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**OFFERING DIMENSIONS IN SERVICE BUSINESS  
WITH ANALYTIC HIERARCHY PROCESS**

Master's Thesis in  
Industrial Management

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**TIIVISTELMÄ:**

Tutkielmassa tutkittiin kohdeyrityksen tuotetarjoamaa service-liiketoimintaympäristössä Analytic Hierarchy Process –menetelmällä. Tavoitteena oli määritellä kokonaistarjoaman kolmen dimension keskeiset kriteerit, arvottaa niiden keskinäinen tärkeys ja muodostaa siten käsitys sekä kohdeyrityksen tekemästä että yrityksen asiakkaiden arvostamasta kokonaistarjoamasta. Lisäksi tavoitteena oli tutkia kohdeyrityksen kilpailijat kyseisellä toimi- ja markkina-alueella, verrata näiden kokonaistarjoamaa kohdeyrityksen vastaavaan ja löytää kehittämiskohteita kohdeyrityksen toiminnan parantamiseksi.

Analytic Hierarchy Process –malli rakennettiin määriteltyjen kriteerien pohjalta joulukuussa 2009, jonka jälkeen kyselyjärjestelyt sekä yrityksen että asiakkaiden kohdalla suoritettiin tammikuun 2010 aikana. Kyselyt lähetettiin maailmanlaajuisesti ennaltavalituille kohdehenkilöille, joiden toimenkuvaan kohdeyrityksen tarjoamat tuotteet ja palvelut kuuluvat. Tulokset analysoitiin Expert Choice –ohjelmistolla sen hyvän solveltavuuden ja helppokäyttöisyyden vuoksi.

Tulokset voidaan jakaa kolmeen pääryhmään; yhtäältä tuotetarjoaman kolmen päädimension kriteerien arvottamisen yhteneväisyystutkimukseen, toisaalta toimialan kilpailija-analyysiin edellämäinittujen kriteerien avulla ja kolmantena avointen kysymysten tuoman lisäinformaation analysointiin ja AHP-mallin antaman viitekehityksen täydentämiseen. Tutkimuksessa tuli esille yhteneväisesti service-dimension tärkeys kohdetyypisessä liiketoiminnassa osapuolten arvottaessa sen selkeästi painavimmaksi osa-alueeksi. Alikriteereissä kuitenkin havaittiin huomattavia eroja tarjoamakriteerien arvottamisessa kohdeyrityksen ja asiakkaiden välillä jokaisessa dimensiassa. Toimialan kilpailijavertailussa saatiin myös uutta tietoa asiakkaan kokemasta kilpailuedusta eri tuotedimensioissa. Avoimet kysymykset syvensivät saatua kuvaa ja toivat esille muutamia spesifejä seikkoja, joita asiakkaat ovat panneet merkille nykyisessä toiminnassa tai arvostaisivat saadessaan. Tulosten pohjalta määriteltiin muutamia toiminnan kehittämis- ja jatkotutkimusehdotuksia.

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**AVAINSANAT:** Analytic Hierarchy Process, Palveluliiketoimita, Tuotetarjoama

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**ABSTRACT:**

In this thesis the total offering package of the case company was surveyed with Analytic Hierarchy Process method. The objective was to define the essential criteria of the offering package, evaluate their weights compared to each other and formulate the understanding of the offering package the case company is providing but also what offering criteria the customers are appreciating. In addition the goal was to study and define the competitors of the case company in the market area, to compare their offering package and to find areas of development in the offering package of the case company.

Analytic Hierarchy Process model was constructed based on defined criteria on December 2009 and the enquiry process within case company and its customers was executed on January 2010. The enquiry was done globally by the preselected people, in whose area of business the products and services offered by the case company are included. The enquiry results were analyzed by using the academic licence of the commercial software Expert Choice. The software was selected for suitability reasons.

The results can be sorted on three main categories; first on congruent study of the total offering package criteria weighting, secondly on competitors analysis with aforementioned criteria and thirdly on further additional analysis with information gathered from the open questions. In the thesis the importance of the service dimension was discovered since both parties judged it as the most important criteria of the offering package. On sub-criteria however, distinct differences were discovered between the weighting of the case company and customer criteria. Also in comparison between competitors differences were detected and new information about how the customer is experiencing the added value on each criterion was found. The open questions added depth to the formulated insight on the offering package and brought out some specific matters the customers have perceived or would value to experience on interaction with the providers. As a result some action and further development proposal were sponsored.

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**KEYWORDS:** Analytic Hierarchy Process, Service business, Offering package

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# 1 INTRODUCTION

Every company formulates its own way to operate in the market. Some focus heavily on technical aspects and pursue the technical leadership status whereas other player might use stellar maintenance operations as a competitive edge. Some companies even ride a long way with excellent relations with customers. Most of the companies formulate their competitiveness on combination of these factors since quite naturally all of these factors are present when interacting with the customers. In every business, the quality of operations is a prerequisite for successful trading and when operating on service oriented business, quality of operations is how customers see it and quality of service how customer perceives the processed tasks. Service quality is thus the deviation between the expectation and experience of the executed service and challenge to the service providers is to recognize the correct service elements and execute them effectively and right-timed. However, effectiveness, functionality, scope of the operations and cost-effectiveness are often opposing objectives, therefore each service provider must define its own service concept, on which it is competing on markets. The challenge is to identify and to understand the strengths the providers possess and to build the competitive edge based on this. Even though the benchmarking provides excellent information about the best practises in the business, the total package which the benchmarked company is using may differ crucially from the case company's package. The understanding that different offering package strategies can perform as well and act accordingly is the key to successful business.

The study is done together with the case company where I've been working for several years since year 2002. The idea to study the service oriented operations within particular automation division of the company originated from the observation that since the division in question was regrouped and redefined recently and there were also changes in organization structures and business models, the products and services offered to the customers also experienced some changes. How well the current offerings then meet the demands of the customers and how well the different areas of offering dimensions are perceived by these customers was ergo the main idea of this thesis.

The purpose of this study is divided on two parts. First objective is to map and grade the criteria involved in total offering package of particular divisions in the case company with the Analytic Hierarchy Process method which is one of the most famous decision making tools especially in cases where multicriteria and multidimensional issues are handled. The criteria are judged and weighted both by the case company and by the customer representatives in order to seek out the different emphasis and to formulate the insight on what factors customers' value more and what factors may be overrated or – emphasized.

Secondly the Analytic Hierarchy Process is used to evaluate the service providers within market in question with the same criteria formulated in the first phase. The results are analyzed to find the differences in the offering structure of the case company compared to it's competitors but also together with first phase information to seek the understanding on what would be the optimal offering package choice for customers. The insight is also deepened by a set of open questions, where the respondents have room to clarify their opinions and to give a forum to respondents to point out issues that are considered important concerning the matters in question. Should there be any major findings the current model will be reviewed and recommended improvement actions are stated.

## 2 SERVICE

### 2.1 *Definition of service*

Service is often defined as to be non-ownership equivalent of a good and as an economic activity that creates benefits to customers' assets. But as stated e.g. by Løwendahl, services are highly heterogeneous and extremely difficult to define in general terms. They are often intangible and perishable after the procedure has finished e.g. hotel accommodation can have some tangible, storable and reusable parts e.g. engineering design services, the service process duration can vary from minutes e.g. verbal instructions over telephone to years when fundamentally restructuring company's operations. Most of all services tend to combine these parts and often in unique way whenever service is processed. The wide variety of service processes makes it difficult to generalize service management as service procedure in one subject can be disastrous in other. However some fundamentals exist and service providers should ensure that these fundamentals are present in their offered service processes.

(Løwendahl 2005)

According to Schmenner, services fundamentals and characteristics are;

1. Intangibility. Services themselves cannot be "touched" even though services may be associated with physical elements such as airplane or legal brief. It is the provided resolution e.g. transportation or legal advice, that is in question in services.
2. Inability to inventory. The consumption of service is often simultaneous with its production. One cannot produce service before-hand for the peak-consumption which lead to that management of service capacity is crucial to the success.
3. Service production and consumption togetherness. Services are often created and delivered on the spot e.g. on barber or on help-desk. However some delay can be present e.g. technical advice can be formulated and consumed on different time. The close bond between production and consumption requires an em-



phasis of the quality control of service during the operations not just at the end of process.

4. Easiness of entry. Providing service will require less capital investment or proprietary technology than manufacturing the object in question. The low entry barriers leads that service operations are sensitive to competitive actions and reactions and competition can shift quickly. Thus there is a greater and constant need to revise strategic scenarios and plan operations accordingly. However, the technical issues, the knowhow of personnel, the level of customization, the relationship with customer and reputation of the service provider can form significant entry barriers especially in professional industrial services.
5. Outside influence. Services can be affected greatly by e.g. technological advance, governmental regulations, customer policies and energy price and availability. These factors can change service offered, how they are offered and size and structure of the service provider. E.g. the deregulation and computerizing has enabled variety of financial services. (Schmenner 1995)

### **2.1.1 Professional services**

According to Silvestro et al. for management purposes service organizations can be classified into three types on the basis of the number of customers served per day. The classification to professional, service ship and mass services as show in figure 1, can also made by other factors such as customization, process vs. product emphasis and people vs. equipment emphasis. The common trend in these definitions is that more customized and process or people oriented the services are, the more professional they become. The definition of numbers of customers served per day is natural outcome of these other factors. (Bryson et al. 2007)

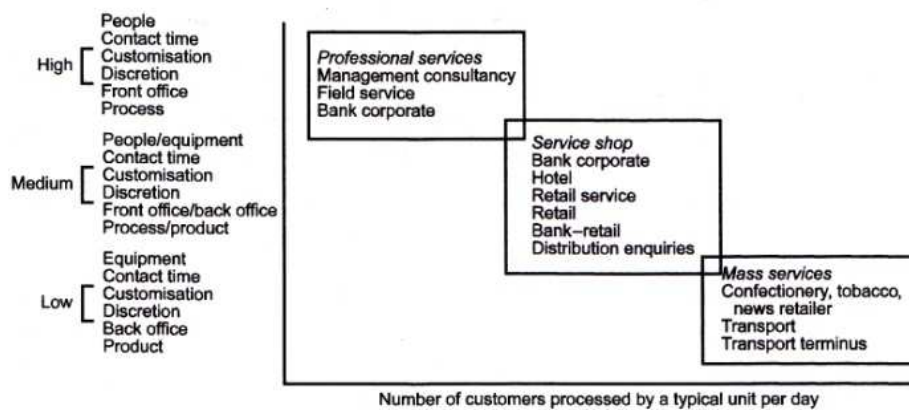


Figure 1 Three types of service, Silvestro et al. (1992)

As stated by Løwendahl, professional services will rely to a large extent on the interaction between knowledgeable buyers and highly educated service providers who engage in some form of joint problem solving activity. Since professional services are inputs in the value creation processes of other firms, they also have an indirect effect on the quality and efficiency of these firms' output. So primary characteristic of professional service could be stated to be altruistic service to clients thus in cases of conflict of interest between profitable actions and best solution to the customer, the latter should be chosen. This is clearly difficult constraint to impose, but it is imperative for long-term high quality reputation. One bad business operation will smoothen over time, but image can be lost only once. According to Løwendahl, professional service has the following characteristics;

1. It is highly knowledge intensive, delivered by people with higher education and frequently closely linked to scientific knowledge development within the relevant area of expertise.
2. It involves a high degree of customization
3. It involves a high degree of discretionary effort and personal judgement by the experts delivering the service.
4. It typically requires substantial interaction with the client firm representative involved.

5. It is delivered within the constraints of professional norms of conduct, including setting client needs higher than profits and respecting the limits of professional expertise. (Løwendahl 2005)

## 2.2 Drivers to move into services

The main driver for a company to expand its processes to services is naturally the race of survival on the markets. It's customer who is dictating the winners of the competition and the companies must adapt their business to correspond this. Penttinen et al. has divided the drivers into four categories as seen in figure 2.

