, there is a large improvement potential within this area. Optimizing the vehicles fleet will result in savings as well as in a decreased environmental impact, furthermore, right fleet will improve the operations. If machines larger than needed are used fuel will be spent in unused capacity, however, low capacity will shorten the specific cycle time but may result in lost production as well as in a high loading of the vehicle. By adapting the equipment to prevailing circumstances, gains in terms of captured production and efficient use the equipment will be seen.

5.3.2 Service Process

This section outlines the activities needed to realize the Energy efficiency consultancy service and with it, improve the customer's overall and environmental performance by reducing energy usage. The individual needs of the customers are highly site specific and therefore require a flexible offer in order to fulfill different customer requirements. Consequently, the service contains several elements and most of them are interrelated and fit to each other. The primary intention is to provide a package

which is combing activity elements according to the needs of the customer. The package of service elements aims to create greater customer value as an entity than the sum of each activity element would do if delivered separately. The additional value is created by Volvo CE as a service integrator. However, the solving activities can in some cases stand alone, if it is especially asked for by the customer. Nevertheless, the focus is to combine service process elements to customized solutions and thereby the offer targets a broad customer base. However, a potential customer site needs to exceed a minimum production volume in order to achieve cost savings which are large enough to motivate the service investment. Still, the ambition is that site operators, regardless of the site's maturity stage should find the service value adding.

Figure 17 illustrates the main structure of the service, it consists of three phases. The primary intention is that the customer starts in the assessment phase and continues to the stages of realization and operations management. Based on the urgency of the assessment the customer continues to buy solving approaches or service entities from the realization base, the services are bought with or without support of implementation. As a final stage is operations management provided and it is a number of service entities which has the objective to sustain the improved site performance that is achieved during the realization phase. In addition to those three phases, training and performance measuring are offered as a supportive or a separate service option. Figure 18 illustrates the different elements included in each service phase.

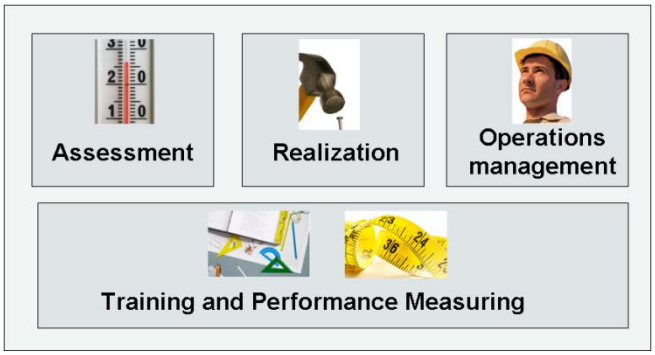

Figure 17 The Energy efficiency consultancy offer

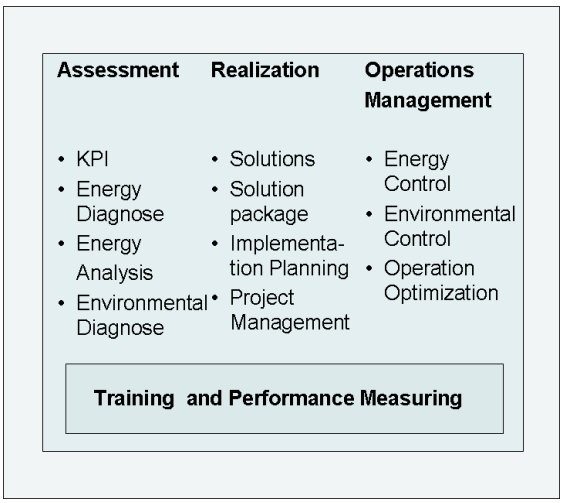

Figure 18 The service elements

Assessment

The Energy-efficiency consultancy service offer takes off in the assessment phase were the pre-conditions for the following steps; realization and operations management, are set. The objective of the assessment is to provide data for increased control of the potential improvement areas at site as well as to create valuable data to support efficient decisions connected to the highlighted problems and the energy usage. The assessment phase is divided into four areas which cover a range of assessing services. The areas are; Key Performance Indicator (KPI), Energy diagnosis, Energy analysis and finally Environmental diagnosis.

KPI

KPI is recommended to be the initial service. It is fundamental and gives a brief indication of the energy use at site connected to the specific problem areas. This service element will result in a proposal of how the customer should develop their work in connection to the identified problem areas. Consequently, the energy optimization potential will be delivered as well as a prioritization list of actions for improvement.

Energy diagnoses

The Energy diagnoses service makes further use of the information gained during the KPI activity. However, the information is further complemented by a site study conducted in cooperation with the customer. Additionally, customer data and statistics as fuel consumption et cetera are used when conducting the energy diagnosis of the site. Furthermore, customer input is fundamental to secure that site specific experience and past knowledge is highlighted and applied in the diagnosis. Consequently, interviews, observations and an analysis will result in an indication of the customer's energy usage level and improvement potential of the site. Furthermore, energy saving areas is highlighted along with suggestions of how to prioritize the possible improvements areas.

Energy analysis

The Energy analysis offer is based on the Energy diagnosis and further focus within areas, identified as critical and therefore in need of further and deeper investigation. The service provides a detailed description and understanding of the critical problem areas in regard to energy usage. Moreover, the information can additionally be used as input into environmental projects. The deeper analysis may also be helpful as a foundation in decision-making of future investments.

Environmental diagnoses

The Environmental diagnosis is founded in the information gained during the Energy diagnosis or in customer data if there is a robust amount of data covering relevant areas. However, the offer additionally transforms the result into environmental parameters important within the customers' operation. The service is valuable to the customer since it appoints the environmental impact of the site operations, which are data useful in, for example, environmental reporting as well as within other marketing aspects. Furthermore, the information gathered in the Environmental diagnosis could be useful in regard to the regulations and permits.

Realization

To realize the solutions within the Energy efficiency consultancy service there is a need of concrete actions fulfilling the expectations of the full service offer. The realization part of the consultancy service aims to offer service activities which create fuel efficiency at the customer site.

Solutions

The concrete activities target the six identified main areas for energy wastage at site. Hence, the services are focusing on road quality, capacity level, logistics, handling of vehicles, synchronization between production processes and finally inventory management. Figure 19 illustrates the solutions categories, the concrete solution suggestions as well as the problem areas and their connections. There are a number of options available and the customer is suggested to buy one or several service solutions to obtain increased energy efficiency at its particular site. Which services that are suggested is generally a result of the outcome of the previous assessment phase. Still, the suggestions are flexible and the customer has the opportunity to add and choose service solutions by their own preferences. However, if the service is applied to support the design of a new site or a complete re-engineering of an existing one, ultimately services within all problem areas are used because then an overall optimization between the problem areas could be achieved.

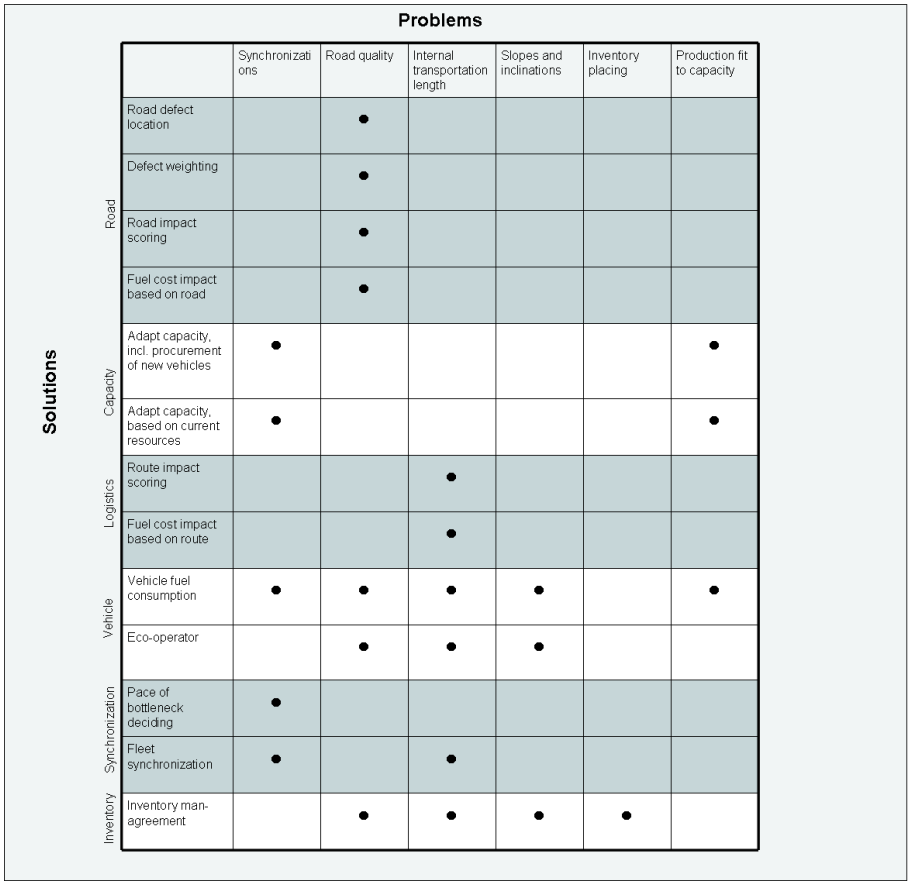

Figure 19 Problems and service solutions

Road quality

Two of the larger cost bases for aggregate production are fuel consumption and equipment maintenance along with its replacement. The quality of roads at site has a substantial impact on these costs. Moreover, improved road quality contributes to an improved working environment for the machine operators. Furthermore, it is usually beneficial if the customers enter the site themselves to pick up their aggregates but the customers require acceptable road conditions because they are of course not willing to put their vehicles at risk.

Roads coated with asphalt are optimal in regard to lower fuel consumption, wear and tear of machines as well as for the comfort for the operators. However, asphalt coating is also the most expensive alternative. Therefore, choice of road coating is a trade-off between the user frequency and expected life-length of the road yet existing and alternative routes impact the outcome.

- *Road defect location* – The quality of the roads are investigated and the result will be given together with improvement options. The cost of quality improvement is compared against the fuel consumptions as well as to the wear of the vehicle. The defects are visualized on a site-specific map.

- *Defect weighting* – At a majority of sites, there are a number of roads to use and these are of varying quality. The defect weighting will support the sites with information concerning the most urgent areas were improvements are required.

- *Road impact scoring* – Is a broad approach which is considering several parameters resulting in a suggestion of the optimal road choice based on the conditions of the roads. The parameters, which are considered in this investigation, are which type of road it is, i.e. if the road is used mainly for transportation to a crusher, transportation to inventory or used by customers et cetera. Furthermore, slops and road quality are also included in the investigation. The result of the road impact scoring is a report indicating which road to use based on parameters affecting fuel consumption along with maintenance cost of vehicles for example cost of tier wear.

- *Fuel cost impact based on road* – This part of the consultancy service offers an investigation of the specific fuel consumption based on the different road coating options at site. The awareness is valuable to the customer for example when planning extraction order and future routes for internal transportation.

Capacity level

Oversized but also too small machines in relation to demanded production capacity are non-optimal from a fuel-consumption but also from an overall cost perspective. Furthermore, not just the machines but the fleet as a whole needs to be adapted to the production level, since poor fleet configurations with vehicles ill adapted to each other's capacity level generates wastes, primary idling and/ or additional but unnecessary sub-operations to avoid idling. However, optimal fleet configuration require procurement of new machines, however, balance improvements may be obtained also by rearranging the use of the current machine fleet which is generating only smaller investments such as new accessories.

- *Optimization of fleet configuration, including procurement of new machines* – First the demand and production target is put in relation to contextual factors and current productivity performance of the site. The outcome serves as a base for setting up a suitable fleet configuration. This service package, since it directs substantial investments in new vehicles, is mostly applicable to the establishment of new sites or re-engineering of existing sites.

- *Optimization of fleet configuration, limited to current state of site and fleet* – Also this service entity begins to establish understanding for the production target, contextual factors of production as well as current production levels. The fleet configuration is then determined based on the available fleet, however, adjustments which require smaller investments are most likely directed.

Logistics

At site, internal transports are needed; however, these transports are not value adding in their selves. Hence, internal transports should be kept at a minimum. However, it is challenging to maintain efficient internal logistics over time at a quarry site, since site conditions are continuously changing as the extraction line is pushed forward. The service packages are targeting to lower the energy consumed due to internal logistics. Thereby, the service packages impact route lengths and vertical movements.

- *Route impact scoring* – This service option focuses the length as well as the slopes of the roads at site. Thereby the best roads and optimal routes are identified from a fuel consumption perspective.

- *Fuel cost impact based on route* – this offer has a broader approach investigating the fuel consumption in a larger perspective. The impacts investigation takes off in the initial phase of the site operation, i.e. in the first transportation after the blasting activity. (see section 4.3.2) The service aims at providing the customer with data supporting an optimal use of the current stretch of roads and site layout.

Vehicle related

The fuel consumption level differs substantially between operators and also between sites. This service category aims to change the behavior of machine operators to operate more fuel efficient. Therefore, these services are education focused and departure in the current site conditions. Thereby, the service entities does not require cost which incur larger and additional investments.

- *Vehicle fuel consumption* – By collecting fuel information from the individual vehicle directly from the operators alternatively from the machines an analysis of the specific consumption is possible. The information will be complemented by other facts as the vehicle specific operation as well as weather conditions et cetera. The information will support the site to decrease the energy use by the possibility of following up activities, comparing as well as functioning as a base point when setting targets of a decreased energy usage level.

- *Eco-operator* – This service supports an optimal use of the machines which results in decreased costs and a lower environmental impact due to an increased fuel efficiency. Nevertheless, this service is already offered today but as a standalone service offer.

Synchronization

Poorly synchronized processes create inefficiency and waste within the production. A systematic approach to adapt and match production processes to each other reduces related wastages and increase flow of production. Hence, activities which are aiming to improve synchronization, create predictability and balance within the production process as a whole. This is obtained for example by streamlining operations and adopting an overall and common production pace at the production site.

- *Pace of bottleneck deciding rate of production* – To have a common production pace for all constituting processes of the production, means that the production processes are balanced to each other. A balanced production pace is beneficial since it helps to detect production problems. However, balanced processes can only be achieved if the bottleneck of the production process as a whole is decisive to the production pace. Therefore, this service package helps the customer to identify the bottleneck and adjust the other processes to the pace of the bottleneck. This service also adds value to the customer by appointing current capacity and which processes that are constraining to increase it.

- *Fleet synchronization* – The service aims at optimizing the vehicle flow at site by applying a GPS solution. The improved communication between the vehicles will facilitate the internal logistics by reducing unnecessary waiting and occasions when operators need to reverse to let another operator pass. The outcome of this service is enhanced if the production pace first is balanced.

Inventory

The inventory category targets many sites' unstructured handling of inventories, the service primarily takes a layout perspective. The aim is to create visual and accessible piles for operators as well as for aggregate customers. From an overall as well as a fuel efficiency perspective; moving around inventory piles cannot be motivated since it adds production costs but no value to the end product.

- *Inventory Management* – This service aims at support the site with knowledge of the optimal inventory placement. The suggestions are mainly founded in the specific site lay-out, production planning as well as in the current road conditions and levels of extraction. Several parameters interrelate and affect the optimal solution for a specific site. However, the inventory management service does not generally incur any larger additional investment costs. The implementation first and foremost requires moving of inventory piles.

Service package

The service package consists of the different solutions bundled into a package suitable to the particular site at hand. The site owner gets support in which services to buy in order to increase the energy efficiency as much as possible in regard to available resources. The package takes the overall perspective and hence, sub-optimization problems are avoided and instead synergies may be obtained.

Implementation planning

The service considers the chosen service element or package and aims to plan implementation together with the site owner to obtain as smooth and efficient realization as possible. The co-operation is a prerequisite for a successful implementation because Volvo CE's general insights to and expertise of site operations need to be complemented with site specific details. The service facilitates a smooth and efficient implementation of the service elements which constitute the package. Two examples of activities given within this service is support in procurement of needed services or products incurred by this service as a whole and another is scheduling of activities which are needed to achieve improved performance.

Project management

The project management service means that Volvo CE is responsible for the management of implementation of suggested process changes. The service starts in appointing a project leader within Volvo which works together with a team from the customer to implement the changes that the outcome of the service elements suggests. The process manager executes the needs appointed within the realization phase.

Operations Management

The last phase of the service offer is a set of services which sustains and improve the results appointed and implemented during the realization phase. Therefore, the services within the operation management category focus continuous evaluation of operations by measuring process performance and react on process deviations.

Energy control

The energy control service continuously measures the energy usage at site and simultaneously builds a database which stores the performance data in a structured manner. Moreover, deviation outside the tolerance limits in regard to the target performance are noticed and explicit measures ought to be taken are addressed to the site manager. This control and evaluating service is ultimately based on telematics and energy consumption data is sent to a back office at Volvo CE where the data is processed. An alternative to the automatic telematics solution is that the site manager posts the consumption data on the web interface. Regardless of how performance data is collected is feedback on the performance communicated to the customer through a web interface. Hence, the customer value of the service is that Volvo CE keeps track of site performance and gives feedback and if reactive actions are needed then these are explicitly proposed. Moreover, if the deviation cannot be fixed by the suggested measures a Volvo consultant visits the site in person.

Environmental control

Environmental control is similar to the Energy control service; however, environmental performance is the point of departure. Hence, performance targets and tolerance limit concerns environmental measures. Nevertheless, feedback of performance data and suggested follow up actions in case of deviations are offered as in the Energy control service. The Environmental control service naturally integrates environmental focus into the daily production operations. The service creates competitive advantage as differentiator of the site's products but also a possibility to be prepared to meet regulatory requirements which are becoming stricter.

Operation optimization

Operation optimization aims to continue and improve the changes implemented during the realization phase. It is a program which explicitly appoints how to continue to work with the changes in order to get out further effect. This service is applicable to many of the service elements within the realization phase. However, operation optimization is not applicable to all of them.

Training and Performance Measuring

Training and Performance measuring is a continuous part of the service offer and is recommended to be applied throughout the service process but also prior and/ or after service delivery. The training sessions are customized in regard to the company context and the competencies of the intended students. Therefore, the given training differs in length, content and education methods. Still, all training sessions have exercises where the topic dealt with is applied in the everyday work of the participants.

The process performance measurement is given as a separate service but it is also included in several of the service elements which are given within the realization category. This is in order to show impact of the delivered service. The performance measurement is conducted either as a generic set of KPIs or as measures which are defined by the site. In addition, Volvo can help a site to develop suitable measures and routines to work with, in order for the site to secure its performance. When measures and routines are defined the site can continue with the measuring themselves, however, Volvo CE also sells assistance of performance measuring on a regularly basis.

There are several reasons that training and measuring are offered, however, the most prominent cause is that these activities gather the customer organization around energy and environmental issues. The training creates understanding and awareness, for how every employee can impact the energy consumption. Furthermore, training stimulates internal and site improving idea generation, it increases work content along with loyalty among employees. Measuring is offered in order to visualize the performance of the organization's processes. Measuring could be used to show the impact of production process changes. Moreover, process measures could be a requirement from the permit holder or a base for benchmarking, in regard to the own performance over time or towards other quarry sites. Furthermore, regular process measurement is a prerequisite for process control and for reliable processes. Thereby, performance measurement is a vital part of a company's quality and environmental work.

5.3.3 Service System

The service system aims to support the activities that are conducted during service delivery. Thereby, identification of the service system requires that the actors involved in the service delivery are known. However, organizational issues are delimited from the scope of this report. Still, the report needs to take a stand in order to continue with the service system. Through interviews with Volvo internal and external competencies (2011) it has become apparent that there are several advantages of rolling out the Energy efficiency consultancy service within Volvo CE's existing dealer structure. The benefits of using the current dealer structure primarily refers to that the customers prefer to have one Volvo CE contact. The dealer already has established customer relations and there are possibilities for the dealer to increase sales by offering a portfolio which is expanded with services. Moreover, using the current dealer structure limits the need for organizational changes and hence, increases smooth of implementation. Taken together, this means that the service system is built around the actor structure presented in figure 20. Thereby, the delivering actors are the dealer which is responsible for the consultants and Volvo CE which is divided into two entities; one developing part and one supporting part – the back-office. The figure's filled arrows represents interaction while the transparent arrow shows information exchange.

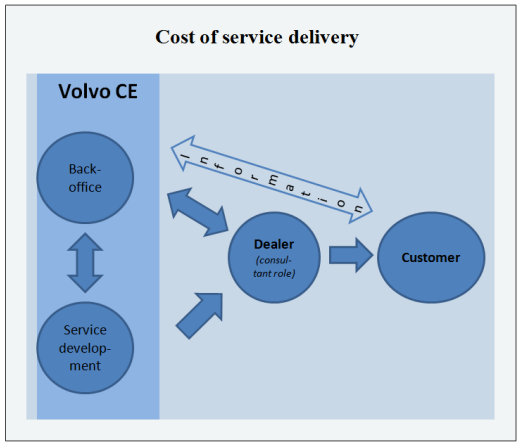

Figure 20 Actor structure for service delivery

Knowing the actor structure the service system can be defined. What competencies and material resources does each of the actors need? Starting with the competencies the three delivering actors have a competence need which regard service theory, lean philosophy and the quarry and aggregate business. Generally, the more interaction the actor has with the customer the more operational competence or capability is needed. Figure 21 summaries the competencies that the service system needs to include for providing the Energy efficiency consultancy service. The figure directs each competence to a certain actor.

The service developer needs a solid theoretical base in order to develop the service offer and to be able to communicate it to the consultants which execute the service and represents the dealer. Therefore, the service developing part of Volvo CE needs a solid theoretical foundation along with a competence that is training the consultants.

The back-office part of Volvo CE has some direct interaction with the customer, however, the relation is not intuitively perceived by the customer since the relation does not mean direct face-to-face contact but information exchange. This since, the back-office is a co-provider of some service elements within the operation management part of the service offer. Therefore, the back-office needs to have the competence of a fuel consumption data analyst. Moreover, the back-office supports the service delivery by being a competence resource to the consultants especially in case of time consuming and complex tasks, for example analyses work. Finally the back-office also has a role of collecting experienced based data from the consultants' customer interaction. The data is then utilized by the service development part within Volvo CE to improve and develop the Energy efficiency consultancy service. For example, by facilitating comparative studies.

Finally, there are the consultants that belong to the dealer organization and they need to have operational skills to realize the service offer. These realization skills first and foremost regard to apply the consultant's service toolbox. The toolbox is developed by the service developing part of Volvo CE in order to enhance and streamline service delivery. Still, use of the toolbox requires understanding for the rationale of the service offer, which means that the consultants need to have a basic understanding for service theory and lean philosophies. The consultants receive this basic understanding as well as the ability to apply the service toolbox during the Energy efficiency consultancy training and that is given by the service development's consultant training competence.