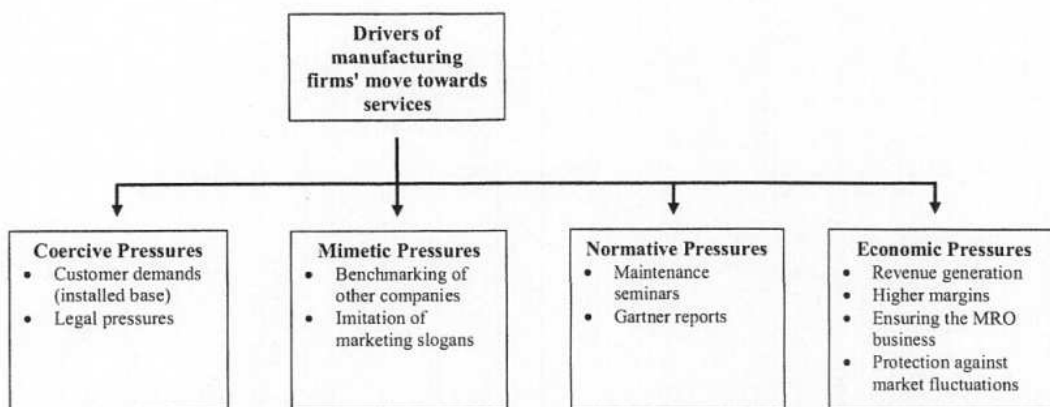


Figure 2 Main drivers to move to service, Penttinen E. (2007)

*Coercive pressure* covers the formal and informal pressure coming from the parties interacting with the company. Most visible are the customer demands of more complete solutions to be offered, but there are also more subtle factor such as customer's revised strategy, market changes etc. The legal pressures can play a major role in cases where the regulations changes particular actions to be imperative. Elevator maintenance is a stellar example for this.

*Mimetic pressure* rises from the success of other operators above all from competitors. This is accordant to M. Porter's five force analogy; should there be blooming business opportunities in certain service, the appeal to compete will rise. *Normative pressure*

rises from information exchange between professionals and from the academic literature which will set the professionalization into practise.

*Economic pressure* is naturally the most distinct category since the ensuring the organizations future, it must maintain its economic growth. The revenue accumulation of many manufacturing companies have changed so that maintenance, repair and operations business (MRO) will produce significant or even major part of the revenue, since the base product revenue has been reducing prominently. The service has been in past years the easiest way to ensure higher margins and to achieve economic growth. (Penttinen 2007)

### 2.2.1 *Becoming a partner*

Another way of seeing the service as a competitive edge is to increase the interaction between the customer and vendor. By increasing the customer's competence the vendor can achieve higher and more dependent status. The transition to the deeper interaction normally takes time and also experience increase due to the fact that in order to succeed, the vendor must have proper requisites to meet.

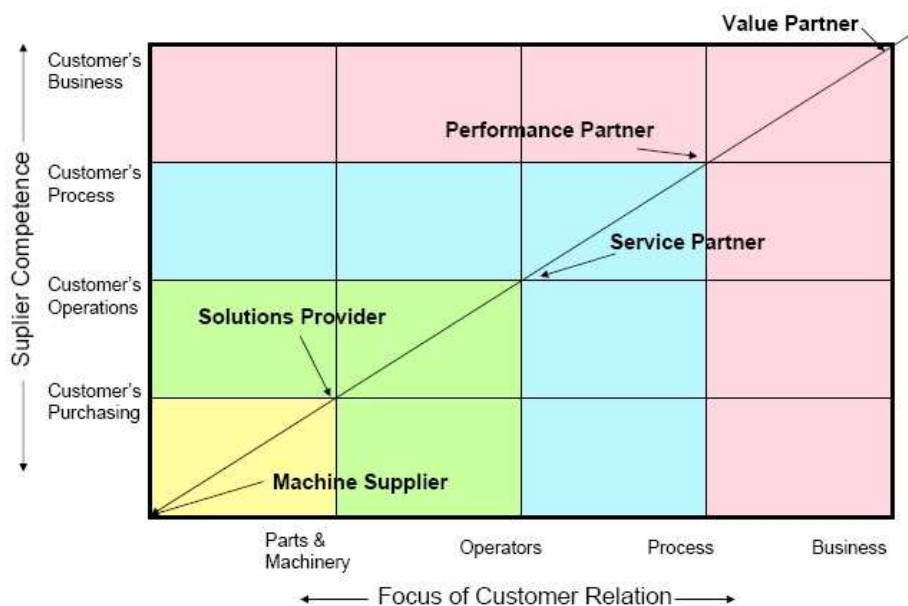


Figure 3 Service evolution, Tuominen (2004) & Maula M. (2006)

The transition from machine supplier to performance and value partner starts with adding the service elements to the offering as seen in figure 3. Machine supplier covers business, where vendor is supplying machines and equipment plus basic services such as major spare parts after sales. By taking over certain operations done by customer, the vendor provides solutions to the customer. The provided solutions can vary from maintenance of a machine or supplying all spare parts to life-cycle management. When focusing deeper into customer's operations, e.g. taking full or partial responsibility of the maintenance process, vendor is a service provider. This concept also quite often includes anticipatory system based on remote controlling technology.

To gain performance partner status, vendor and customer will develop together the efficiency, quality and productivity of the customer's process. In order to get this function satisfactory to both parties, the business must be cost efficient and pre-evaluated. The cornerstone to achieve this is wide and profound understanding of the processes and activities of the customer.

The highest level of collaboration or even symbiosis is the value partnering. In this stage, vendor can supply and perform actions that are elevated to the competitive edge of the customer. This business model does not only require extensive collaboration and discussion on all operative and management levels between vendor and customer, but also with customer's customer interface. The trust among the partners must be solid and partners should share the normally confidential information between value partners to ensure the fast and accurate information flow. The fast information sharing enables the agile reaction and adaptation to the market fluctuations, which keeps the competitive edge of the value partnership constellation at maximum.

(VTT 2004 & Maula 2006)

### 2.3 Value expanders

Mittal et al. have formulated a value space structure as shown in figure 4 where the three core value spaces are price, performance and personalization. The value expanders are the means and operations that will expand the offerings made to the customers by adding the elements to the products and services. For example, airline companies can provide to frequent flier a free upgrades, customized meal options etc or freight carrier provides customized seminars on handling the hazardous materials. Whether given free, at cost or even at profit, value expanders can be seen as an effective differentiation when distinguishing from the competitors. Company can use multiple expanders on single occasion but some of the elements may possess opposing targets such as increasing customization and lowering the target cost simultaneously. However, according to Mittal et al, there is a hierarchy among value space elements and companies must follow the hierarchy. Customers want and need the performance first. Should the product not perform and do the task defined, the price of the product is not good, no matter how low and attractive it may be. The customers' always tend to spend the least amount of money possible, but the amount is conditional, not absolute. Thus the price is conditional upon the product or service delivering the prerequisite performance. (Mittal et al. 2001)

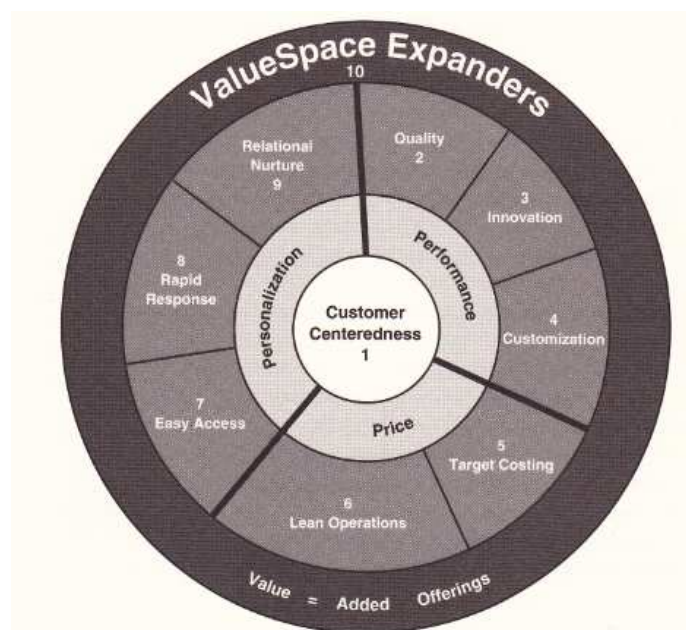


Figure 4 Value Space, Mittal et al. (2001)

When performance value is adequate, then the customer will look for the price and personalization value. There is requirement of equilibrium on these elements also. Company cannot smooth the inadequate performance of product or service or of the scale pricing by adding excessive personalization. Thus according to Mittal et al. performance is the foundation. Then price and personalization can be used, in this particular order, to enhance and expand the offerings. E.g. the airline company must provide on-time flight with acceptable price as a prerequisite before using the personalization as a competitive edge. In addition, the sub-types of value expanders have the similar built-in requirement sequence. On performance value space, companies must follow the sequence of quality, innovation and customization. There are multiple reasons. First, a company with superior quality is able to use the personalization elements and differentiate itself. However, some competitors will eventually catch up on quality and the differentiation edge is lost. So company must enhance the value-delivery by using the next expander, innovation and so on. Secondly, an innovation produced in a low-quality system produces low quality outcome which will be perceived by customers as the same negative offering. The same pattern is present on customization. Customers will prefer a good quality product or service which is standardized over a customized product with poor quality and they will also prefer latest generation standardized products over out-of-date customized ones.

Mittal et al. also states that on price expanders there is a natural progression from fair price to value price where value price is lower. With the price sub expanders the target costing should be built before lean operations. The statement is that the products have to be designed to be within costs targets, since even lean production can later squeeze the costs notably, the price space where the product will compete is determined at the product design stage. The similar pattern is present also when building up service processes. The lean operations come relevant and often imperative when the company is offering customization based on performance value. The personalization expanders are functioning on similar matter. Easy access is required to as a prerequisite to personalization to be initiated in the first place. The access must be followed by rapid response. The easy

access without an adequate, prompt response will enrage the customer quite easily. When access with sufficient response time is established, the business relation can be handled and nurtured in totally different level. This naturally will take a longer period of time due to the human behavioural issues.

(Mittal et al 2001)

## 2.4 The service offering

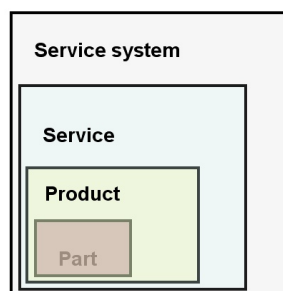


Figure 5 Levels of operation, Sipilä (1995)

One of the main issues for companies is to decide and define the strategy and the means to implement that strategy concerning the other operations involved with customer than production of goods. As stated earlier, there are various reasons and drivers why manufacturing firms have entered the service area as well. According to Sipilä, there are at least four levels on which the company can operate as seen on figure 5. Sipilä states that each company must review its strategy and potential on each area. The review should spring from the idea, that what the company is providing must be beneficial to customer on each level. Should there be elements that are not functioning as optimal, the whole offering will be hindered. Sipilä is suggesting that in most of the cases a company must build the system gradually in order to have optimum outcome or have a significant resources to perform well on each area. However, Sipilä emphasises that keeping the company as parts or product supplier can be as successful as widening the operations to cover the whole service aspect. The focus and aim are then different and strategy must be organized accordingly.

(Sipilä 1995)



It has been noticed that the service organizations have often difficulties to describe their service product and define and adjust the strategy accordingly. One of the challenges is the intangible nature of service, but also the customer involvement on the service process. Fitzsimmons et al. has defined a five-sided service package, where the package is bundle of goods and services with certain information provided in particular environment. The five areas of the package are:

1. *Support facility*. The physical resources from where the services are offered. This can vary from hospital or barber shop (the place where service is occurring) to buss depot or warehouse (from where the service is provided from). The criteria of support facilities include location, supporting equipment, facility layout and also interior decoration or architectural appropriateness. Naturally the importance of these criteria varies significantly in different business. E.g. providing professional services for pulp mill, there's little or non-existent relevance to the architectural issues from where the service is provided from whereas beauty salon services cannot be provided from oily, damp and dark warehouse premises.

2. *Facilitating goods*. This area consists of the items consumed by the customer and/or provided by the service provider. In professional services, the goods can bear a great significance e.g. leasing the vehicle or providing all spare parts to the equipment in question. Criteria consist of consistency, quantity and selection. The service mix between the criteria is often dependant on other criteria as well. E.g. the quantity and selection level can vary greatly according to what has been agreed on other areas of the package.

3. *Information*. The information flow between parties. One other hand the information given to the customer during and after service actions but also the prior information provided by customer to enable efficient and customized service. The criteria are accuracy, time-relativeness and usefulness. The usefulness and accuracy are easy to perceive, but can be sometimes quite hard to deliver. The time-relativeness is linked to the service type and encounter type. In face-to-face interaction e.g. asking instructions how

to operate new television set, the time gap must be as minimal as possible whereas when asking legal advice the acceptable time span can be weeks or even months.

4. *Explicit services.* The explicit service covers all benefits of the service that are observable by senses or measurements. These are also the essential part of the service features offered and of which the customer is willing to pay directly. The example could be the smooth operation with 10% less downtime of equipment that has been maintained or response time in case of emergency. The criteria are e.g. training and competence of service personnel, comprehensiveness, consistency, agility, reliability and availability of the service.