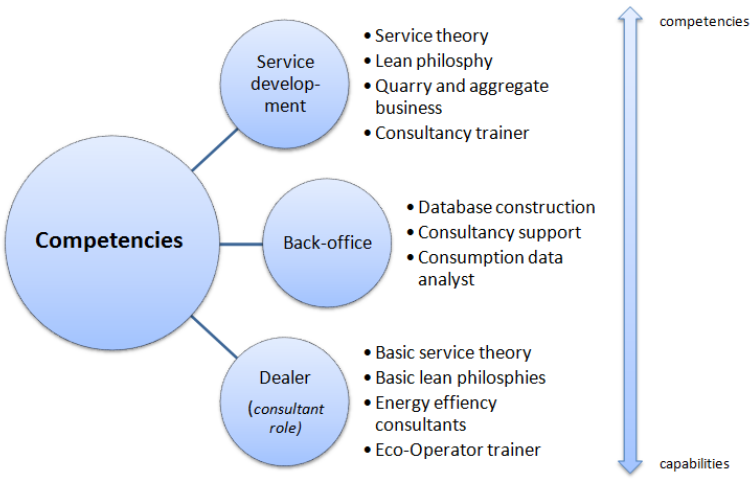

Figure 21 Competence needs

However, the service system also consists of material resources. The material resources are defined rather wide and include routines and other documented material as well as software specifications but also tangible and generic things, for example the consultant's kit. Figure 22 presents the different needs of material resources and the needs are connected to its providing actor.

The service developing part within Volvo CE needs to provide toolboxes for service execution. The toolboxes constitute a point of departure for the consultants' service delivery. Thereby the toolboxes operationalize and facilitate service delivery. Moreover, these boxes streamline service delivery and through them Volvo CE has the opportunity to partly control service content and quality. An important aspect of service quality is the quality of the tangible deliverables that the service offer includes. Again, the service development unit has the possibility to impact that the delivery actually includes what the service intends to by equip the consultants with guidelines and routines. Hence, the service development part at Volvo CE needs to include routines for documentation into the service system. In addition the service needs to comprise information communicated during promotion as well as during service delivery. The developing part, as well contributes with customer and promotion material and thereby the developing part has another opportunity to influence service content and quality. Finally, the service development part needs to provide tools and equipment to support the execution guided by the toolboxes. The equipment refers to software controlled by Volvo CE. Especially the realization phase (see chapter 5.3.2) of the service offer has several service elements which are facilitated by the functionality in the Volvo owed software programs SiteSim and Matris.

The back-office needs to operationalize the competencies which it is required to provide. This means that the competence to construct an actual database needs to be realized into a database, where consultancy experiences can be systematically stored. Moreover, the consumption data analyst needs to get the data from the site. However, means are also needed to communicate the results of the analysis back to the site. The first matter is preferably arranged by a telematics solution and the latter by a web interface between the back-office and the customer.

The dealer i.e. the consultants need to have sufficient preconditions to make use of the skills and competences they need to master in order to deliver the Energy efficiency

consultancy service. These preconditions are covered within the directed consultant's kit. The kit covers practical facilitators of the service such as a computer and a car.

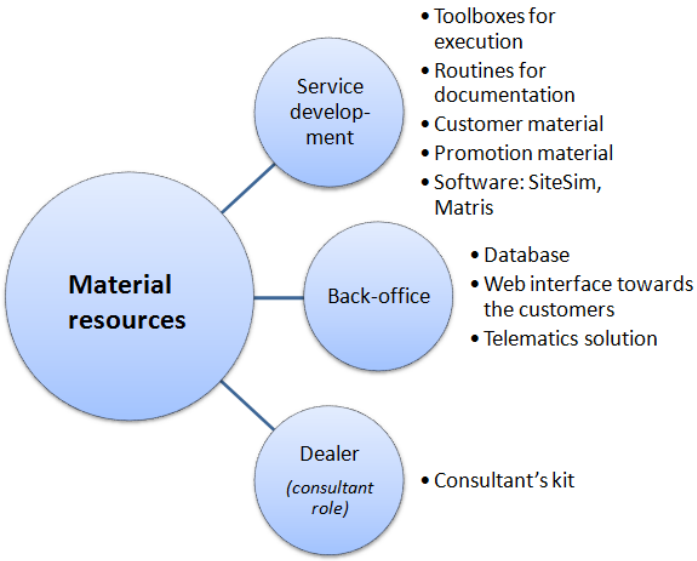

Figure 22 Material resource needs

6. Pricing Strategy

This section aims at provide a pricing strategy for the Energy efficiency consultancy service. By literature studies, mainly concerning pricing strategies of services, combined with specific methods and empirical studies a pricing strategy is developed. The structure of this chapter is as follows; literature review, methods description and presentation of the empirical results.

6.1 Literature Review Pricing Strategy

Pricing of a service is crucial for its value contribution to the service provider (Margetta, 2002). The chosen price level impact profit margin but also demand. Hence, overpriced as well as underpriced services are damaging to the profitability of a company (Lovelock & Wirtz, 2011). This implies the importance of applying a well-founded pricing strategy. However, choice of pricing strategy is complex since several parameters interrelate and must be take into consideration (Kotler, Keller, Brandy, Goodman, & Hansen, 2009).

Effective pricing transforms sales into revenues; hence, pricing is core for the financial success of a company. Thereby, pricing creates value to the business owners. The amount of created value is dependent on the price level. A low price creates low margins per sold unit, while a high price lowers product demand which as well impact the revenue streams (Margetta, 2002).

Pricing is about balancing unit margin and demand, in order to maximize profit. However, unit margin and demand are multifaceted concepts and thereby, it is easy to understand that pricing is a rather complex area. Pricing of services are particularly difficult because of their characteristics of intangibility and perishability. The many pricing strategies applied in today's service market confirm the perception of that service pricing is not an obvious field (Lovelock & Wirtz, 2011).

To continue, the first step in deciding a pricing strategy is to know the objective of the service that is dealt with. The second step is to build a founding understanding for the fit between the service at hand and the available pricing logics. There are three different strategic logics for pricing; cost based pricing, competition based pricing and value based pricing. The strategic direction can be chosen when financials, demands and substitutes of the service have been investigated (Roegner, Seifert, & Swinford, 2001). Lovelock and Wirtz (2011) describes the three investigation areas as a tripod, which is visualized in figure 23.

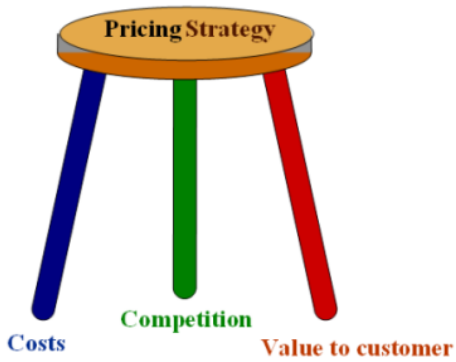

Figure 23 The Pricing Tripod (Lovelock & Wirtz, 2011)

6.1.1 Pricing Objective

As a starting point for determine a pricing strategy, the provider needs to be certain about its overall objective of offering the service. The objective may refer to direct and monetary advantages but can just as well target strategic development and thereby, the monetary focus is less direct. Foote et al. (2001) and Johansson et al. (2003) highlight non-monetary advantages for product centric companies to go into services. The main benefits refer to that services enhance competitive performance by differentiation and act as door openers to new markets. Additionally, there is a great value in establishing long-term relations with stakeholders in general and customers in particular. Closer customer relations imply an increased understanding of customers' needs, demands and wishes. That is facilitating to soft but also to hard product development (Foote, Gailbrath, Hope, & Miller, 2001).

Further on, the overall objective's impact on revenue requirements along with demand expectations needs to be clarified. Requirements for revenue refer either to cost coverage or profit generation. Moreover, cost coverage needs to be further defined since there are three different levels of cost coverage. These three are fully allocated costs, costs of providing one particular service and incremental costs. The first include corporate overhead costs, while cost of providing the particular service excludes corporate overheads and incremental costs equal the cost of selling one extra unit. Services which have a non-monetary objective usually take one of the cost covering perspectives. Profit generating objectives, on the other hand, must cover fully allocated costs and in addition provide a profit margin.

The demand expectations either wish for as large demand as possible or to increase demand within an appointed market segment. Maximizing demand is often in line with the overall objective if the service production is connected to a large fixed cost because then the service production is benefitted by economies of scale. Alternatively, the demand expectation targets a user base for example to increase the company's share within a particular market segment and thereby attract a steady user base. Increasing the market share is most generally beneficial to the company's soft and hard product portfolio as a whole.

6.1.2 The Cost Leg of the Pricing Tripod

Looking deeper into the cost leg of the tripod; financials, marginal costs, fully allocated costs and break even prices need to be investigated. However, costs and especially in regard to services are hard to predict. The largest cost of service delivery is most often related to labor costs and these are generally harder to predict than cost of material which is the common cost base within manufacturing. However, the literature advocates different strategies to tackle cost tracking in regard to service provision. Lovelock and Wirtz (2011) suggest dividing the cost elements into fixed and variable costs. Fixed costs are defined as costs unaffected by the produced quantity, for example corporate overhead. Variable costs are, in opposite to fixed costs, dependent on the production volume. An example of a variable cost is the material consumed during service delivery. Kotler et al. (2006) advocate a more advanced technique to identify costs; the Activity Based Costing method. The method is more accurate but also requires more in data. However, tracking the cost of service delivery identifies the floor or the minimum price.

6.1.3 The Competition Leg of the Pricing Tripod

Competing service offers as the second leg of the Pricing Tripod needs to be investigated in order to understand competitive advantages at the market. Competing service offers refer to direct competitors but also to actors that are providing substituting services. The bases for competitive advantage in regard to services and in addition to low price are speed, personal relationships, switching costs and specific time and location for delivery (Hutt & Speh, 2007). However, due to the heterogenic characteristic of a service, they are generally hard to compare. Still, a service provider needs to understand the pricing strategy of its competitors. Understanding the approach of the competitors also enhances the possibilities for an effective market communication and that is regardless of which strategic path that the company chooses. Furthermore, the competitive investigation appoints a target price (Kotler et al., 2009).

6.1.4 The Perceived Customer Value Leg of the Pricing Tripod

The third leg of the Pricing Tripod, i.e. the customer's perception of service value intends to create understanding for the service's net benefit value. Lovelock and Wirtz (2011) define the net benefit value as the benefits minus the costs generated by the delivered service and recognized by the customers. Consequently, the net benefit value reflects both monetary and non-monetary service elements. The service providers' ability to communicate the non-monetary benefits is decisive for how the customers judge the net-value of the service and hence, to the customer's willingness to pay. The aim to investigate the customer's willingness to pay is to identify the ceiling or the upper price limit (Roegner et al., 2001). Johansson et al. (2003) highlight the importance of understanding and being able to quantify the value perception of the customers' by providing an example of a chemical company which charged their customers several percentages below the average willingness to pay. In doing so, the company lost an opportunity to increase its revenue and above all its profit.

6.1.5 Set the Pricing Strategy

Investigating the three areas suggested in the Pricing Tripod establishes an understanding for the viable price range of the considered service offer. This is because the outcome of the tripod's cost leg sets a price floor, while the perceived value leg directs a ceiling. The idea of that a floor and a ceiling price are indicating a service's possible price range is pictured in figure 24. Furthermore, the achieved insights into competitors' pricing, through the Pricing Tripod, are useful to map a target price within the directed price range; moreover, the insights are useful to understand competitors' pricing strategy.

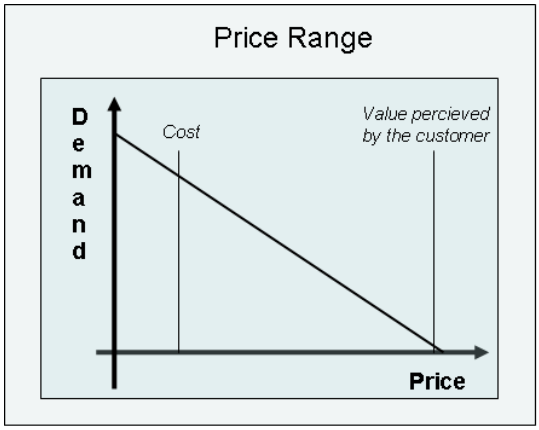

Figure 24 Idea of a price range

Following the price range, the next step is to select a pricing strategy. There are three strategic logics to departure from. Firstly, the cost-based pricing strategy allocates costs and adds a mark-up which corresponds to the profit margin. The profit margin is dependent on the service kind, if demand or high unit margin is prioritized (Kotler et al., 2009). The cost based pricing is problematic in regard to that delivery costs are hard to map and predict. In addition, cost based pricing has the drawback of reflecting the provider's cost structure – something that the customer is rather uninterested in. The customer is interested in service value and service price. This implies a risk that the service provider focuses to reduce cost. However, the service provider will only stay competitive if it reduces cost by eliminating activities which the customer perceives as non-value adding (Lovelock & Wirtz, 2011).

A competition based pricing strategy suggests pricing a service at the competitors' price level. This strategy is useful if the service cannot be effectively differentiated from its competitors. Moreover, customers must have good possibilities to compare service offers in regard to service quality and content. Additionally, the customers cannot perceive that low-cost equals low-quality. If applying the competition based pricing strategy, the provider should focus to keep costs low. This is in order to survive while keeping up in the competition (Kotler et al., 2009).

The value-based pricing strategy is often the most beneficial pricing strategy for services. This holds especially for the category of services which are more complex, as consultancy services (Johansson et al., 2003). The most important insight if applying a value based pricing strategy is to know the customer's willingness to pay (Kotler et al., 2009). The second important knowledge is to understand how the customers' value perception of the service can be increased.

The customers' idea of value can be affected either by decreasing outlays connected to the service or by increasing customer recognized benefits. An example of reducing customer costs in relation to service usage is decreasing the customer efforts in regard to monetary and timely costs. An example of increasing customer value is to expand the offer and include service add-ons as a part of the offer. Moreover, the value of the service and its relation to the price need to be efficiently communicated to the customers. This requires knowledge of how the customers calculate costs – do they compare cost element one by one or do they take a lifecycle perspective (Lovelock & Wirtz, 2011)?

Pricing and particularly in regard to services which generally are less defined than tangible products could be perceived as unfair and unethical by customers. If so, the goodwill of the providing company and the sales of the services would be damaged. Therefore, an additional aspect when choosing price strategy is to ensure that the choice can be communicated to the potential customers as logic and fair. The relationship between the pricing strategy, the deliverables and the charged price needs to be recognized as transparent (Lovelock & Wirtz, 2011).

6.2 Method Pricing Strategy

The method applied in this thesis, departures in the presented theoretical pricing strategies. However, the method is adjusted to the contextual preconditions in regard to the Energy efficiency consultancy service. The most influencing aspect is that the service still is in a rather early phase of development. Some parameters, especially costs, are hard to predict in absence of testing and realization. Figure 25 presents the steps which have been gone through in order to identify a suitable pricing strategy for the Energy efficiency consultancy service.

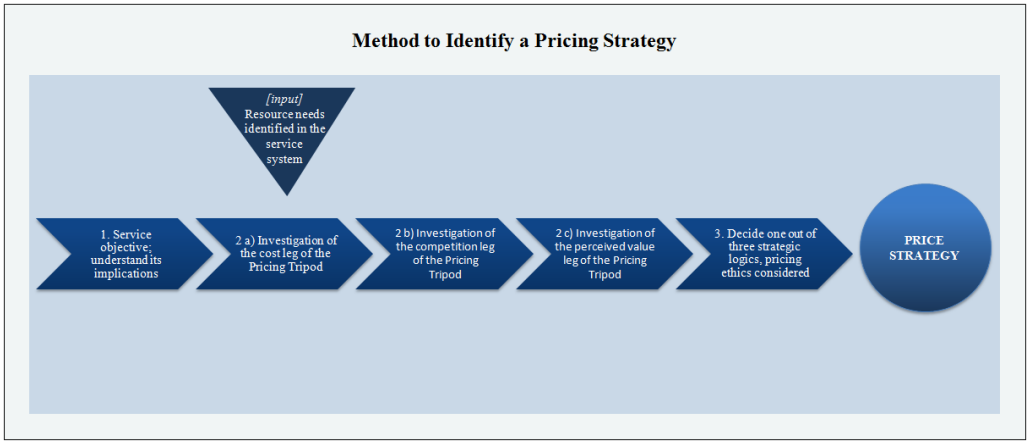

Figure 25 Method of identifying a service price strategy

6.2.1 Service objective

To decide the overall objective of the service, the Energy efficiency consultancy service was put in the context of Volvo CE. Several questions were answered: How the suggested service, as an advanced service would impact Volvo CE as a whole? Are there direct, monetary reasons to go into this service? What are the non-monetary values of providing the service? Are the non-monetary values enhancing the strategic objective of Volvo CE? The answers of these questions were found in the description of this thesis work – the drivers for Volvo CE to at all initiate this thesis project. Moreover, information has been retrieved from the Volvo CE's internal web page.

6.2.2 The Cost Leg of the Pricing Tripod

The cost of providing the service was estimated based on the previously defined service objective and service system (section 5.3.3). The cost estimation was conducted according to the logic of fixed and variable costs suggested by Lovelock and Wirtz (2011). Cost data was retrieved internally from Volvo CE and VTEC. The reviewed material was general pricelists for inquiries and business case for already launched services.

6.2.3 The Competition Leg of the Pricing Tripod

The investigation of the competing offers and substituting services was conducted in two steps. Firstly, an investigation of external material provided by firms within the energy efficiency business was conducted. The broad scope of investigated companies is explained by the lack of Energy efficiency consultants targeting the quarry segment. The external material was studied in order to understand the actors pricing strategies as well as the target price level. Secondly, interviews were held with relevant competencies from some of the external firms. For interviewed firms and competencies, see appendix K. The second step with interviews was conducted because the external material was rather sparse.

6.2.4 The Perceived Value Leg of the Pricing Tripod

The perceived value was determined by reviewing previous interviews, especially the interviews that was held during the business analysis conducted as the final stage during the service conceptualization (see chapter 4.3.5). However, the already gathered material was complemented with phone interviews when clarifications were needed.

6.2.5 Set the Pricing Strategy

Finally, in order to decide the pricing strategy, the findings of the previously conducted steps were reviewed and related to each other as well as to the three pricing logics. The chosen and recommended pricing strategy was the alternative which was considered as most beneficial to Volvo CE still, viable from market perspective.

6.3 Empirical Result Pricing Strategy

This section presents the result of investigation area 3; i.e. a suitable pricing strategy. Initially the service objective is presented, which is followed by specifications of the Pricing Tripod. The section is finalized with a suggestion of a price strategy for the Energy efficiency consultancy service.

6.3.1 Service objective

The main objective of Volvo CE to launch the Energy efficiency consultancy service is to realize the strategic aim to move its business into services. In doing so, the company needs to provide services which can cover their own costs and preferably also generate a profit. With it, Volvo CE needs to change its traditional approach to services and stop giving away services for free. However, in order for a product centric company as Volvo CE, to successfully achieve service transition there are some substantial changes which need to be conducted. Two examples of the substantial changes refer to changed business logic as well as to changed organizational set up. Taken together, Volvo CE has a long journey ahead before it will become a successful service provider. Thereby, the expectations of services launched in the near future, when Volvo CE not yet has changed to favor service provision, cannot be that the services are profit generating. However, in the long-term perspective and within a functioning service organization the Energy efficiency consultancy service is intended to be profit contributing.

However, Volvo CE as an immature service organization needs to prioritize the non-monetary values related to the launch and offer of the suggested service. These are experience of service provision as well as of service as door openers to new markets. Therefore, the revenue objective of the service is limited to cover the incremental costs of proving the service, i.e. the cost category which is neglecting corporate overheads along with the cost of setting the structure for the service system in place.

The demand perspective, as a consequence of that Volvo CE needs to focus their service transition is to build a user base. Focus on a user base is beneficial for future sales of services and products. Moreover, a user base focus is the most beneficial way to launch the considered consultancy service because it allows for a small scale start and expansion as demand increases. In addition, maximizing the demand suits better for more commodity like services.

6.3.2 The cost leg of the Pricing Tripod

The methodology suggests estimating costs according to the revenue objective of the service and based on the resource requirements specified by the service system. The revenue objective of the Energy efficiency consultancy service directs cost coverage of incremental costs related to service provision. Hence, this part deals with the variable costs specified in the service system.

Variable costs are by definition triggered of service production and delivery. Therefore, when reviewing the actor structure (section 5.3.3) it becomes apparent that most variable costs arise within the dealer organization. The dealers' variable costs directed by the service system are the cost of personnel and the cost of consumed material covered within the consultants' kit. The largest cost element within the consultants' kit is expected to be travel costs. In addition to these costs, the dealer must also cover the variable costs which arise within the Volvo CE organization. It is suggested that this is arranged through a license fee which Volvo CE charges the dealer every time the Energy efficiency consultancy service has been delivered.

The variable costs within Volvo CE refer to costs due to back-office dealer support, consultants' training and provision of customer material. These cost elements are estimated to constitute 10% of the total service delivery costs. The estimation is rough, however; it is based on man hours consumed within Volvo CE in regard to service delivery and in relation to the number of man hours spent by the dealer. Consequently, the Volvo CE's license fee is 10% of the price that the dealer charges the customer. Moreover, the license fee estimation has been triangulated towards the Eco operator service and the 10% seems reasonable. The Eco operator service is a service which Volvo CE provides within a similar actor structure as this service is suggested to apply. So, the estimate of the license fee is regarded as accurate enough to serve as in data and base for appointing a suitable pricing strategy.

Table 4 summarizes the dealer's variable costs including the license fee. The fee assumes that a consultant debit customers 70 % of its working time, hence, the fee is 10% of 70% of a consultant's full time cost. The number of working hours in a year is set to 1808, which corresponds to 226 working days. The cost estimations are triangulated towards figures presented in Volvo internal material. The costs are presented on a yearly basis.

Table 4 Variable dealer cost structure

COST/ YEAR		
One fulltime consultant	321 670	SEK
Consultants' expenses; travel costs et cetera	10 720	SEK
License fee	22 520	SEK
TOTAL	354 910	SEK

Finally, cost of service delivery per project is estimated. However, since the service length not can be certainly predicted, cost of service delivery is hard to estimate. The duration of the service is primarily dependent on the preconditions at the particular site. Still, in order to get an idea of the cost for providing one service delivery, delivery costs of different project lengths are calculated and visualized in figure 26.