5. *Implicit services.* This area covers the psychological benefits that the customer may sense only vaguely. Examples can be the sense of luxurious status of high level hairdresser or easiness of business making and informality with certain service provider.. The most common and often the criteria to be adjusted are service personnel attitude towards service, atmosphere, status, sense of well-being, privacy, security and convenience. The challenge in implicit services is also that they may vary heavily depending on service provider's personal interaction with customer. They are very hard to measure or grade and the service provider obtains only weak signals of the success. For example the atmosphere of the service consists of numerous sub-levels and it is virtually impossible to direct them all. On service encounter, one customer may enjoy informality with greasy jokes while other may place value by proceeding strictly to business issues with no deviation. When changing cultural area, the gap on implicit issues will expand and it will be even harder to obtain the weak signals from the encounter or they can be even misinterpreted.

One must bear in mind that even though the explicit services are the most "visible" part of the service and the customer and often also the service provider focus heavily on these criteria, the service package should be viewed from each areas. Otherwise there is a danger that the adjustments are only made in explicit area, which can lead to partial optimization.

(Fitzsimmons et al. 2008)

### 3 THE TOTAL OFFERING PACKAGE

Wallin et al. are taking another approach on the issue and are stating that there aren't such thing existing than pure (physical) good. They suggest that by widening the definition of offering to a group of activities expands the definition so that it includes also the possibility to utilize and deepen the relationship between parties. Especially b2b-functions relationships are often viewed as a part of the benefit-wholeness of which the buyer acquires after the business deal is agreed. This could mean from key account manager activities of the vendor to company level joint tasks.

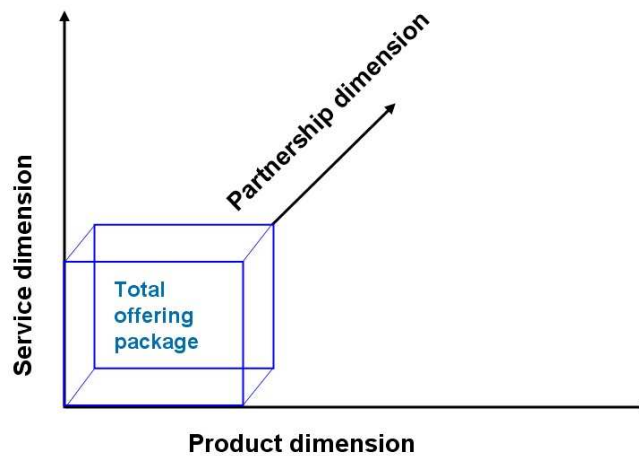


Figure 6 Total Offering Package, Wallin J et al. (2001)

Wallin et al. have formed a concept of the offering package, where the three dimensions of the package are physical product content, services and personal interaction or partnership as seen in figure 6. Physical product content package consists of e.g. the core product, the packaging, the quality and reliability of the parts combined to the physical product and product range. Service content contains e.g. the distribution of the content package, technical support, product alterations and their availability to customer, customer training, on-line-services, problem solving, warranties and other trust advancers, reputation of the brand, handling of feedback and claims, integrated data systems and invoicing. Personal interaction content covers e.g. long-term relationships and partnerships, trust among involved personnel, reputation and general development of the personnel resource within companies.

According to Wallin operators within the same market segments may possess a totally different approach towards value adding operations which will lead to different emphasis on offering dimensions. Wallin uses as an example the car manufacturers General Motors and Toyota. Toyota aims to establish a long-term relationships and partnerships with its suppliers and customers whereas General Motors has concentrated more on individual business transactions and haven't seen long term partnerships giving additive value. Therefore the dimensions of the total offering package of these two companies will differ fairly much from each others and the companies will also measure the success differently. However, one must note that despite their discrepancy, different offering packages can prevail as well on the market. The question is to understand and internalize, what is the company's offering package and is it coherent with the customer's value base. (Wallin et. al. 2001)

### **3.1.1 Adding value**

According to Wallin et al. adding value is a process, where offerings are produced in mutually beneficial relationship between vendor and the customer. Another operator can also be entered into this relationship, such as sub-contractors or customers' customer. Both parties of the relationship are functioning symbiotically and this leads to the positive, value-adding activities for both parties. The operators that are part of the co-production process of the value addition, forms according to Wallin et al. a value constellation. Should this value constellation equilibrium be tottered to disadvantage of either of the party, the wholeness of the offering package will diminish starting with personal interaction and it keeps diminishing until the next equilibrium level is reached. This thus means that there can be several equilibrium levels depending on the magnitude of the offering package. One company can by design keep the service and interaction content rather low in order to shield some physical content or business issues from spreading while other company increases these aspects aiming for e.g. establishing itself on new markets and customers or binding the existing customer tighter to relationship with oneself. Due to this nature, the value constellations are constantly changing and

reshaping themselves and it requires the parties involved to be continuously evaluating the process not only for themselves but also for the other constellation parties also.

(Wallin et. al. 2001)

### 3.2 Service strategies

The idea and vision of how to compete in the market and add value to the customer by service operations will be crucial in strategy forming. Fitzsimmons et al. are defined in the figure 7 a framework of the issues needed to be settled when forming the service strategy. Main issues are categorized in four main areas, them being service delivery system, operating system, service concept and market segments. The questions within the category define and evaluate the success of the selected methods and the questions between each category evaluate the success towards prior category.

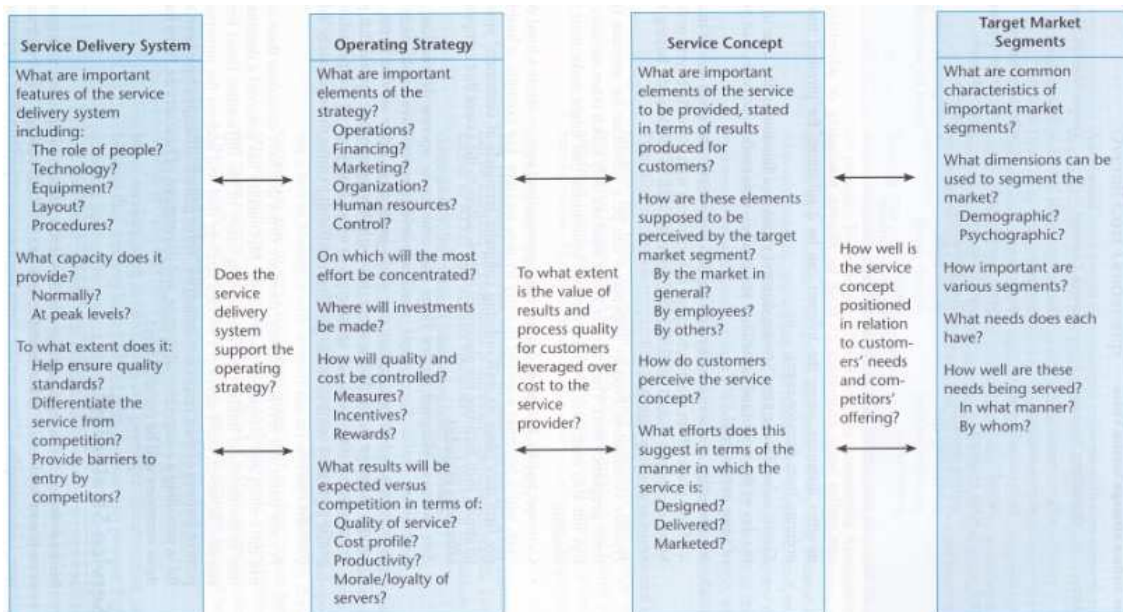


Figure 7 service profit chain, Fitzsimmons et al. (1997)

The service providers will generally, unless operating on very specific business area requiring high level expertise, face quite difficult business environment. Fitzsimmons et al. have stated at least six factors that harden the competition on service operations. 1. *Relatively low overall entry barriers*. Most of the service innovations cannot be pat-

ented, so the innovations are easily spread among and implemented by competitors. Also service business is not capital but labour intensive, so low cost copycats can prevail by adapting the existing innovations. 2. *Minimal opportunities for economies of scale*. As discussed in chapter 2.1, the service is produced and consumed on most cases simultaneously, there is not large scale possibility to produce and store service on low demand time. 3. *Erratic sales fluctuations*. Service demands vary heavily seasonally, weekly or even daily and in some industry areas such as in pulp and paper, most of the customers may demand the service at the same time e.g. in summer shutdown periods. 4. *Product substitutions*. New product innovations can substitute the offered services completely such as sample taking and analyzing so service companies should anticipate also the impact of technical innovations to their business. 5. *Exit barriers*. Especially marginal service firms may continue their operations despite nonexistent profits. These firms often employ family members or relatives and their short term goal is to ensure the continuation of the service rather than maximising the profits which allows them to use the price as a tool against profit-motivated professional service companies. For the new companies in the market the 6 *customer loyalty* can be tough to overcome since established companies have created a loyal customer base by personalizing the service or have built a partnership system with the customer.

(Fitzsimmons et al. 2008 & Blumberg 1991)

### **3.2.1 The service strategy choice**

As stated by Michael Porter, there are three main competing strategies to choose from; overall cost leadership, differentiation and focus. Each strategy has different approach, strengths, threats and requirements in their implementation and it is crucial that management has defined the strategic vision clearly and will stick to the game plan or otherwise the lost focus will lead to unoptimized outcome and market loss. However, Fitzsimmons et al. state that no matter what strategy is chosen, the main focus must be on customers' needs and satisfying that need with selected tools.

(Dos et al 2008 & Fitzsimmons et al. 2008)

### 3.2.1.1 Overall cost leadership

According to Fitzsimmons et al. the strategy of overall cost leadership requires efficient scale facilities and resources, tight cost & overhead control and also often innovative technology involvement. Low-cost structure acts as a defence against competition since it defines the lower margin of the cost level and less efficient competitor will suffer sooner from cost competitive pressure. Successful low-cost strategy usually requires high capital investment in high performance equipment, aggressive pricing and often start-up losses to build proper market share, but cost leadership strategy can revolutionize the whole industry sector such as McDonald's and Federal Express. According to Fitzsimmons et al. service companies can achieve low-cost leadership position by using following approaches.

#### Seeking out low-cost customers

Some customers cost less to serve than others and they can be targeted by the service provider. The means to implement this strategy is to cut down the channels, the time frame, the variety and the level how the service is provided.

#### Standardizing a custom service

Service can also be made more efficient by routinizing it. By routine task the personnel expertise of the service company can be set on lower level which brings savings both in education expenses and lower wage level. The challenge is to keep the standardization on correct level. Too high standardization diminishes the amount of potential customers to niche whereas too low level keeps the cost level too high to gain the advantage.

#### Reducing the personal element in service delivery

While service business tends to be rather labour intensive business, having some of the tasks transferred to the work of machines, software or even to the customer, can result as significant reduce in cost structure. This is a high-risk strategy and in order to be successful, the substitute procedure must be convenient and widely accepted by target customers. The example of such success is a re-

placing live teller of the bank by ATM. The main reason for acceptance in this was that the money withdrawal process is now available greater period of time thus the availability increased substantially.

#### Reducing network costs

Unusual start-up costs are encountered by service firms that require a network to connect their service personnel and the customer. Normally, even the company would have the sales network established isn't sufficient for service purposes since service encounter are usually more rapid and requires faster solving time than sales process. Moreover, when new customer is acquired, the company must create new network or extend the existing to ensure the adequate service level which can be costly if the distances are high. As a possible solution to reduce network costs, Fitzsimmons uses an example of Federal Express which founded a hub-and-spoke network where specific location is selected to be the hub with high capacity and high level operators with sufficient resources. the hub then acts as center of the network from where the sufficient service resources are distributed to the locations of the demand.

#### Shifting service operations offline

Many of the services such as haircut or passenger transportation are dealt "online" since they can only be performed with presence of customer. However, great deal of services has elements where customer presence is not required for whole process time. Then service can be decoupled to have some of the elements performed offline, such as arrangements, processing the data of the service task and so on. For example, machine repairing service can have front end operations where the interaction with customer is dealt and back operations where the machines are maintained centralized. In some cases some of the operations are done beforehand in back operations in order to serve the potential customer more efficiently. Performing services offline can represent significant cost savings due to the economies of scale from consolidations, lower-cost facilities and often due to the absence of customer in the system. It's notable that decoupled service operations runs much like a factory. (Fitzsimmons et al. 2008)



### *3.2.1.2 Differentiation*

According to Fitzsimmons the root of the differentiation strategy is creating a service that is perceived as being unique by the target in need. Approaches to differentiation may vary from technology and features to customer service and brand image. Differentiation strategy does not ignore cost as a driver, but the primary force lies in the creation of customer loyalty. The loyalty is achieved by abovementioned methods at the cost level the customer in question is willing to pay. For the service companies Fitzsimmons states the utilization of following strategies for differentiation.

#### Making the intangible tangible

As their nature, services often are intangible and do not give customer any physical reminder of the service in question. Provider can enhance the service encounter by adding tangible elements such as physical reminder e.g. embedding signboard with company logo to the subject of the service or adding regular inspections and recommendations to managers for preventing potential problems beforehand.

#### Customizing the standard product

Most of the services are customized on some level, but a company who also makes its standard products to have at least a hint of customization, may differentiate itself sufficient enough from its competitors.

#### Reducing perceived risk

Lack of information about the service task in question can create a sense of lone risk-taking for the customer. Should the customer lack the knowledge or self-confidence about services, the urge to choose the provider who takes the extra effort to explain and mitigate the risk involved rises. Customers often state that the peace of mind and confidence with trusted partner are being worth of the extra expense and the savings are received indirectly from smoother operations.

#### Giving attention to personnel training

Investment in personnel training and development which enhances the service quality is clear competitive edge that is difficult to replicate directly. In order to achieve the same expertise level means similar training effort or acquiring the same personnel and both options will take time and resources. Companies that lead their industries are known for their training program quality.

#### Controlling the service quality

Delivering a consistent level of service quality at multiple locations in labour-intensive business will pose a significant challenge. Companies can mitigate the risk of fluctuation in quality in many ways such as personnel training, explicit procedures, technology involvement, limiting the scope and direct on-going supervision. The challenge is to understand the quality from customer's point of view since the quality of service is how the customer perceives it to be and how big is the gap between customer expectations and experiences.

(Fitzsimmons et al. 2008)

### 3.2.1.3 Focus

According to Fitzsimmons et al. the focus strategy is to service a particular target market sections very well. It requires addressing the specific needs of the target customers. This strategy rests on idea that the company can serve its narrow target market more efficiently and effectively than broad market service providers thus the company gain competitive edge by meeting the specific needs with lower costs through specialization. Therefore the focus strategy can be seen as an application of differentiation and overall cost leadership to a particular market segment. The challenge implementing this strategy is the need and amount of suitable customers within selected market. The threat is that the service provider has too few suitable customers in order to implement focus strategy profitable or the amount of customer rises too high and the provided service cannot anymore be specialized.

(Fitzsimmons et al. 2008)

### 3.3 Challenges in providing service

As stated, services are largely intangible and developed in interaction with customer. This leads to certain characteristic challenges. First, service quality is difficult to guarantee due to the fact that required service cannot be pre-tested. Second, service operations management is highly complex procedure as service cannot be stored and occurs in real-time during the service process. Third, often the information asymmetry or knowledge gap between service provider and customer creates for the customer a challenge to understand the issues in question correctly and with right extend.

Schmenner has illustrated the challenge faced on different types of service by creating a matrix dividing the areas by degrees of labour interaction and customization as can be seen in figure 8. For high labour intensified and customized professional service firms the main challenges are keeping the highly educated personnel performing the desired quality, scheduled and scoped service but simultaneously keeping the cost increases at acceptable level while maintaining employee satisfaction.

(Fitzsimmons et al. 2008)

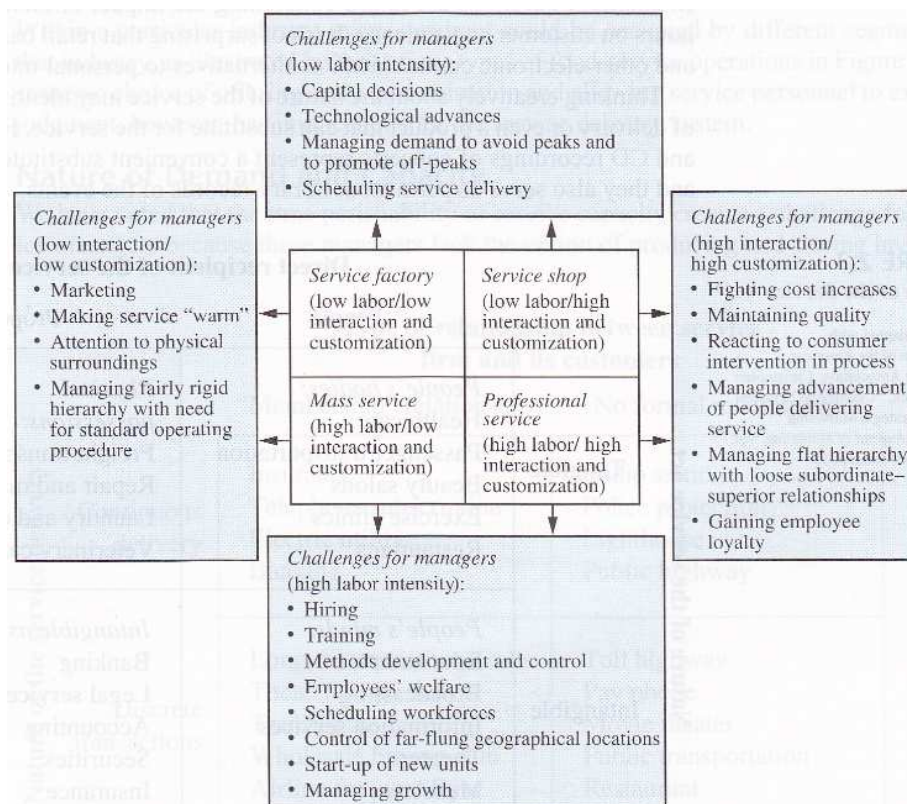


Figure 8 Challenges for service managers, Schmenner R. (1995).

According to Sipilä one of the paradoxes in service providing is that customer wants customized and ample services, but is willing to pay only standardized, stripped mass level service price. This is especially experienced within companies that are providing both comprehensive service systems and specific service tasks, because these companies are often competing against companies that are reactors but also copy-cats, whose service package is only nominal at best. And as stated earlier, customer quite often focuses only to the explicit part of the service package, which will easily lead to the distortion or even exclusion of some vital service package area when making the decision.

Sipilä is suggesting that in order to prevent this, company must observe its competitors; should competitor offer limited service emphasizing strongly the price, the company have to formulate similar limited service offering. One can then evidence that the question is not the price difference but the strategy difference. Thus company is able to offer wider service and can include certain elements, which competitor will not or cannot produce in their service package. According to Sipilä, it must also be noticed, that selling comprehensive service systems or wide service solutions cannot be considered to be more valuable or excellent than selling the limited or particular service; they are different strategies where customer makes the decision which will prevail. The service providers task is to set the knowledge level of customer high enough for him to make the optimal decision for his needs.

(Sipilä 1995)

### *3.4 Bottlenecks in service*

Bottlenecks can be stated to be temporary blockades to increase the output of the particular process. According to Schmenner the ability to react well at the peak period is outcome of the ability to keep things simple. Thus the small operation focused on particular task often does better on peak times than more complicated, larger-scale operations. The main idea is to control the flow of the goods and information in the service process and the flows are enriched by keeping them small and understandable. Schmenner is stating this process to be triage, where certain demands are handled in particular way which will differ from the other demand types. This kind of arrangement

can be seen e.g. in emergency rooms or in service call numbers where the service need is defined with preliminary questions and/or evaluation. Thus segmenting the service process may ease the process handling and help in the battle for bottlenecks.

(Schmenner 1995)

Schmenner is dividing the bottleneck factors in two main categories, to episodic and chronic bottlenecks where former requires often immediate and straightforward actions but the latter planning or design changes. The episodic bottlenecks can be divided into three sub-categories of equipment breakdowns, material and labour shortages where chronic bottleneck falls into two, material and process problems.

### **3.4.1 Episodic bottlenecks**

Equipment breakdowns may cause the biggest short-term bottleneck if the broken machine happens to be vital part of the service providing process. Should e.g. the main crane of the mill broke down in the time of the service, the opportunity to perform may be hindered to the level of unachievability. However, many of the machine breakdowns can be mitigated or even prevented with up-front planning and necessary preventive actions. The preventive maintenance is often neglected activity. On peak periods the temptation to choose business over maintenance often prevails and on the down periods the aim to squeeze everything out from the existing machines is strong. However as Schmenner states, the breakdown time and cost exceeds the planned maintenance and prevents also the quality issues surrounding the breakdown events, thus the task of planning maintenance and as good prevention of breakdowns as possible is being recognized as the most cost-effective policy to mitigate the breakdown bottleneck.

Material and labour shortages possess a different kind of bottlenecks and requires diverse prevention model. As being the most common bottleneck category, the material bottlenecks are often a result of machine or information breakdown earlier in the logistic chain. Some service operations can utilize substitutive items such as for the barber using knife instead of scissors but especially on professional services with high customization level there is no possibility to use any other material than the particular,

required one. In order to prevent material shortages, the founding of safety stocks, prolonged ordering safety times and verified information exchange can be implemented. Labour shortages occur from unexpected absences, simultaneous customer requirements and personnel movement out from the company. Schmenner observes, that this bottleneck is more present on the companies where major amount of workers are part-time or temporarily employed but the feature is present in all companies. To minimize the risk, careful planning of the work load with sufficient reserve capacity, the functional human resource organization and vivid co-operation with stand-in providers should be implemented.

(Schmenner 1995)

### **3.4.2 Chronic bottlenecks**

Material problems can be divided to two main categories. First, when company is constantly facing wrong kind of materials or there is continuous shortage of materials, the focus point of correction will not be necessary on the vendor's side. Most of the cases, as Schmenner states, are present due to the late or incorrect purchase orders, incorrect or vague specifications, poor forecasting of the demand, deficient inventory control and booking etc. Secondly, if there is constant change in the material mix, there is no time for the logistic chain to settle for efficiency and the bullwhip effect will easily take place. This is more present on the services operations where the actual demand is seen when operations begins such as in season-related services like sun lounger rental.

The process problems may occur from several issues. There may be insufficient capacity to begin with. The planning of sufficient capacity can be very tricky since the peak level demands may multiply the normal capacity need, but the duration of the peak level can be short and is hard to pinpoint. The capacity planning should include sufficient unused capacity for unexpected occurrences. Quality problems in the service offering chain may present themselves episodic as for example in time of machine breakdown, but if the fundamental cause of the problem is not fixed, the problem becomes chronic. In service business the poor layout may become one of the main bottleneck issues. As Schmenner states the lengthy distance between people interacting,

bad queuing arrangements and scattered information may, especially in crowded conditions, have a terrible effect on productivity of the operations. Some bottlenecks may also be result from inflexible processes. In these situations the bottleneck is designed into the process or is exposed by changes in the pattern of the demand. Good example can be the large general-purpose equipment or computer program which is designed to do series of tasks. When it is functioning as planned, everything is all right, but in cases where additional operations are required or the functions available do not match the need of the process, the operations may start to run unoptimized.

(Schmenner 1995)

## 4 AUTOMATION

Since automation is mere framework and background level on this study, it will only be described briefly with main definitions, terms and applications. Automation is wide generic term, which means automated parts and components of a control system, used technology and engineering of that system. Automation can thus be seen as area of technique. Besides immediate control of a particular process automation often features a higher level function such as process optimization and production control. However in common business language the automation is seen as a part of control system of the process facility in which the automation structure is defined. The structure consists of computing algorithms for operating sequences and warning level checks of the control circuits, of databases where gathered process data and coding library are stored and of interface which cover all the manners that are used to communicate with the automation system. There can be also other features such as automated links to the laboratory or maintenance databases or operating system or to the remote control features.

The basic terms in automation include principles of control, scale of automation, rate of automation, level of automation and automation hierarchy. *Principles of control* describe regardless of level of automation the criteria, of which the process feature is controlled. It includes initial data, principles of decision making and actions directed to the process such as process measurement analysis, process rules, algorithms and adjustable process parameters. *Level of automation* describes how much of the guidance and adjustment parameters are included on the upper level control system thus the scale of adjustable parts in the process. *Rate of automation* defines the distribution of work between automated processes and otherwise controlled (e.g. human) processes.

(Rautila 2001)

Process automation has changed the way of working in many environments. Operator in control room now commands wider area of process and makes decision that have larger and more profound impacts on process. In addition, operators quite commonly deal with the challenging exceptional process statuses, which have been formerly managerial decision, so the operator cannot focus on small details in a same way than some years ago.



So far the emphasis on automation engineering has been on technical and financial factors, but now also the user-oriented approach has been increasing as competing edge. Rate of automation can be increased on two ways; first by automating new process areas or process phases or second by increasing the upper hierarchy levels e.g. by increasing the process optimization by more precise process sensors and better defined algorithms. However, the latter way requires naturally that the lower level automation has been implemented first or simultaneously.