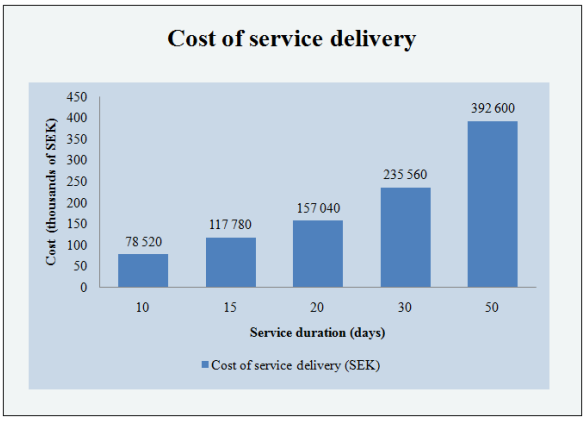

Figure 26 The cost of the service delivery

6.3.3 The Competition leg of the Pricing Tripod

The second leg of the tripod directs investigation of competitors' pricing strategy and price level.

Externally communicated information is limited to provide generic and vague descriptions of the content of the offered service. Moreover, information regarding price levels or price strategies is fully absent. The lack of price information is probably partly explained by that the offered services have a high degree of customization. The extent of the delivered service can vary considerably. Hence, there is no standardized pricelist instead the price is adjusted to every particular case. This benefits a value based pricing strategy.

Nevertheless, there is one exception to the poor provision of information and it regards training sessions or courses that are dealing with the energy efficiency topic. The pricing of the courses is remarkable because the price range is very wide and that is regardless of the highly similar contents. For example, a 2-day course which is dealing with energy efficiency on a rather general level is charged between 3 600 SEK and 11 995 SEK dependent on service provider (Energi & Utbilding i Sverige, 2011; Wikströms VVS-Kontroll, 2011). The large variation in price indicates that it is hard for the customer to quantify its value of the course into monetary terms. Moreover, it is also hard for the customer to put the course content in relation to the charged price.

In accordance to the methodology, the externally retrieved information was complemented with interviews with external competencies. The external competencies represented different energy consultants working towards a wide range of customers at the Swedish market. The interviewees all agree that they would like to apply value based pricing. This especially since the impact on cost reduction is facilitated by volume, meaning that the additional cost to lower the energy consumption of a large facility is considerably lower than the achieved cost reduction.

Still, neither of the interviewees use value based pricing because the interviewed service providers find it hard to motivate a value based price model towards the customers. A challenge connected to apply value based pricing is that the result of the service i.e. the cost reduction for the customer often is delayed in time. The interviewees have a general perception of that the customer wants to be certain of the service price and this preferably before the service is executed but at least when the service is delivered and finalized (External_Interviewee, 2011).

Moreover, the discussions with the practitioners in all cases touch upon the phenomenon that customers are willing to pay more, if the service provider carries a higher risk for the service project. Furthermore, this is utilized by all of the service providers. Nevertheless, pricing risk could be motivated using any of the three logics for pricing; cost based, target or value based. In line with the discussion regarding risk one of the interviewees expresses that it is easier to motivate prices which are in line with the business logic of the customers' or their perception of the service providers' price model. The customers' expectations are often colored by their own practice. Consequently, it is easier to convince a customer to pay a value based price, which is familiar with cost structures as total cost of ownership and lifecycle cost (External_Interviewee, 2011).

So, the reality of the interviewed companies is that they apply a price strategy which is a mixture cost based pricing and target pricing. However, all interviewees also agree about that the customers find it hard to compare service content between offers and the relation to the service price. Still, different customers have different prioritizations and this is true particularly in regard to cost savings versus environmental performance. Further on and due to, the inconsistency in customers' prioritizations, the interviewees generally focus to cover their costs and secure an acceptable profit. Then there is some deviation from the cost based price, for example if the price is unnecessary low in regard to competitors' pricing or in regard to the customers' price expectations. Furthermore, in rare occasions and if there is great potential in the customer relationship there might be cases were just cost coverage is accepted. Taken together, primarily cost based but also competitor based or target pricing seem to be the dominating price logics, however, the service providers would prefer value based pricing (External_Interviewee, 2011).

6.3.4 The perceived value leg of the Pricing Tripod

An understanding for the targeted customers' value perception in regard to this service has been developed throughout the conduction of this thesis work. The intended customers are rather conservative and their purchase rationale is controlled by cost. However, the cost focus is a natural consequence of that crushed rock aggregates is a low value product. Nevertheless, the cost focus is decisive to the customers' value perception of the Energy efficiency consultancy service, since the perceived value is restricted to the cost cutting that the service incurs.

Therefore, in order to quantify the customers' value perception of the Energy efficiency consultancy service, the cost savings which are incurred through service delivery need to be calculated. Calculations are presented for a wide range of production volumes because site sizes and with it production volumes differ considerably between sites. (The number of Swedish sites and their production volumes are presented in chapter 4.3.1). Moreover, the production volume has significant impact of the service outcome. Input data for the calculations are given in

table 5, results of the calculations are presented in figure 27 and table 6. The calculations are given in appendix L. Note that the customers' future cost savings have been discounted to current value. The calculations add up cost savings for three years. The length of the period is chosen because external practitioners have indicated that three years is an acceptable payback period for a professional service as the suggested (External_Interviewee, 2011).

Table 5 Input data for calculations (Energihandbok, 2007;External_Interviewee, 2011; SBMI, 2011)

Input for calculations

Definition of data	Data and unit	Additional comment
Energy consumption at an average site	8-10 kWh/ ton	9 kWh/ ton is accounted for
Average share diesel:electricity	1:1	Energy and diesel are genrally used equally much
Energy content in 1 l diesel	9.8 kWh/ l	
Diesel price (April, 2011)	10.6 SEK/ l	
Estimated reduction of diesel by suggested service activities	5-10 %	7.5 % is accounted for
Interest for costing purposes	5 %	

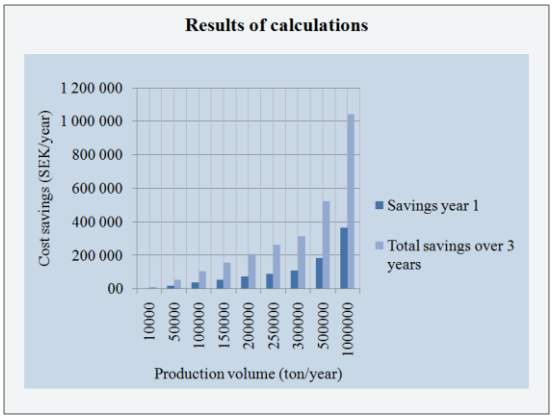

Figure 27 Results of cost calculations

Table 6 Results of Incurred Savings

Results of calculations

Production volume (ton/year)	Savings year 1 (SEK)	Savings year 2, current value (SEK)	Savings year 3, current value (SEK)t	Accumulated savings year 1+2+3, current value (SEK)
10 000	3652.5	3478.6	3312.9	10 444.0
50 000	18 262.5	17 392.8	16 564.6	52 219.9
100 000	36 524.9	34 785.6	33 129.2	104 439.8
150 000	54 787.4	52 178.5	49 693.8	156 659.6
200 000	73 049.9	69 571.3	66 258.4	208 879.5
250 000	91 312.3	86 964.1	82 823.0	261 099.4
300 000	109 574.8	104 356.9	99 387.6	313 319.3
500 000	182 624.6	173 928.2	165 645.9	522 198.8
1 000 000	365 249.3	347 856.4	331 291.8	1 044 397.5

The calculations show that the larger quarry sites; the larger is the perceived customer value. Consequently, the perceived value is closely connected to the site's production volume and hence, the range of the perceived value is broad. This is a rather expected outcome since the result of the service is reduced diesel consumption per produced ton. Thereby, according to a value based pricing methodology should larger sites be charged a higher price.

However, the service also delivers increased environmental site performance along with increased operational efficiency. These improvements are not further reflected in the given calculations because these enhancements do not generate as obvious cost savings as the diesel reduction. This could partly be impacted by an efficient market communication. Nevertheless, it is likely that especially the environmental performance will be possible to transfer into monetary terms in the future. The development is clearly moving towards an increased environmental focus and practitioners believe that the environmental requirements on aggregate production

will increase. These requirements will most likely be driven by customers, by regulations or by a combination of these (External_Interviewee, 2011).

Moreover, there are trends additional to the increased environmental awareness, which may be positive to the customers' value perception of the Energy efficiency consultancy service, especially if the long-term perspective is taken. These trends are that the sites are getting bigger, the vehicle fuel consumption is predicted to remain at today's levels, the diesel price is getting higher and the demand for aggregate products is steadily increasing. Norlin et al. (2010) explains that the there is a change in the market structure moving towards fewer but larger sites. This is due to a limited availability of production areas close to the increasingly urbanized customer. To continue, the diesel consumption is predicted to be sustained because today's vehicle solutions are expected to be dominating within the 20 years to come. What is more is that the increasingly tighter regulatory demands concerning emission levels drives a development towards more powerful engines and hence, the fuel consumption per ton is not expected to decrease (SBMI, 2011).

6.3.5 Set the Pricing Strategy

By investigating the areas of demand, cost and competitors pricing in relation to delivery of the service offer, it is possible to identify a price range and more important a price strategy for the Energy efficiency consultancy service. Knowing the price range is the basic point of departure to select a price strategy. A price range has a lower limit which equals the variable cost to provide the service. The upper price limit targets the value which the customer perceives that the service creates.

However, this chapter aims to identify a pricing strategy for the service. The theory suggests that consultancy services of this kind should be charged according to value based pricing. This is in order to maximize the profit for the service provider. Generally; value based pricing fits the intangible and perishable characteristics of a service. Moreover, the wider the price range is, the more beneficial becomes value based pricing but this requires that the cost of service provision is rather steady. Therefore, the issue of interest is the width of the price range for the suggested service.

Reviewing the findings of when the suggested service was investigated in relation to the areas in the Pricing Tripod, can a price range be quantified and estimated. After all, the incremental costs are estimated along with the customers' perceived value of the service. However, one obstacle remains and that is that the duration of the service cannot be certainly predicted. Therefore, different service delivery length and with it different service costs are put in relation to the cost savings that the service incurs. Thereby, possible price ranges are obtained, which are visualized in figure 27.