(Rautila 2001)

## 5 THE ANALYTIC HIERARCHY PROCESS

The Analytic Hierarchy Process (AHP) is one of the most famous tools for decision making especially when dealing with multicriteria and multidimensional issues. The tool can be used to make a choice among various alternatives, to rank the criterion in question and to prioritize these ranked alternatives in a hierarchical way. The AHP has been utilized successfully in various matters such as British Airways entertainment vendor comparison, relocating earthquake devastated Turkish city Adapazari, Xerox research project allocation and U.S versus China intellectual property rights - sanctioning case. All of these have in common that the criteria involved are more complex than what can be reduced directly to metric figures. The AHP is designed to cope with both the rational and the intuitive to select the best choice from alternatives. According to Saaty, it uses order topology and thus is differs from metric topology by concentrating on the dominance of the one element over others with respect to a common attribute, where the outcome is reduced into priorities. However, the AHP is not based directly on utility theory.

(Saaty et al. 1994)

The founder of the system T. Saaty describes the usage of AHP to derive ratio scales from both discrete and continuously paired comparisons in multilevel hierarchic structures. These comparisons may be taken from actual measurements or from fundamental scale that reflects the relative strength of preferences and feelings. Thus rather than prescribing a correct decision, the AHP helps the decision makers find the one that best suits their needs and their understanding of the problem. This rationality and intuitive approach makes the model useful for persons who are not accustomed to use mathematic models. Or as Forman states, “the hierarchical point of view taken to AHP can also be seen a friendly format of displaying complex situations for the human mind.”

(Saaty et al. 2008)

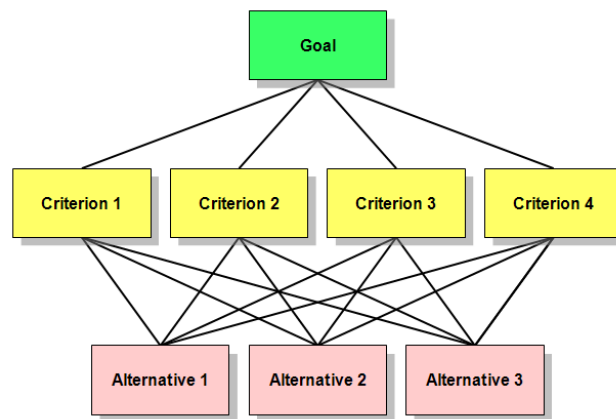


Figure 9 The AHP structure, Wikipedia (2009)

The basic idea is to structure the hierarchy model with minimum of three layers, the goal, the criteria and the alternatives as shown in figure 9. For more complex modeling, there can be also sub-categories for criteria and alternatives. The goal is the final outcome of the decisions e.g. which supplier a company should choose for particular operations. The second level hierarchy consists of criteria which are used to evaluate the alternatives. The third level- or final level, if there is a sub-criteria level - are the alternatives, which are subjected to the comparison.

(Saaty 2008 & Expert choice 2009)

## 5.1 Using the AHP

Saaty describes the four actions to be taken into account when making analysis with AHP. 1) Define the problem and determine the knowledge sought for. 2) Structure the hierarchy. 3) Build the pairwise comparison matrices. 4) Utilize the priorities received from comparisons to weight the priorities to obtain the priority ranking.

### 5.1.1 Scale and the matrix

When prioritizing things a metric topology numbering seldom gives or cannot give at all the correct information. It's very hard to measure e.g. is the offered service twice as good as the other or how much has the customer relationship improved this year. On the

other hand, people are accustomed to use numbers when making decisions and they can carry information in small space compared to their verbal counterparts. So AHP is using numbering as priorities which only tells the relativity of the criteria not the absolute value.

The normal scaling in AHP is to use numbering from 1 to 9 for convenience and psychology reasons for these numbers are easy to perceive. Should there be need for wider range of spectrum a clustering technique can be used to extend the scale. The normal comparison scale is defined in table 1.

(Saaty 1994)

| <b>Intensity of importance</b> | <b>Definition</b>                      | <b>Explanation</b>  |
|--------------------------------|--|---|
| 1                              | Equal importance                       | Two activities or criteria contribute equally to the objective                                  |
| 2                              | Weak or slight                         |   |
| 3                              | Moderate importance                    | Experience and judgment slightly favor on activity  |
| 4                              | Moderate plus                          |   |
| 5                              | Strong importance                      | Experience and judgment strongly favor on activity  |
| 6                              | Strong plus                            |   |
| 7                              | Very strong or demonstrated importance | An activity is favored very strongly over another. The dominance demonstrated in practice.      |
| 8                              | Very, very strong                      |   |
| 9                              | Extreme importance                     | The evidence favoring one activity over another is of the highest possible order of affirmation |

**Table 1 the fundamental scale of numbers, Saaty (1994)**

The importance of priorities elements are input into matrix as shown in table 2, where every element is compared against others. Every element is equal towards itself ergo

$A_{11}$  (or  $w_1/w_1$ ) has value 1. This leads to the fact that value of every diagonal element is 1 and value of element  $A_{ji}$  is an inverse of  $A_{ij}$ . This kind of matrix is called positive inverse matrix due that every elements are positive. When  $A_{ij}A_{jk} = A_{ik}$  on every  $i, j, k = 1, 2, \dots, n$  the matrix is consistent. This also leads that requirement of transitivity, thus if A is dominating B and B is dominating C, then A is also dominating C, is fulfilled. (Saaty 1994)

$$\begin{array}{c}
 A_1 \\
 \vdots \\
 A_n
 \end{array}
 \begin{bmatrix}
 A_1 & \dots & A_n \\
 \frac{w_1}{w_1} & \dots & \frac{w_1}{w_n} \\
 \vdots & \ddots & \vdots \\
 \frac{w_n}{w_1} & \dots & \frac{w_n}{w_n}
 \end{bmatrix}$$

**Table 2 the priority matrix, Saaty (1994)**

On AHP-model there is no prerequisite for absolute consistency, but limitation to the level of inconsistency. There are multiple possibilities to solve the weights on the inverse matrix. Saaty recommends to usage of eigenvector shown in equation 1, where biggest real eigenvalue is calculated. The prerequisite is that sum of the weights equals to 1 and in order to achieve this, the eigenvector must be normalized by dividing the weights on their sum. (Saaty 2008)

$$\sum_{j=1}^n a_{ij} w_j = \lambda_{\max} w_i, \quad i=1, 2, \dots, n$$

**Equation 1 eigenvector calculation, Saaty 2008)**

The example matrix shown in table 3 has four alternatives A-D and they are judged as following; A is strongly favorable over B, strongly plus over C and very strongly over D giving values 5, 6 and 7 to matrix as seen in the table with tan colour. Simultaneously, the values of B, C and D over A are received as there are inverse values thus 1/5, 1/6 and 1/7. Values presented as turquoise in the table. Also the diagonal is set because alternative against itself receives always value 1. The blue

values in the matrix. The rest of the matrix is completed with given comparison data accordingly.

| Weight of the alternative | A             | B             | C             | D |
|---------------------------|---------------|---------------|---------------|---|
| A                         | 1             | 5             | 6             | 7 |
| B                         | $\frac{1}{5}$ | 1             | 4             | 6 |
| C                         | $\frac{1}{6}$ | $\frac{1}{4}$ | 1             | 4 |
| D                         | $\frac{1}{7}$ | $\frac{1}{6}$ | $\frac{1}{4}$ | 1 |

**table 3 Example matrix with four alternatives**

Now the total weight of each alternative can be calculated by multiplying the given val-

ues together. Thus weight of alternative A is  $1 \times 5 \times 6 \times 7 = 210$ , alternative B  $\frac{1}{5} \times 1 \times 4 \times 6 = 4,8$  and so on. With these received sum a fourth root is taken giving the alternative A a value of  $\sqrt[4]{210} = 3,807$ , B a value of 1,480 and so on. In order to fulfil the prerequisite of the total sum of 1, these values must be normalized by dividing the value by the total sum value. Thus the normalized value of the alternative A is received by  $\frac{3,807}{6,204} =$

0,614. When every weight of given alternatives is calculated the alternatives have been compared with using the same scale and the received data can be used for decision making.

### **5.1.2 Consistency of the matrix**

The greatest eigenvalue of the inverse matrix  $A^{-1} \lambda_{\max}$  can be used to evaluate consistency of matrix A. If  $\lambda_{\max} = n$  and n is dimension to A, the matrix A is consistent. Should the matrix be inconsistent, the  $\lambda_{\max} > n$ . The consistency index CI can be calculated from equation

$$CI = \frac{\lambda_{\max} - n}{n - 1}.$$

**Equation 2 Consistency Index, Saaty (1994)**

However, CI value is not comparable, if the dimensions of matrixes are unequal. This can be normalized by using simulated random consistency index RI. By using these two, the consistency ratio CR can be calculated

$$CR = \frac{CI}{RI}$$

**Equation 3 Consistency Ratio, Saaty (1994)**

Allowable consistency ratio should not be over 0.10. Also the CR cannot be made smaller than 10% e.g. 1% or 0.1% without trivializing the impact of inconsistency.

Should the CR be larger than 0.10, Saaty describes a three step solution. First, find the most inconsistent value in the matrix thus where  $A_{ij}w_j/w_i$  is largest. Second, determine the range to which the value can be changed that correspond the change of the inconsistency. Third, discuss with the respondent can he change the value to plausible range. If this is not possible, the criteria or the matrix is not balanced.

(Saaty 2008)

## 5.2 AHP Critic

The AHP has been criticized mainly on alternative changes that can cause priorities to change and on the limitations of the scale. According to Schenkerman the priority rank of hierarchy model can alter, when new alternative is introduced to the hierarchy. When the new alternative is giving new information thus respondents in really weights the new alternative accordingly, the addition is justified. However it has been noticed, that in some cases the priority rank can alter also only due to the mathematical features of the AHP. The phenomenon occurs for the reason of normalizing the local weights and methods to prevent the issue has been developed. Saaty (1994) describes that the

priorities follow the basic laws of economy; the more uncommon the particular criterion is the greater is the “demand” and its weight. When new alternative is introduced, the amount of choice of the criterion are changed, which can alter the priorities. Thus according to Saaty the weighting of the criteria and the alternatives are tied to the set and when changing this set the comparison must be remade.

(Schenkerman 1994)

In addition the common assumption with AHP modeling is that the comparison of the criterion is independent from alternatives. According to Watson et al. this doesn't apply to all cases and models. For example when comparing the priority of purchase price and maintenance costs, one cannot make sensible comparison not knowing the level of these cost on given alternatives.

(Watson et al. 1983)

The AHP scale has been under criticism on several occasions. According to Belton the chosen scale 1-9 delimits the weighting of priorities and the upper limit value 9 can be problematic on consistency aspect. Belton uses an example that should the criterion A be five times more important than criterion B and B five times more important than criterion C, the logical relation to A/C –importance should be 25. In addition the correlation between the semantic and the numerical values used in scaling can be inconstant. Different respondent can have different opinion what semantically a particular definition stands for. Belton also states that preference of terms *demonstrated* (scaling 7) and *strong* (scaling 5) are not prioritized by many respondent in same order than Saaty defines them, which can lead to over- or underweighting the criterion.

(Belton 1986)

### 5.3 *Why chosen the AHP to be used in thesis*

In order to have an understanding on how the customer is seeing the company as vendor, one should not concentrate only to products offered. However, adding a service aspect – particularly if service is defined in quite a strict way - can leave some crucial elements out of the judgement. As introduced by Wallin, the offering is a three



dimensional package, where third dimension of the offering package is personal interaction or partnership. Some of the elements of this dimension can be included in service dimension, but elements such as trust level among parties or vendor's resources directed to the particular customer can be easily excluded. These things however can have a significant role when making decisions concerning the vendors. Should the vendor and the customer share a long-term partnership together, the easier it is for customer to accept minor deviations on quality or performance on elements of the other dimensions. It also creates an effective entry barrier against competitors and its best form can reduce the bureaucracy between parties and speed up the business transactions remarkably. The talk of mutual benefits of partnership is often sought for in corporate action plans, but is it measured sufficiently in practice?

The AHP-model was chosen to be used in this thesis for various reasons. First, the requirement of handling all dimensions of the service package was dexterous to cover with AHP-modelling. The dimensions were built as top-criterion of the model. The modelling of these three dimensions otherwise would mean that three different models should've been created since all have their distinguishable characteristics. Moreover, there was a call to have an understanding how the customers weights the three mentioned dimensions on correlation with each others. Thus how adequate is the provided offering package to the customers' needs. In order to be able to make the comparison, some of the key personnel also filled the questionnaire. Should there be any major deviations between the views of personnel and customers, there is a need to research, rethink and revise the offering package of the company.

Secondly, the sub-criteria of dimensions such as on product dimension functionality, user-friendliness and product cost or on service dimension availability, process know-how and proactiveness are covering a different and in some cases opposite aspects of the business criterion. Other significant issue to be noted is that it will be challenging to measure some of the criterion on normal scales. It's quite difficult to scale e.g. the proactiveness on absolute values. Can the respondent define reliably, is the vendor A 50 % more proactive than vendor B or do the respondents C1 and C4 have a similar scale

when judging the intangible elements? With AHP using priorities these criteria can be weighted at least in some distinguishable manner.

Thirdly, the AHP-questionnaire was used to make a rough benchmark towards other companies operating in same business area. The criteria created for weighting the source company performance was used similarly to weight the operators, thus e.g. criterion availability was measured in a way that the source company was compared to other operators. This is not AHP pairwise comparison, but it resembles the alternatives of the AHP-model and according to Rayko Toshev, a researcher of University of Vaasa specialized in AHP-modelling, the gathered information can be used for this purpose.

## 6 MODEL

The AHP model was created by using software Expert Choice. The Expert Choice is professional optimization and decision making application which enables e.g. the AHP-modeling, calculating inconsistency ratios, evaluating alternatives and prioritizing objectives. The main reason for using software in this thesis was the easiness of model building, inconsistency ratio calculations and possibility of comparing the survey data between the given alternatives. There is a trial version downloadable for academic use which was utilized in this thesis.

### 6.1 *The dimensions*

The model was built to cover the three dimensions of the Wallin et al. offering package - physical, service and partnership – as explained in more detail in chapter 3. Due to the reason that the source is operating on professional B2B-markets and the total offering is the optimization of the woodyard processes or its main equipment, the weighting of the criteria was moved to correspond this. This point of view was enhanced by the representatives of the case company whose area of business the survey was being made. The defined criteria needed to reflect the business environment and the factors that are present when interacting with the customer base. Therefore e.g. packing of the product is not seen as important as Wallin et al. are stating in B2C-markets. The criteria taken into account thus reflect more the practical features of the product. This leads to implement criteria that measures more directly factors of operations or elements of the product. For example the product dimension criterion the core product by Wallin et al. was seen to be too general criterion since with products in question the differences between competitors comes from more subtle differences than mere core product. Therefore the criterion was divided into multiple criteria of functionality, serviceability and product cost. Also some renaming and refocusing of the criterion was implemented. For example the product range was changed to benefit since all the offered products are more or less customized and it gives little or no point to measure the wideness of the product range but the benefit the different solutions can provide.

More profound redefining of the criteria was done in service dimension. The researcher and the representatives shared the view that within specified professional service business some of the criteria Wallin et al. implemented will not measure the correct things and therefore are not suitable for use. Some of the Wallin's criteria were also combined to implement the desired additional criterion but still to keep the total amount in sensible and acceptable level. For example criteria such as distribution and on-line guidance were combined to criterion availability for reasons that in the business in question the service distribution itself does not play major significance without the actions to be made and on the other hand most of the tasks are handled via remote, on-line connections. Therefore the criterion availability was seen to be more suitable to cover the whole availability of the required actions. Also with some criterion renaming was done to correspond better the factor desired to be measured. E.g. Product changes which was considered to be somewhat odd criterion in service dimension was changed to continuous improvement and guarantees was changed to meeting the expectations.

In partnership dimension the criteria were used quite similarly to Wallin's model. The criterion communication was added to measure two things; first the amount of communication between parties and also the level of informality when communicating. In general concerning all the dimensions, the main idea for the changes was that the criterion should correspond to the field inside the dimension to which the providing company can affect, it has features that will add value when provided and it also bears significance in customers' decision making process.

### **6.1.1 *Physical product dimension***

For the physical product dimension criteria were selected to be functionality, reliability, user-friendliness, benefit, product cost and serviceability which cover the business oriented features of the product. All of the criteria are more focused on practical use of the product than its appeal or other appearance-related issues. This does not mean that mentioned features wouldn't be important, but they were left out on two reasons. First, on model building aspect the convenient amount of criterion is normally between 6 to 8, so adding these criteria, the model could become too heavy to answer. Secondly, on this

questionnaire the main aim is to gather information on core functionality and therefore the focus is kept on related matters.

*Functionality* is covering the aspect of how the product is working. The main criterion is that the product works as planned on operations it was acquired for. This could mean e.g. that should the product monitor and adjust the wood flow to the chipper, the well functioning system does this solidly without either giving a false warnings, alarms etc or adjusting the parameter unsatisfactory.

*Reliability* is measuring the solidity of the product output meaning that it gives the data and/or manages the defined process correctly over desired and specified period of time. The criterion covers the issues of physical product failures such as breakage of components which can cause unplanned actions or shut-downs to the process and also the deviations in software which leads e.g. to crashdown of the system or malfunctioning on data gathering and processing.

*User-friendliness* measures the easiness of usage. Personnel can easily learn and manage the control function of the product and the memorability thus knowledge transfer of the system is on correct level. Should the product be used by rocket engineer or blue-collar maintenance worker the level of easiness of basic use can be totally different. The factor that operating menus are clear and understandable on the one hand increases user satisfaction but on the other hand also prevents the operator from making unintentional errors. Well designed user-friendly product also tries to diminish the human errors by having a check procedure for unusual actions such as erasing databases or making out of bounds adjustments.

*Benefit* measures the product giving added value to the process. The product can be seen beneficial, when the information or the function does improve the situation from the starting point. In addition of e.g. direct process savings this can also mean the better information on process bottle-neck, failures or other such things that unoptimize the process. The weighting factor on this criterion is also that the added value can be measured or noticed otherwise from the process.

*Product cost* is the cost level of the product. This covers all the costs in purchasing, implementing and depending on the agreement in some cases also operating the product. The normal warranty and periodical maintenance cost are included if they are sold combined, but should there be an additional service fee, the cost is handled in service dimension.

*Serviceability* is covering the easiness of maintenance of both the physical components and software. First, the product can be maintained so, that certain parts can be replaced without major shut-downs or without dismantling whole system. Secondly, if required, daily services can also be done by operators rather than vendor's experts. Thirdly, serviceability can also include remote services to the software and other things that can be adjusted from range. This can cover things like upgrading the software, software and network monitoring and adjusting the alarm limits.

### **6.1.2 Service dimension**

Service dimensions were selected to represent the professional service aspects and qualities needed in performing world class service.

*Availability* criteria is representing service provider being available to perform service or other counselling actions whenever customer needs. The waiting time that customer experiences should be kept on level the customer accepts. As discussed in chapter 1, the expectation can vary drastically depending on how important the issue is to customer and how much the reaction time hinders customer processes. For example for quick software interface problems the availability should be considerably higher than for optimizing the production process of the customer. One must also note that for the 100 % availability ability the provider should reserve unused capacity for the unexpected and unplanned needs.

*Proactiveness* stands for taking active and pre-emptive role. The service provider doesn't just react on issues, but acts in advance of future situations and seeks actively solutions to the customer's problems. Often proactive work requires that the provider is

taking certain control of the processes at least in form of monitoring. In order to perform proactive work in professional service business area, there must be certain level of trust between parties, since the monitored signals are quite often obtained from certain technical product or process.

*Reliability* measures that service provider performs what have been agreed, right timely and right scoped. Measuring reliability can be very challenging since not only may parties possess a different understanding about what have been agreed on, but also how to assess numerically how much more or less reliable the provider is. Naturally e.g. figures derived from due dates, warranty costs, non-conformance matters or from other numerical data can be used for weighting, but the base values and the deviations from it should be agreed together. Otherwise the supplier may have the impression that their performance is reliable but the customer can see things in a different way. For example, if there is a service need for certain machine and provider performs a quick and sufficient service on it, but the service performed only covers half of the tasks customer was looking for, is the performed service then reliable?

*Meeting the expectations* covers the issues where service provider meets or exceeds the need and wishes of the customer concerning the service in question. (Note; Price is not included in this criteria) The expectation of the customer can be e.g. that provider can solve an issue with malfunctioning machine, but the agreement is done for maintenance of that particular machine. The challenge is on whether the customer can formulate his basic needs into a clear request or not.

*Cost* is the cost of the services invoiced separately e.g. additional upgrades, adjustments etc. Should the offering package include the service work, it should be calculated as a product cost. The service cost is often agreed to be valid for some period of time such as on yearly basis. Also different categories are often introduced for tasks in different competence classification.

*Process know-how* measures service providers' know-how of the products, the systems and also customers' processes. The know-how consists of both explicit and tacit knowl-

edge. The explicit knowledge is measurable or codifiable and is relatively easy to transfer to other members, for example the cycle speed or circuit topology of process equipment or raw material analysis, whereas the tacit knowledge consists of silent knowledge which the bearer himself does not necessarily realize possessing. The tacit knowledge builds within long period of time when experiencing the similar situations and finding suitable solutions to the issues. This necessitates the adaptation of former knowledge to the current situation. The example can be that even if someone has the explicit raw material analysis, it would require the tacit knowledge to gain understanding how to adjust the on-going process accordingly. For high-grade process know-how the provider must possess personnel competent enough and experienced enough with similar kind of tasks.

*Agility stands for service providers' ability to adapt quickly on the changed business environment. The agility is combination of knowhow, company culture, flexibility and adaptability. The common definition of business agility is "to adapt rapidly and cost efficiently in response to changes in the business environment. Business agility can be maintained by maintaining and adapting goods and services to meet customer demands, adjusting to the changes in a business environment and taking advantage of human resources"* (Wikipedia, cited 20.12.2009) The agile provider can thus change more quickly than its competitors to meet the new and altered demands of the customer. This leads to the customer getting better and more suitable services and provider staying competitive on markets.

*Continuous improvement* Service provider seeks to improve its performance. It is an on-going process together with customer. The on-going improvement is a vital for company's success and various management tools have been introduced to gain continuous improvement such as the quality circle of Deming, Kaizen and Six Sigma or SERVQUAL.

### **6.1.3 Partnership / Interaction dimension**

The partnership and personnel interaction dimension covers the issues that are linked to the personnel in both parties. Some of the qualities are deeply characteristics of the particular person and can be very hard to transfer to another person. Company can facilitate



some of the elements such as resources or personnel's expertise but the communication, not to mention trust between parties can be very challenging to transfer completely from one person to another. The case can be that the customer trusts a particular person of the provider and wants to communicate exclusively with that one; even if the other elements are in the same level or even better with other supplier, customer tends to choose the trusted one.

*Trust among parties* measures the trust level between business partners. In order to gain trust between parties normally requires previous successful business transactions. The trust can be assessed from how much business processes are revealed to the partner. The level tends to be higher between parties operating on similar culture background. Also notable is that should the trust level be high, the business negotiation and transaction procedure will be significantly more informal, which makes the supply chain more effective and quite often also more beneficial for both parties.

*Communication* stands for the communication activity between parties. The more communication there is, the more open minded approach towards the discussion normally lingers. Also this criterion measures the informality of the communication between parties. This goes in some level hand in hand with trust level; the more trustworthy the partner is the more informal discussion happen which often reveals more on partners processes and current situation. The provider with excellent communication skills can advance into position where it has an up-front opportunity to solve the customer's needs without any competition.

*Personnel expertise* stands for the expertise of the supplier's personnel on issues concerning the customer. The personnel expertise can be seen to consist of two areas; first the overall expertise on equipment, process and their required maintenance and secondly the expertise on the particular issues (equipment and processes) concerning the customer in question. Especially the process parameters can vary drastically and require unique expertise to handle. The expertise of supplier's personnel is also the ability to discuss with customer at customer's perspective and at customer's level thus "speak the same language." Should the customer be expert on issues concerned, the discussion can

be held on very detailed level, but should the customer's knowledge on issues be insufficient, the discussion must be kept on understandable level.

*Company resources* measure the supplier's resources to perform tasks for particular customer. This can mean that supplier has implemented a key account management system to ensure sufficient resource and interaction between parties or other arrangements such as resource allocation, sub-contractors or partnership. In order to keep sufficient resources, the supplier must have an understanding of current and future needs of customer and also reserve resources for unexpected issues.

*Reputation* represents supplier's reputation on market. A good reputation of the company lowers the hierarchical bureaucracy demands and can affect the business terms to be agreed on the tasks e.g. payment terms such as down-payment issues or longer payment time or tasks can be settled verbally between parties. The good reputation is built on period of time and some of the reputation effect can be transferred from customer to another, but the solid reputation must be gained separately on each customer. A good reputation functions also as a buffer against bad performance; should something go wrong in service encounter, a supplier with good reputation can get another chance to correct the issue and ensure the future business collaboration but supplier with neutral or bad reputation seldom get this chance.

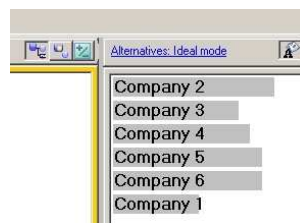
## 6.2 Modelling

First phase of the modelling was creating the structure for abovementioned dimensions and criteria. The model was set on three levels where level one is the goal – the offering package – the level two is the main criteria and level three the sub-criteria. The modelling tree is presented on figure 10.