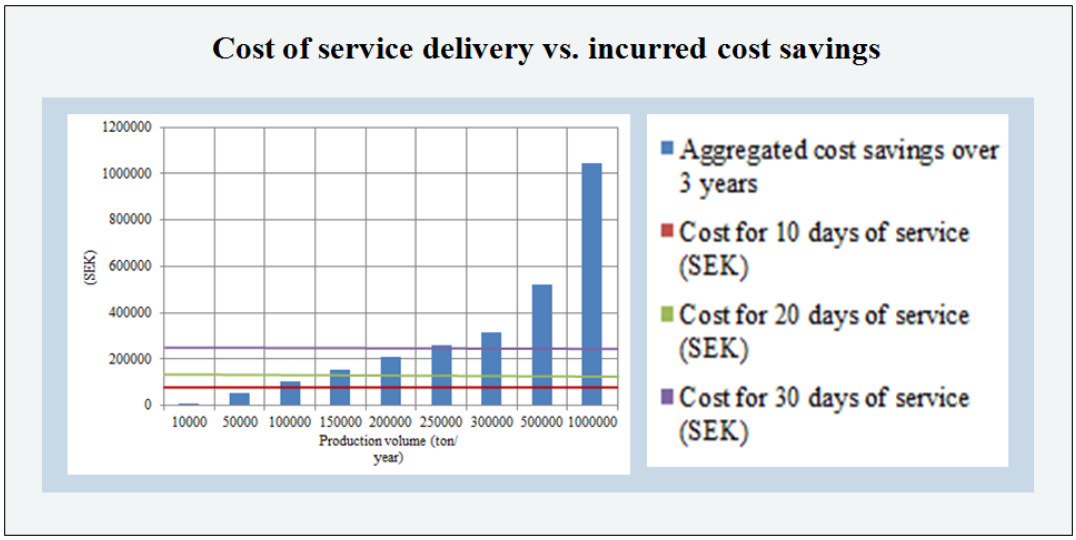

Figure 28 Cost of service delivery vs. incurred cost savings

Figure 28, shows a possible price range which clearly is increasing with a site's production volume. This is because the value of the service increases faster than the costs to provide it when sites become larger. So, in order to capture the created value with pricing, it is intuitively right to target larger site. However, as described in section 4.3.1 larger sites in Sweden are too few to constitute a sufficient business volume. Thereby, smaller sites have to be included in the target group since the service objective for Volvo CE is to get experience.

The reason for the small price range is that the service is rather extensive and consequently it is expensive to deliver. The value the service creates is cost savings due to reduced fuel consumptions. The problem of the value based pricing and the benefits to apply it in regard to consultancy services are not captured in this case because the outcome of this service is clear and measurable in monetary terms. Still, the price range would be enlarged and the upper price limit pushed further, if the customers valued environmental performance higher. After all, the service substantially improves the site's environmental performance. However, interviews with external competencies throughout the thesis work and also with actors within the energy consultancy business indicate that the customers are rather conservative and "money talks" is still the dominating customer perspective. Nevertheless, there are indications of that this sole and monetary focus is changing in favor of environmental values (External_Interviewee, 2011). In addition, increased fuel prices would affect the customer value in a positive direction.

Reviewing competitors' pricing strategies or service providers within the energy segment the picture of a customer demanding fairly short payback times are confirmed. The interviewed actors generally apply a cost based pricing method since the value based strategy is found to be hard to motivate for the customer (External_Interviewee, 2011). The problem of argue for value based pricing refers to the characteristics of energy optimizing services being so closely connected to cost savings which are measurable in monetary terms. Nevertheless, it seems that there is an exception to this rule and that is the educational part of the service, it looks like the customers are confused about how to value knowledge that not creates instant pay back. In order to increase Volvo CE's profit for the Energy efficiency consultancy service, it may be beneficial to differentiate the constituting parts of the service and

apply different strategies dependent on the price range for each separate part of the service. This is especially applicable to the operational management part as well as the training and measuring part. However, a differentiated pricing strategy requires the value of each constituting part of the service is investigated. A differentiated strategy would charge closer to the upper limit of the price range, when possible.

Taken together, and as long as environmental values not has higher value among the targeted customer group a cost based pricing is recommend. And the rationale for the recommendation is the willingness to pay among the customers; it is generally too low to reap the benefits out of value based pricing. Yet, as the service evolves and the demand for different parts in the service offer is explored, there is a potential to go towards a more refined pricing strategy.

7. Conclusions

This chapter shortly connects the findings from this work to the purpose statement and its related areas of investigation. The purpose and its belonging investigation areas are addressed in the introductory chapter.

7.1 Purpose and Thesis Result

The purpose of this thesis was to: "*based on the business operations of the construction equipment segment, quarries and aggregates, formulate a site performance improvement consultancy service inspired by lean thinking. In addition, a pricing strategy for the service is investigated".*

The service which has been formulated by service development and service specification is the Energy efficiency consultancy service. The service targets the greater actors within the quarry and aggregate business on the Swedish market. Furthermore, the service aims to reap the market potential to increase energy efficiency within aggregate production and at quarry sites. The service belongs to the service category of professional advisory services and is executed as a consultancy service. Moreover, the service is conducted according to the logic of lean methods.

The pricing strategy which is suggested for the service is cost based pricing. The strategy recommendation is a result of that the customers generally are price sensitive and require rather short pay-back times to this type of service investments.

7.2 Areas of Investigation and Thesis Result

The areas of investigation are dealt with one by one. First, the question directed of each area is stated and right after answered. The answers highlight findings of the thesis.

7.2.1 Investigation Area 1

Which service solution provides a business opportunity to Volvo CE?

The service solution which is considered to constitute a business opportunity to Volvo CE is the suggested Energy efficiency consultancy service. This service targets a market and a need which holds a great potential for energy optimization and further on the competition is close to non-existing. However, the outcome of the service is a reduction in fuel usage between 5 to 10 %. As a consequence the impact of the service increases with scale. The problem is that the number of sites at the Swedish market which are large enough to have substantial benefits from the service are few. Yet it is likely that future changes in the business context will make the Energy efficiency consultancy service more beneficial to the Swedish market. Moreover, transferring the service to an international market where larger quarry sites are more common, the Energy efficiency consultancy service is regarded to hold a great potential.

Additionally, the investigation area highlights the service fit to Volvo CE. This relation is considered as rather obvious: The service focuses the vehicles at site, which to a large extend are included in the product range of Volvo CE. Moreover, several already existing Volvo solutions are integrated in the service realization specification. The service is also well aligned to Volvo values; environmental awareness and fuel efficiency.

7.2.2 Investigation Area 2

Which resources and competences are needed in order to realize the identified service solution?

The service requirements to facilitate realization of the service could be specified into service process and service system. The service process regards the dynamic structure of the service activities. Whiles, the service system considers the static system which needs to be in place in order to support service activities. The service system addresses needs of material resources and competencies.

The outcome of this investigation area is an activity structure for the service and the needed supportive system. The activity structure, if it is described by its highest level of aggregation consists of an assessment phase and a realization phase which can be continued through an offer of operation management. Additionally, training and performance measuring are provided either as a part of a larger service project or as separate service offer. The required service system which identifies the needs of material resources and competences is rather comprehensive, furthermore, it is concluded that the service system constitutes a great challenge to Volvo CE.

7.2.3 Investigation Area 3

What pricing strategy should be used to commercialize the service?

The suggested pricing strategy is a cost based pricing. This is recommended as a result of the rather price sensitive customer segment and the limited business volume at the Swedish market. However, market conditions of the suggested service are expected to change at the Swedish market and this will be in favor of the Energy efficiency consultancy service. However, the greatest potential for the service seems to be outside Sweden. If the service should be launched at a foreign market, the analysis of a suitable pricing strategy is recommended to be conducted all over again and in regard to the particular market. This is because suitable price levels are rather context dependent. Theoretically and from the service provider's point of view value based pricing is to prefer for consultancy services.

8. Discussion and Further Work

The final discussion aims to shed light on how the outcome of this thesis contributes to fulfill the purpose of the Contractor Development Service (CDS) project. Hence, the starting point for the discussion is, if the Energy efficiency consultancy service with its directed pricing strategy constitutes a business opportunity to Volvo CE. So, this final discussion deals with, if the suggested consultancy service attracts a sufficient volume of customers and if the customers are willing to pay a profit generating price. The discussion focuses the current situation; however, facilitating and constraining trends are dealt with concurrently. In addition, the chapter elaborates around how to enhance the business potential of the Energy efficiency consultancy service and its suggested pricing strategy. Finally, areas of further investigation are appointed. The final section aims to direct the future work for Volvo CE in order to obtain service transition.

Furthermore, the purpose of this thesis was to formulate a site improving consultancy service for the industry segment of quarries and aggregates. In addition, a pricing strategy for the service was to be developed. The result and purpose fulfillment of this thesis is the Energy efficiency consultancy service which is recommended to be charged according to a cost based pricing approach. However, this thesis is, as presented in the introduction section 1.4 a part of the greater CDS project. It aims to investigate if providing a site performance improving service constitutes a business opportunity to Volvo CE.

8.1 Critical Business Volume

The critical business volume in relation to a business opportunity regards that enough customers are attracted. This is dealt with in the thesis by looking at the market potential of the service. However, the critical issue is if the promising market potential can be transformed into profit generating customers. The investigation of the quarry and aggregate business concludes that the industry holds a great market potential for a site performance improving service.

Aggregates of crushed rock material are produced at more than 1 500 quarry sites (figure 10, chapter 4.3.1). Furthermore, the quarry and aggregate business in general could be described as “fat and happy”, which implies that the industries’ rather high margins have made the development and innovation rate of the business quite slow. The business is quite conservative and is lagging behind from a production economic point of view. Comparing the quarry and aggregate industry to other producing but also extracting business areas; for example the automotive and the mining industry, the quarry business is less efficient. Further on, the owner structure of Swedish quarries is considered as beneficial to a site improving performance service. More than 50 % of the aggregate production is controlled by any of the five major players within the business. Moreover, the quarry and aggregate business is appointed of Volvo CE as a build segment, which indicates that the segment holds a great potential.

However, looking further into the pricing strategy and the customers’ value perception it turned out that transforming the potential market into actual and profit generating customers will be challenging (see 6.3.4). This is given the current set up of the service along with the dominating and conservative business logic within the business. The conservative mind-set of the customers is problematic when it comes to evaluate costs as well as hire consultants to execute work that the customers think

they can manage in-house. The Energy efficiency consultancy service would be benefitted, if the business had a better understanding of holistic cost perspectives as lifecycle cost and total cost of ownership. A changed approach to costs would impact the customers' value perception to better appreciate non-monetary and long-term generated values.

The suggested and current set up of the Energy efficiency consultancy service together with the unfavorable way of the customers' to account for costs, challenges the business potential of the Energy efficiency consultancy service. This is since, the service is rather extensive and thereby fairly expensive in relation to the yearly cost savings it incurs. That becomes problematic because the customers prefer short payback periods. As shown in figure 25 in section 6.3.5 does the proposed service incurs cost savings with short payback periods first when the production volumes exceeds 250 000 ton. This is problematic since the average yearly production volume is close to 40 000 ton and the number of Swedish quarry sites with a production volume exceeding 300 000 ton is about 40 (External_Interviewee, 2011).

However, there are trends indicating that the business case will be improved. These are presented in the in section 6.3.5 and refer to expectations of an increasing diesel price, larger sites as well as tougher environmental requirements either regulatory or from aggregate users.

8.2 Customer's willingness to pay

The customers' willingness to pay is related to the customers' value perception and suffers from the same problem causing the rather poor business volume; small to medium sized sites do not perceive the outcome of the service to fast enough cover the one-time cost of the service. However, the number of potential customers that has a production volume large enough to obtain fast recovery of the service cost is dependent on the final price of the service. The recommendation in the pricing strategy chapter is a cost based pricing approach. This means that the intention is first and foremost to cover the costs incurred by service provision along with the profit requirement of the service. However, to generate a profit the allocated costs of providing the service should be fully covered and it refers to the fixed as well as to the variable costs connected to provide the service.