**Figure 10 The AHP model tree**

The next step was the creation of alternatives to be used in questionnaire. Six alternatives were used which will represent most of the actual alternatives on market. One of the alternatives was the local supplier, which represents different company in different market area while others are global players in the market in question. The description of the alternatives was their real-life name when the modelling was made and questionnaire handed to respondents, but for the academic thesis the names have been coded.



**Figure 11 The alternatives**

When the basic structure was completed, the questionnaire was created from data as seen in figure 12. The questionnaire is structured on pairwise comparison of each criterion toward each other to correspond to the AHP model. There is possibility to utilize the Expert Choice software directly when filling the questionnaire, but it would require

the close face to face contact with the respondent which would require greater resources.

Questionnaire

File Edit Assessment Go Help

Compare the relative importance

FUNCTIONALITY versus RELIABILITY

with respect to: Product (L: .389)

|    |                   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                   |
|----|-------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-------------------|
| 1  | Functionality     | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Reliability       |
| 2  | Functionality     | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | User-friendliness |
| 3  | Functionality     | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Benefit           |
| 4  | Functionality     | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Product_Cost      |
| 5  | Functionality     | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Serviceability    |
| 6  | Reliability       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | User-friendliness |
| 7  | Reliability       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Benefit           |
| 8  | Reliability       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Product_Cost      |
| 9  | Reliability       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Serviceability    |
| 10 | User-friendliness | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Benefit           |
| 11 | User-friendliness | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Product_Cost      |
| 12 | User-friendliness | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Serviceability    |
| 13 | Benefit           | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Product_Cost      |
| 14 | Benefit           | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Serviceability    |
| 15 | Product_Cost      | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Serviceability    |

1 = Equal    3 = Moderate    5 = Strong    7 = Very Strong    9 = Extreme

Invert    Calculate    Close    Cancel

Figure 12 Pairwise comparison

The questionnaire was then transferred to Microsoft Excel –format to be sent to the selected respondents. There is also possibility to print the questionnaire from Expert Choice, but it was chosen to use Excel-format on two reasons. First, to ease the answering process with possibility to mark the answers directly to the Excel-file e.g. by using border or highlight tool. This way the questionnaire could be kept on digital format and the answering was quick to do. Secondly, in order to minimize the compatibility errors, using the 2003 Excel-format should guarantee minimum risk of incompatibility.



| Product related criteria |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |            |
|--------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------------|
| <b>Functionality</b>     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |            |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company Y  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company Z  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company VV |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company S  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company L  |
| <b>Reliability</b>       |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |            |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company Y  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company Z  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company VV |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company S  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company L  |
| <b>User-friendliness</b> |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |            |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company Y  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company Z  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company VV |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company S  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company L  |
| <b>Benefit</b>           |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |            |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company Y  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company Z  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company VV |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company S  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company L  |
| <b>Product Cost</b>      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |            |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company Y  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company Z  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company VV |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company S  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company L  |
| <b>Serviceability</b>    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |            |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company Y  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company Z  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company VV |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company S  |
| Company X                | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company L  |

Figure 14 Alternatives comparison

The third and last part of the questionnaire was five open questions purpose of which were to give the respondents the opportunity to deepen their answers, to define more their attitude towards case company and to give an informal way to give feedback on products and services the case company offers. The open questions covered issues such as “What should the case company do to be/stay as a first choice on automation products?”, “Is the case company offering the process optimization with adequate product range?” and “What areas of operations are functioning best?”

### 6.2.1 Task performed after receiving the filled questionnaire

When the filled questionnaires were returned, the results were input to the software by using the pairwise individual assessment mode. With this mode each respondent were handled individually and there is a possibility to check the inconsistency value of each respondent separately. On figure 15 is a screenshot from one assessment matrix filled with three respondents’ data with automated calculation of geometric average and variance.

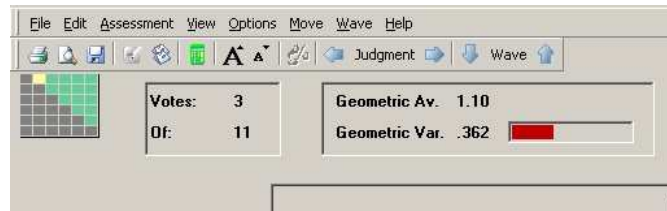


Figure 15 Individual assessment

When every answer was input to the software, the priorities calculation was done automatically with inconsistency value as seen in figure 16. The priorities are calculated in respective both to goal, thus service offering package and sub-levels of the criteria. Thus the analyst can obtain not only the overall priority but drill-down how the priorities are weighted in certain level for more sophisticated results and to derive and analyze the differences with given alternatives.

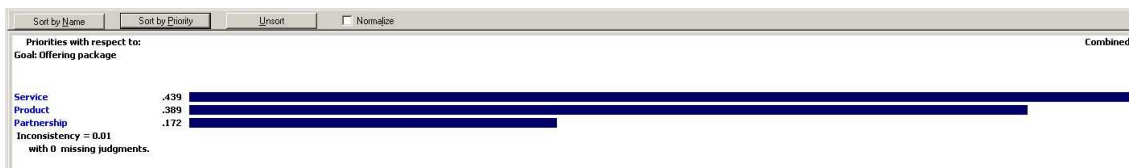


Figure 16 The priorities on level, the total offering package

To ease the handling and display process of the received data, the results from the priorities were transferred to Microsoft Excel. The data was grouped accordingly and sorted by priority. After these actions the data was easy to display in suitable graphics such as pie charts, radar models and columns.

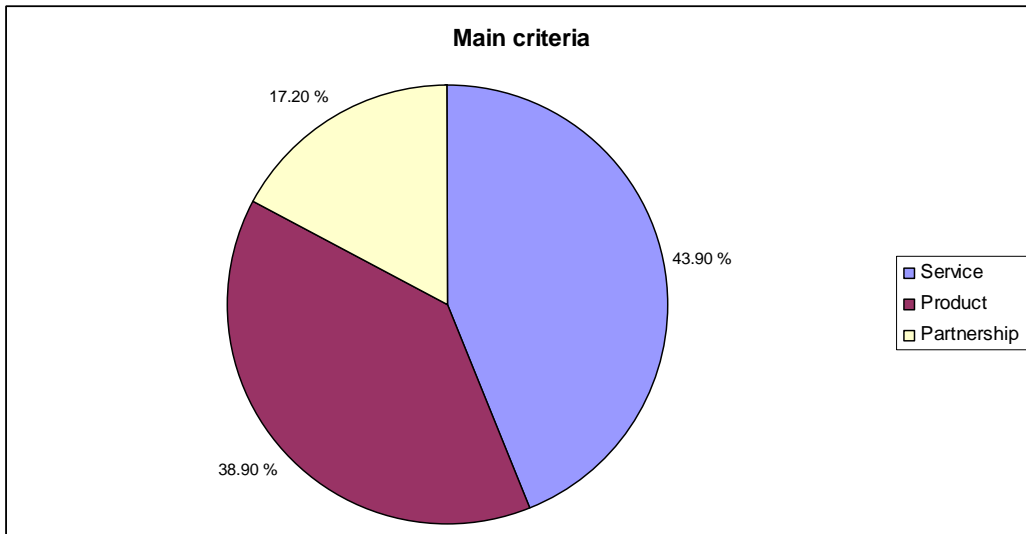


Figure 17 The priorities on pie chart.

The alternatives were input into model by using the pairwise verbal comparison tool where the alternatives are weighted against each other. Due to the fact explained in chapter 6.2, the comparison is done only on case company towards other companies, which diminish the data validity in some respect, but on acceptance limits.

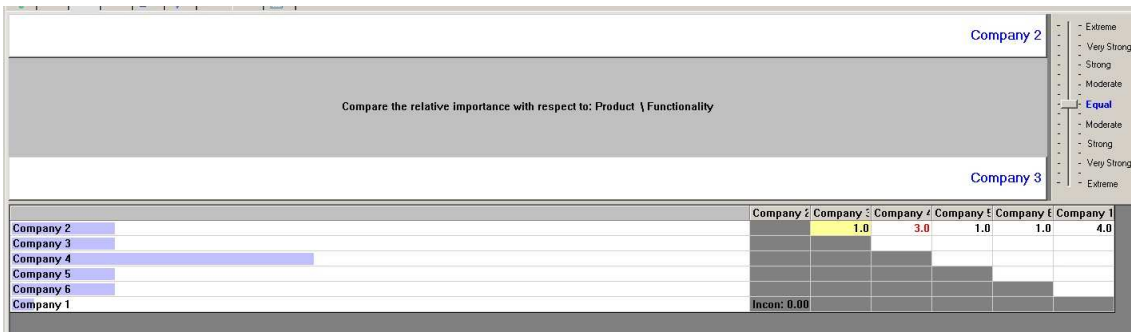


Figure 18 The alternative comparison



## 7 SURVEY ARRANGEMENTS

The inquiry was done as directed poll with two main respondent categories. First, the internal part of the case company consisting of persons involved with automation products and systems in pulp mill woodyard globally. The second category was customer representatives on suitable positions. Most of the customer respondents were either woodyard managers of the pulp mill or persons responsible of developing the woodyard processes. The main idea was to investigate two things. First, do the personnel of the case company and their customer weight the criteria thus the total offering package dimensions coherently or is there a fundamental difference in opinions. Should the case be the latter, the case company must review its business strategy and its implementation. Secondly, the model was set to investigate, how the case company is viewed and weighted towards the main competitors in the selected market area in respect of the same total offering package criteria. Again, should there be major differences against the case company, a review of operations e.g. benchmarking, best practice ect., should be implemented.

Due to the nature of the questionnaire and the specific products in question, the amount of respondents was set quite low. The questionnaire was sent to thirteen people and the filled questionnaire was received from six making the reply rate of 46.15% of which the external respondent value was 30 %. On normal poll this would be an excellent result, but since this was heavily directed poll, the return expectation was set to be higher.

### *7.1 The reliability, validity and the consistency*

Even though the poll in question had some elements of quantitative inquiry, the poll is qualitative poll due to the nature of AHP model where qualitative factors are judged and the sampling is chosen and specified. Thus the requirements of quantitative reliability and validity are not used, but the judgement of reliability which is covering the whole survey. The evaluation is done by the criteria of the transparency, of the starting point of the researcher and of the reliability and credibility of the stated arguments. The AHP

model has also the requirement of inconsistency, which measures the logicity of the replies towards each other.

(Mäkelä 1990 & Saaty 1994)

#### Reliability and validity

The reliability criterion defines how well the researcher has reached the reality of the examined issue. The reliability is increased if the researcher is familiar with the context and the researcher and the respondents have a same language or that they are using the similar professional vocabulary. (Robson 1993) The issues increasing the reliability in this survey were that the researcher knows the industry branch and the industrial aspects in question quite well and most of the operations described and utilised in the criteria were known beforehand. Also the fact that the most of the respondents are known personally and that there has been former interaction with the respondents, increases the reliability in a fashion that it is easier to understand the point of view of the respondents. The reducing factors to reliability are the lack of profound outlook of the automation systems and technique which may affect on how the replies are viewed and processed. This phenomenon is attempted to avoid by keeping the gathered information as intact as possible. With numerical AHP data it is no problem at all, but with open questions the researcher should pay attention. Also the small sampling can be seen as reducing factor especially to the requirement of transferability and must be checked carefully before generalizing the results.

(Robson 1993)

#### Consistency

As described in chapter 5.1.2, the AHP has a specific demand for inconsistency being 0.10 or under. This prerequisite was fulfilled with internal respondents clearly since the highest inconsistency of the questionnaire was 0.07 on sub-criterion service. However with external respondents two sub-criteria, product and partnership, had inconsistency over the acceptance limit. The sub-criterion product had inconsistency value of 0.16 and partnership 0.11. As Saaty described on chapter 5.2, the exceeding of allowance level of inconsistency can mean two things. First, the criterion or the matrix is unbalanced and the outcome is biased within these criteria or secondly, some of the respondents

have replied illogically and contradiction to their own former replies. The question of which case is valid is to be solved by analysing the model and the weightings. This leads to the conclusion that the latter case has happened on criterion weighting in sub-criteria level since the whole external model has inconsistency of 0.10 and it is supported by the fact of low level inconsistency on internal respondents.