Coverage of allocated costs of the Energy efficiency consultancy service plus profit is challenging in the current business context along with the suggested service set up. The problem could be better understood if reviewing figure 27, it visualizes the variable costs of service delivery in relation to the cost savings which the service incurs. According to this figure, the difference between the variable costs and the incurred savings is too small to hold full allocation of costs as well as a profit margin. The exception to this observation is sites with very high production volumes. Hence, it seems reasonable to conclude that there is not likely that the suggested consultancy service launched in its current design in today's business context would be successful in terms of profitability. However, there are indications of a future business context which considerably will improve the business case for the Energy efficiency consultancy service (see section 6.1.4). Moreover, the business potential of the service would be sufficiently improved if the cost of service delivery could be reduced. The last part of this discussion elaborates how the business case of the service may be improved.

8.3 Enhance business potential

So far, it has become clear that the business case of the Energy efficiency consultancy service need to better meet customers' value requirements in regard to costs. Obviously, the solution to better meet the customer requirements are to either decrease cost or increase the perceived value of the service. The largest variable cost element of the service is the hourly cost of the consultants. Therefore, one way to decrease service delivery costs is to compress the delivery time of the service. Alternatively, activities to boost service value are focused. Examples of value boosting activities are educating the customer to take a lifecycle perspective or to narrow down the targeted customers to the really potential ones. In addition to the strategy of manipulate cost or perceived customer value, the business case of the suggested consultancy service can be facilitated by targeting new markets in regard to geography or industry.

8.3.1 Cost Reduction

The strategy to enhance the attractiveness by cost reduction suggests making the suggested service more slim and focused. This should be based in a thorough analysis of each element of the service; how each element's cost contributes to cost savings at customer site and how each element is connected to each other and creates synergies. The analysis is important because a slimmer offer should not mean that the service entity become scattered yet a solution should be provided. Still, the slimmer service may be more attractive than the suggested, if the analysis shows a bit weaker result obtained to a much decreased cost.

An alternative outcome of an analysis of how each service element drives cost versus how the element contributes to cost savings is to build a strategy of focusing some parts of the service offer. These parts should support each other and create incitements for buying as well as selling the service. For example it can be to achieve fuel reduction through a slim set of measures. This service is then complemented with services of measuring and teaching which seems to have less customer requirements of an outcome which generates direct monetary value. However, the selling of teaching and measuring services should be boosted by a fuel saving reputation which is derived from the full service offer.

8.3.2 Value Improving

To continue, the focus is changed to value boosting activities. One suggested measure to increase service value is to educate customers in order to obtain a change in their business perspective and with it change their value perception of the Energy efficient consultancy service. However, the education idea is a theoretically advocated solution to increase customers' value perception. The practical value of this advice is dependent on the amount of resources that are needed to change the customers' mindset. This cannot be said with certainty yet the impact on the business volume is unsure.

A second idea to facilitate value is that the target of the service is narrowed down to serve only the highly potential customers. The suggestion is that customers who are expected to achieve much higher fuel reduction than the estimated and average 7.5% is focused. This limits the business volume but increase the price that could be charged for the service. Two examples of customer types where it is likely that high effects can be obtained are customers' which are in a site building or site re-

engineering phase. Nevertheless, at the Swedish market there is a great risk that also this business volume will be insufficient.

8.3.3 Market Expansion

Finally, the additional strategy to business case enhancement is dealt with by discussing the potential of market. Expanding the market and hence, the business volumes for the service can either be done by increasing the geographical reach or increasing the application areas of the service. The expansion ideas both require adaption of the service offer to the new context. However, the potential is expected to be significant. After all Sweden is a nine million country and the demands for larger construction projects are quite saturated. Thereby the market for aggregate use is rather small. This is especially apparent if the Swedish market is compared to booming economies as China and Brazil.

The second expansion alternative is to expand the service into other business segments within Volvo CE. From a process point of view there are some segments similar to the quarry and aggregate segment. Still, too little is known about the contextual factors within the business to predict the demand and viability of applying the Energy efficient consultancy service within other industry segments.

8.4 Further Work

This work conducts a base for Volvo CE, to departure towards service transition. Still, by the initiating findings of this work, direction for further work can be appointed. There are two large areas which are identified as most urgent to continue to develop. Firstly, it is to further develop and concretize the Energy efficiency consultancy service offer. This in order to be able to test the service but also to get a more robust understanding of its provision costs as well as a more accurate quantification of service impact. Secondly, the possibilities for the service on other geographical markets and/ or within others of Volvo CE's industry segments should be investigated. Because there is a need to find solutions that are expanding the business volumes and hence, enhancing the business case of the service.

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Appendix A. Interviewees in Strategic Planning.

External

• Service Market Manager, region South	Swecon
• PhD Crushing Plant Performance	Sandvik
• PhD Screening and Crushed Rock Material	Swerock
• Responsible for aggregate extraction	Fraktkedjan Väst
• Sales Manager	Hallindens Granit
• Site Manager	Angereds Krossen, Skanska
• Site Manager	Kållereds Krossen, Jehander
• Site Manager	Partihallslänken, Skanska
• Site Manager	Vikan Krossen, Skanska

Appendix B. Site Visits in Problem Identification

- Angereds Krossen Skanska
- Kållereds Krossen Jehander
- Partihallslänken Skanska
- Vikan Krossen Skanska
- Tossene Täkt Hallindens Granit AB

Appendix C. Interviewees in Problem Identification

Internal

• Sales Tools Development	Volvo CE
• Global Improvement Leader	Volvo CE

External

• Service Market Manager, region South	Swecon
• PhD Crushing Plant Performance	Sandvik
• PhD Screening and Crushed Rock Material	Swerock
• Responsible for aggregate extraction	Fraktkedjan Väst
• Sales Manager	Hallindens Granit
• Site Manager	Angereds Krossen, Skanska
• Site Manager	Kållereds Krossen, Jehander
• Site Manager	Partihallslänken, Skanska
• Site Manager	Vikan Krossen, Skanska

Appendix D. References applied in the Frequency Analysis

- Service Global Development Process S-GDP Volvo Technology Corporation.
- Key Concepts for New Service Development. (Edvardsson & Olsson, 1996)
- Operations Management. (Slack et al. 2007)
- Selecting Profitable Products (O´Meara, 1961)
- Criteria for Screening New Industrial Products. (Cooper & de Brentani, 1984)
- Handbok för processledning vid tjänsteutveckling (Malmqvist & Andersson, 2010)
- Business Marketing Management: B2B (Hutt & Speh, 2007)
- Generating and Screening New Product Ideas. (Rochford, 1991)

Appendix E. Interviewees in the Business Analysis

Internal

• Sales Tools Development	Volvo CE
• Global Product Manager	Volvo CE
• Business Engineer	VTEC
• Project Manager	VTEC
• New Business Manager	VTEC
• Global Director Cement and Aggregates	Volvo CE

External

• PhD Crushing Plant Performance	Sandvik
• Manager R & D	NCC Roads, Sweden
• After Market Service Manager	Swecon
• Service Market Manager	Swecon
• Site Manager	Vikan, Skanska
• Site Manger	Kållered, Jehander

Appendix F. Calculations for the Value Stream Map

The following calculation is presented with fictitious numbers. The calculations aim at illustrate the calculation procedure.

Yearly site production 500 000 ton

Fuel Consumption

Initial transportation and inventory handling:	65 000 liter diesel
Crushing:	110 000 liter diesel
Transportation and inventory handling:	85 000 liter diesel

$$Total\ yearly\ fuel\ consumtion = 65\,000 + 110\,000 + 85\,000 = 260\,000\ liter$$

$$\frac{Fuel}{Ton} = \frac{260\,000}{500\,000} = 0{,}52\,\frac{liter}{ton}$$

$$Fuel\ consumtion\ in\ the\ value\ adding\ activity = crushing\ activity$$

$$\frac{110\,000}{260\,000} \approx 42\ \%\quad hence\ 58\ \%\ of\ the\ fuel\ is\ consumed\ in\ non\ value\ adding\ activities,$$

$$howerver\ the\ activities\ can\ still\ be\ nessesary, but\ the\ imporvement\ possibilities\ are\ evident.$$

Appendix G. Specification of the 12 Concepts by the Artifacts

Cost Control Consultancy Service

Cost tracking connected to production, inventory, ownership and energy. The service aims to increase the cost awareness by mapping the costs connected to the production process.

Site Layout Consultancy Service

The service focuses quarry site layout and design. Furthermore, the consultancy service aim for long-term production planning e.g. plans for blasting combined with plans for road construction. Site specific facilities are adapted to the plan or the other way around dependent on the preconditions of the site.

Inventory Management Consultancy Service

The service aims at increasing the control of the inventories by, for example support the site with the long-term planning.

Production Plan Consultancy Service

The service aims at securing the right production by considering fluctuations and market variations by merging ongoing projects a long-term production plans.

Business Consultancy Service

The service aims at optimizing the business process in regard to the business condition of the site. By leaner production and shorter throughput time, an increased efficiency will be obtained.

In Service Training Consultancy Service

The service is founded in the idea of knowledge transferring. Education of the operators at customer site will efficiently gather the employees around important issues and objectives. The expected result is to lower the amount of waste and thereby lower operational cost.

Operational Incremental Improvement Consultancy Service

The service aims at developing and formulating an incremental improvement program which may be implemented over time. The program regards both operational and / or business aspects. The result of the service is expected to be increased performance of the processes at the site as well as raised commitment from the personnel.

Production Control Consultancy Service

The service aims at helping the customers to know its operations but also how to achieve and maintain process control. This will be done be visualizations of the processes. Critical operations in regard to productivity are highlighted to facilitate the work towards reliable and predictable processes.

Business Model Consultancy Service

Support the customer business by investigating the possibilities to affect the need and demand of the products by for example market activities and pricing strategies. The service also aims to increase the value of the product by for example, including parameters as environment into the product offer.

Investment Consultancy Service

The service offer includes a replacement plan which is aimed to secure the capital investments and thereby also the up-time of the operations. The idea is that the optimal use of the equipment should be identified and replacement should be conducted at the right time. The service is visualized by the loss of money and time caused by unused capacity.

Energy Efficiency Consultancy Service

The service aim at decrease the total energy consumption both connected to operations as well as to vehicles. The machines as well as the site layout are focused by the service. The result of the service is expected to be an energy usage reduction.

Logistics Consultancy Service

The service focuses the number of vehicles, their operating hours as well as the use of the internal roads. The service offer aims at improving and optimizing the coordination of the operations at site. Fleet configuration is also a central aspect of the service and is aimed to result in an optimal match to improve the production flow.

Appendix H. The Screening Result of the 12 Concepts

The result of the first screening is indicated in the table. Symbol ✓ indicates that the criterion is passed, while symbol ✘ indicates that the criterion is not fulfilled. The numbers in the table corresponds to the following services:

1. Business Consultancy Service
2. In-Service Training Consultancy Service
3. Operational Incremental Improvement Consultancy Service
4. Production Control Consultancy Service
5. Cost Control Consultancy Service
6. Site Layout Consultancy Service
7. Inventory Management Consultancy Service
8. Production Plan Consultancy Service
9. Business Model Consultancy Service
10. Investment Consultancy Service
11. Energy Efficiency Consultancy Service
12. Logistics Consultancy Service

In total, the Energy efficiency consultancy service along with the In-Service Training Consultancy Service and Operational Incremental Improvement Consultancy Service pass the highest number of criteria and hence, these are regarded as the concepts that hold the greatest potential.

Criteria	1	2	3	4	5	6	7	8	9	10	11	12
CUSTOMER DESIRABILITY												
Customer willingness to pay	*	✓	✓	✓	*	*	*	*	*	*	✓	*
Service fulfill customer needs	✓	✓	✓	✓	✓	✓	✓	✓	*	✓	✓	✓
Service fulfill customer wishes	*	✓	✓	✓	*	*	*	*	*	✓	✓	*
TECHNOLOGICHAL AND ORGANIZATIONAL FEASIBILITY												
Access to the right skills	*	*	*	*	✓	*	*	*	*	✓	✓	✓
Access to the right technologies	✓	✓	✓	*	*	*	*	*	✓	✓	✓	✓
Enough organizational capacity	*	*	*	*	*	*	*	*	*	*	*	*
Enough financial resources	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BUSINESS VIABILITY												
Satisfactory financial return of the service	*	✓	✓	✓	*	*	*	*	*	*	✓	*
In line with current business	✓	✓	✓	*	✓	*	*	*	*	✓	✓	✓
In line with market conditions	*	✓	✓	✓	✓	✓	✓	✓	*	*	✓	*
In line with market size	*	✓	✓	✓	✓	✓	*	✓	✓	*	✓	*
In line with market development	*	✓	*	✓	✓	*	✓	✓	*	*	✓	*
Competition in the same trade	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Competition from invaders	*	✓	✓	✓	✓	✓	✓	*	✓	✓	*	✓
Uniqueness of service	*	*	*	*	*	*	*	*	*	*	*	*

Appendix I. Narrow Description of the three "Winning" Concepts

In-Service Training

The in-service training concept offers the customer to share Volvo CE knowledge and insights about quarry operations. The outcome of this competence improving education can be tailored to specific site conditions by merging Volvo CE knowledge with customer insights in interactive workshops. The education is given within three themes; environment/ sustainability, production economy and best practice. The in-service training can be adjusted to fit any target group within a company operating quarries, for example if management is intended the teaching will focus a strategic and long-term perspective, while for operators the approach will be a direct and operational. The goal of the training is to equip the customer with knowledge and insights that will facilitate changes improving site performance, the improvements will be direct or indirect dependent on target group within the customer organization.

Discussion – Clarifications

- *Intended Audience*

The service is intended for all levels of the company. However, it will be adjusted to the daily work of the audience. For example, if education is given to operators at site the education will regard the operational work in the context of the chosen theme (environment and sustainability/ production economy/ best practice).

- *Actions Delivered*

The actual delivery of this service is teaching sessions and workshops.

- *Expected Results*

The expected results are increased awareness of the audience in regard to the chosen theme of the education. Moreover, the outcome from the workshop should be a list of improvements in the context of the given teaching. For example, if the training is given on a management level, the outcome will be a foundation for strategic decisions, smaller as well as more radical ones.

The service may also be used to create alignment within the customer organization if teaching at the same theme is given throughout the organization. Still, the education will be adjusted to the particular work tasks of each hierarchy level. Moreover, the service is expected to raise employee loyalty since the in-service training generally increases work-satisfaction.

- *The service in a long-term perspective*

The in-service training has an element of continuation, because knowledge is developing and need to be updated. Moreover, knowledge has a characteristic to fade with time and hence, the knowledge level of the employees needs to have a "top up" every now and then.

The In- Service Training specified by service concept artifacts

Value	**Operations**		**Outcome**
	Methods	*Available resources at Volvo CE*	
Awareness*	Conventional teaching (one-way communication)	Superior knowledge about Volvo machines	Increased operational awareness*
Willingness to change*	Workshops (two-way communication)	Superior knowledge in optimization of Volvo machine fleets	Increased motivation to operational changes*
Adaptation ability*		Experiences from the "Eco Operator Service"	Increased ability to adapt to operational changes*
Employee loyalty		Good insights into regulatory requirements of machine performance	Increased employee loyalty
Improved site performance		Good insights into customer needs	Improved site performance

**in regard to chosen topic*

Energy Consultancy Service

Based on long-term experience and knowledge of equipment energy consumption combined with sophisticated operator training skills, Volvo CE offers a site specific energy consultancy service optimizing energy usage connected to operational work. The energy consultancy service will decrease cost associated with energy consumption by optimizing the use of equipment in combination with providing knowledge in how to set up the optimal site. In addition to cost savings environmental regulations stress the importance of increased energy consumption awareness which is fulfilled by a visualized set-up identifying the areas of energy usage. The created awareness results in more qualitative decisions based on facts.

Discussion – Clarifications

- *Intended Audience*

The result of the service is intended to attract the strategic function of a quarry site, moreover, the changes incurred by the service need management support. However, it is also of great importance that the operators of the site understand how and why the energy consumption should be lowered. Thereby, this service has several stakeholders within the customer organization. Still, the manpower at quarry site will get much of the attention; especially in the second phase of the service when measures for improvement will be implemented.

- *Actions Delivered*

The service will be divided into two phases; one initial assessment phase which is assessing energy consumption as well as appointing areas of improvement. The second phase is an execution phase which is guiding the measures ought to be taken.

By process mapping of quarry sites, Volvo CE get the ability to, by a benchmarking strategy; transform the collected knowledge into an offer which is providing the customer with an optimal layout to its specific site. The site lay-out part of the service includes; design of roads, a focus on the differences in heights and optimal inventory placement et cetera.

- *Expected Results*

Expected results are a measurable and substantial decrease in energy usage at site. The decrease is of advantage both in regard to fuel costs and environmental impact.

- *The service in a long-term perspective*

In a long-term perspective the service is expected to incur re-buys. The re-buys are expected from assessment phase customers as well as from full solution customers. The service intends to deliver results motivating further improvement in energy efficiency at plant and hence, additional sales of the consultancy service. The service aims to build and will also benefit from a long-term relationship with the customer.

The Energy Consultancy Service specified by service concept artifacts

Value	**Operations**		**Outcome**
	Methods	*Available resources at VCE*	
Higher Margins	Mapping Site	Superior knowledge about Volvo machines	Savings
Marketing possibility	Benchmarking	Equipment experience	Improved environmental position
Visualization of condition		Training program (“Eco Operator Service”)	Cost control
Awareness		Site Simulation Tool	
Knowledge			
Improved decision base			

Operational Incremental Improvement (OII) Consultancy Service

By the advantage of a well founded knowledge and experience of construction equipment, Volvo CE offers an operational incremental improvement consultancy service aiming at optimizing the operational work at site. The service consists of two steps; the first step assesses the current productivity status of the site along with appointing possible areas of improvement. The second step identifies and describes performance improving undertakings. Suggested undertakings are founded on lean concepts and the specific preconditions at site. The service intends to optimize the customer's performance incrementally and thereby, provide advantages as ease of implementation and little need for new major investments.

Discussion – Clarifications

- *Intended Audience*

The result of the service is intended to attract the strategic function of a quarry site, moreover, the changes incurred by the service need management support. However, it is also of great importance that the operators of the site understand how and why the incremental performance improvement should be implemented. Thereby, this service has several stakeholders within the customer organization. Still, the manpower at quarry site will get the much of the attention; especially in the second phase of the service when measures for energy reduction will be implemented.

- *Actions Delivered*

The service will be divided into two phases; one initial assessment phase and one following phase which is guiding measures ought to be taken. The first phase includes process-mapping yet it is appointing potential areas of improvement. The mapping is value adding in itself, since it creates awareness and is fundamental for improvement work. The second phase then acts on the outcomes of the assessment in order to provide enhanced site performance. Continuous improvement is a culture of sustained improvement targeting elimination of waste in an organization. The OII-service applies lean methodologies to identify operational waste and hence, particular areas of improvement.

- *Expected Results*

The expected result is improved productivity and with it, a lower production cost per ton.

- *The service in a long-term perspective*

The assessment in itself as well as the full service including plans and instructions for improving actions will be natural to sell repeatedly to customers since, preconditions of operations are changing. Moreover, in this service the customer has an important role as co-creator of the service which facilitates trust and a long-term relationship between Volvo CE and the customer.

The OII Consultancy Service specified by service concept artifacts

Value	**Operations**		**Outcome**
	Methods	*Available resources at VCE*	
Performance awareness	Process mapping	Superior knowledge about Volvo machines	Cost savings
Operational insights	Measuring KPI's	Supplier network	Increased productivity
Ease of implementation	Identification of pain points – according to lean methodology	Site simulation tool	Performance assessment
Improved site performance	Identification of solutions – according to lean methodology		
Decreased costs			

Appendix J. The Result of the Second Screening

The result of the second screening is indicated in the table. Symbol ✓ indicates that the criterion is passed, while symbol ✘ indicates that the criterion is not fulfilled.

In total, the Energy efficiency consultancy service passes the highest number of criteria and hence, it is regarded as the most superior service alternative.

Criteria	In-service Training	Energy Efficiency	OII Service
CUSTOMER DESIRABILITY			
Customer willingness to pay	✓	✓	✘
Service fulfill customer needs	✓	✓	✓
Service fulfill customer wishes	✘	✘	✘
BUSINESS VIABILITY			
Satisfactory financial return of the service	✘	✓	✘
In line with current business	✘	✓	✘
In line with market conditions	✘	✘	✘
In line with market size	✓	✓	✓
In line with market development	✓	✓	✓
Competition in the same trade	✓	✓	✓
Competition from invaders	✘	✓	✘
Uniqueness of service	✘	✘	✓

Appendix K. Interviewees for the Competition Leg in the Pricing Tripod

Internal

• Market Communication Manager	Volvo CE
• Project Manager	VTEC
• Business Developer	VTEC

External

• Customer Relationship Manager	Dalkia
• Energy Controller	ÅF
• Customer Relationship Manger, Services	Energikonsulterna AB

Appendix L. Calculations of the Perceived Value of the Pricing Tripod

Customer value = incurred cost savings due to the service

Incurred cost savings = obtained fuel efficiency.

Diesel consumption per produced ton

- 1 l of diesel contains 9.8 kWh energy

  Consequently; 1kWh = 0.102 l of diesel

- An average site consumes around 9 kWh per produced ton of aggregate and 50 % of this energy consumption is from diesel.

  Consequently; 4.5 kWh diesel/ produced ton

Diesel consumption per produced ton; 0.102 * 4.5 = 0.459 l/ produced ton

Diesel saving per ton transferred into monetary savings

- Diesel price; 10.60 SEK/ l
- Expected diesel savings; 7.5%

Cost saving per produced ton; 10.60 * 0.075 = 0.365 SEK/ ton

Incurred cost savings for different site sites

- Internal rate is estimated to 5%

  Present value is calculated according to the below formula:

$$C_t = C(1+i)^{-t} = \frac{C}{(1+i)^t}$$

  Where C represents the savings, t the number of years into the future and i represents the interest rate, which in this case is 5 %.

Site size; yearly production volume (ton/year)	Incurred cost savings year 1 (SEK)	Incurred cost savings year 2 (SEK)	Incurred cost savings year 3 (SEK)	Aggregated cost savings year 1-3 (SEK)
10 000	3652.5	3312.92	3312.92	10444
50 000	18262.5	16564.6	16564.6	52219.9
100 000	36524.9	33129.2	33129.2	104439.8
150 000	54787.4	49693.8	46693.8	156669.6
200 000	73049.9	66258.4	66258.4	208879.5
250 000	91312.3	82823	82823	261099.4
300 000	109574.8	99387.6	99387.6	313319.3
500 000	182624.6	165646	165646	522198.8
1 000 000	365249.3	331292	331292	1044397.5

Cost of providing the service

- Cost per consultant hour; 196.3 SEK
- Working hours per week; 40 hours

Duration of service (days)	Cost of the service (SEK)
10	78520
20	157040
30	235560