As Saaty describes, one must first find the most inconsistent value thus where the alternative weighting is largest. In the matrix of sub-criterion product, the weighting difference comes from the comparison of reliability versus product cost with geometric variance of 0.52. On sub-criterion partnership the comparison trust among partners versus communication has the highest variance with value of 0.524. The second phase on inconsistency check is to define the range of the answers. In Product criterion reliability-product cost the range of replies varies from weak benefit favour to strong product cost favour which will increase the inconsistency significantly. On partnership criterion trust among partners - communication replies have range from weak trust to strong communication which creates the inconsistency. The third phase on correction would be to go the inconsistent replies through with the respondents and to discuss was there a proper understanding of the criterion and can the values be rechecked and input within the range. However, this inquiry was done anonymously and it is impossible to track the individual respondents and make such rechecks. The inconsistency level of these two sub-criteria will alter the outcome in some level, but since the main inconsistency on external respondents is under the limit (0.10), these figures can and will be used for analysis. The detailed consistencies on each criterion are given on the next chapter along with the derived charts.

(Saaty 1994)

## 8 COMPARISON

The data derived from the questionnaire was transferred to priorities which were analyzed and sorted to correspond required specifications. The data will be presented mainly on pie charts due to their suitable nature. The pie structure is built as seen in chart 1, that starting from top position 12 o'clock, the most important factor is presented first, the second most important next and so on. The weight of each criterion is also displayed on the pie chart. The colours do not represent any unified meaning other than to differentiate the criteria from each other within a pie and colour of the criteria can vary from pie to another.

### 8.1 Case Company results

#### 8.1.1 Main criteria, internal

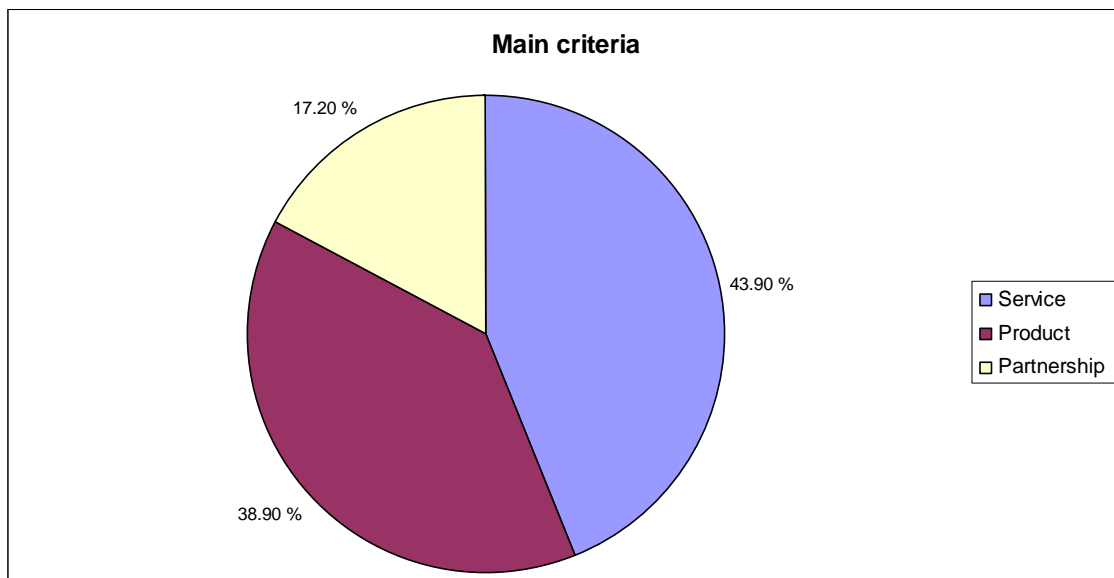


Chart 1 internal main criteria

The main criteria – being the dimensions product, service and partnership – were judged internally in the case company as seen in chart 1 with the total inconsistency of 0.01. The service was seen as the most important criteria with 43.90 % weight from the total. This can be seen as quite natural as the division involved with these systems is structured to be inside the company's service divisions. Also the fact that the offered prod-

ucts are heavily interrelated with services and are quite often also offered as a combined package, can enhance the internal importance of the service dimension. In addition as stated e.g. by Penttinen in chapter 2.2, the service can be seen as a competitive edge or as a portion where the company can take advantage and differentiate itself from its competitors which can give the criterion added weight on the opinions of the respondents. That being said the notably close is the product dimension with weight of 38.90 %. This can also be seen as quite natural result since the core product is the tangible part of the offering and also often the basics and target of the other operations such as service. The partnership was valued as 17.20 % of importance.

### 8.1.2 Product dimension, internal

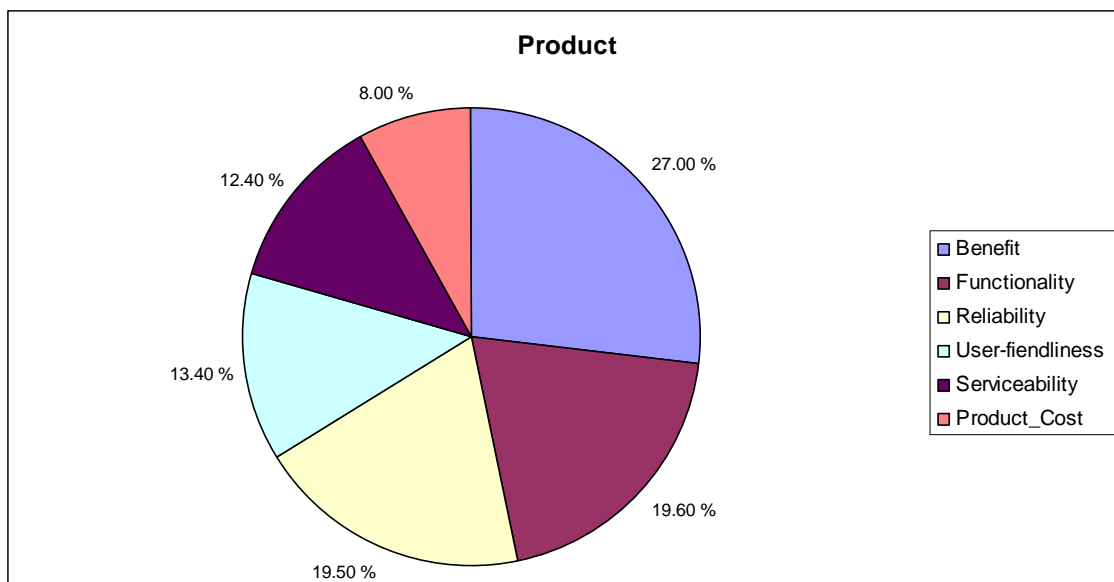


Chart 2 internal product criteria

The sub-criteria of the product were judged as seen in chart 2 with total inconsistency of 0.00972 which is a very consistent value. The benefit was judged clearly the most important criterion with 27 % weight which sounds natural for internal vision of the product criterion. Product must have a reason for its existence and adding value to certain process gives the needed reason. Likewise the high level of functionality and reliability seem sensible since the product must function as planned and solidly to give added value. However, what was somewhat surprising was the weight of the product cost with

only 8.0 % importance. There can be two explanations to this. First the product cost is not seen internally important thus the other features and criteria are more important than the mere cost of the product. Secondly the product cost may among the internal respondents perceived to be on correct level so it will not rise to have any greater importance.

### 8.1.3 Service dimension, internal

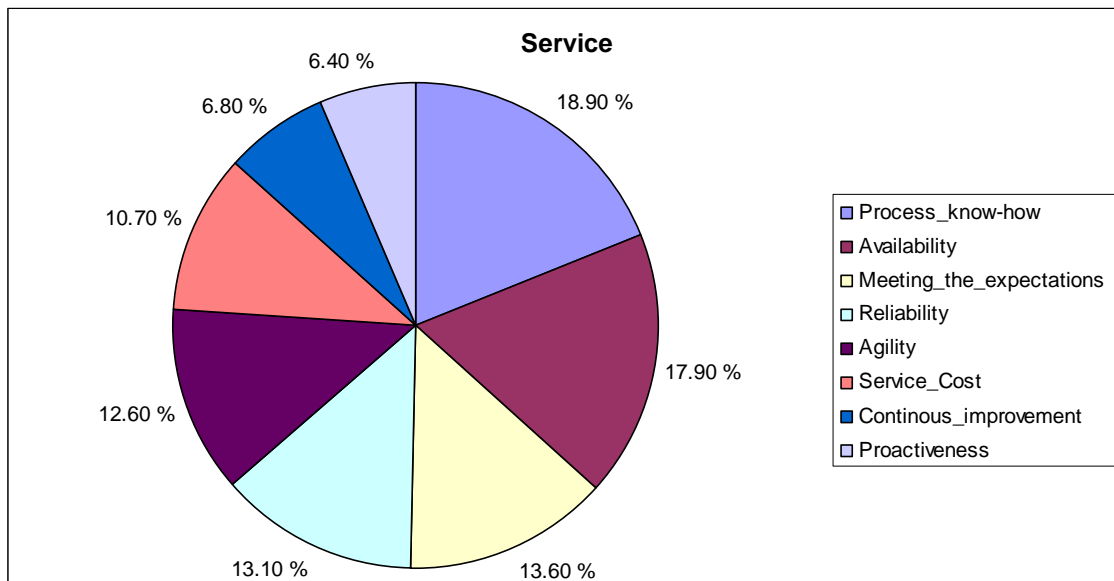


Chart 3 internal service criteria

The sub-criteria of the service dimensions were judged as presented in chart 3 with inconsistency of 0.07. The process know-how and availability bears a similar significance with weights of 18.90 % and 17.90 % which again seems quite natural since in order to perform the service tasks personnel must have sufficient know-how, time and other resources to do it. Meeting the expectations and reliability can be seen as a next important group with similar weights of 13%. These two cover the aspect of functioning service operations and it is quite natural that they are seen internally as a tool of competence. The low level of continuous improvement and proactiveness can bear some significance. One possible explanation for the continuous improvement is that the standard of performed service task at the moment is seen to be in such good level, where the improvement does not play more significant role at the moment. But what can be seen after a fashion surprising is the level of proactiveness. Internal respondents have judged the tasks done proactiveness with active problem solving to be the most insignificant

area of the service albeit the vision of competitive edge of the future service work is often stated to be on proactive tasks. One explanation could be that there is more issues open on other criteria and therefore the criteria is not seen as important. Other rationalization can be that the level of performing the service task is sufficiently proactive and this criterion isn't perceived to be any issue.

#### 8.1.4 Partnership dimension, internal

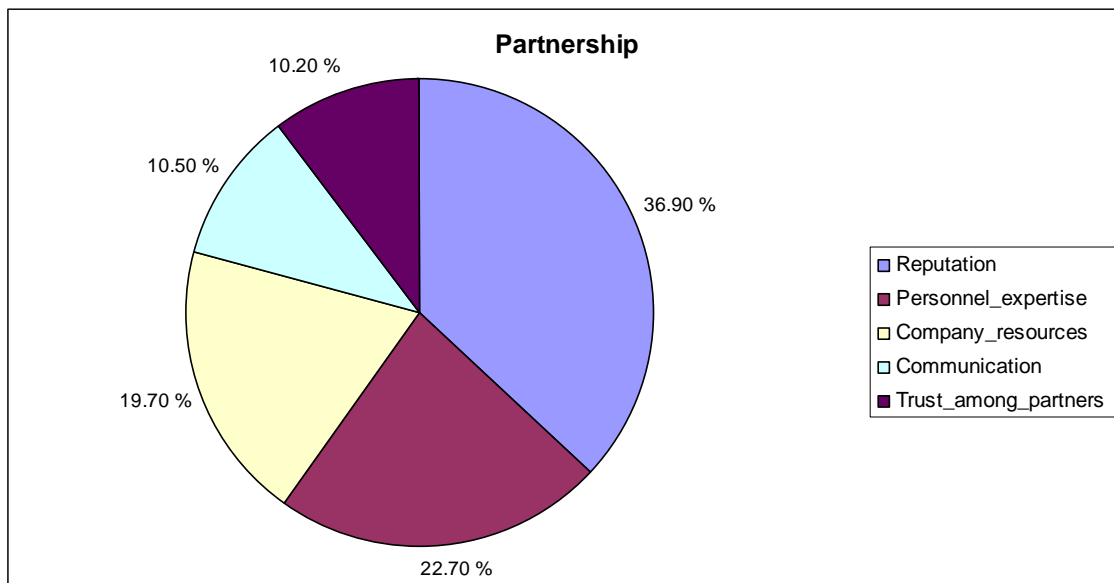


Chart 4 internal partnership criteria

The sub-criteria of the partnership were judged as seen in chart 4 with total inconsistency of 0.06. With 36.90 % of significance the reputation was weighted clearly the most important criterion. The interesting feature is that the trust among the partners was judged as least important criterion with 10.20 % share. This feature can be seen so that it is more important to gain and maintain a solid reputation in the market than pursuit the trust among customers directly. The reputation acts as certificate to customers and the individual trust is developed when interacting with customers.

## 8.2 Customer inquiry results

### 8.2.1 Main criteria, customer

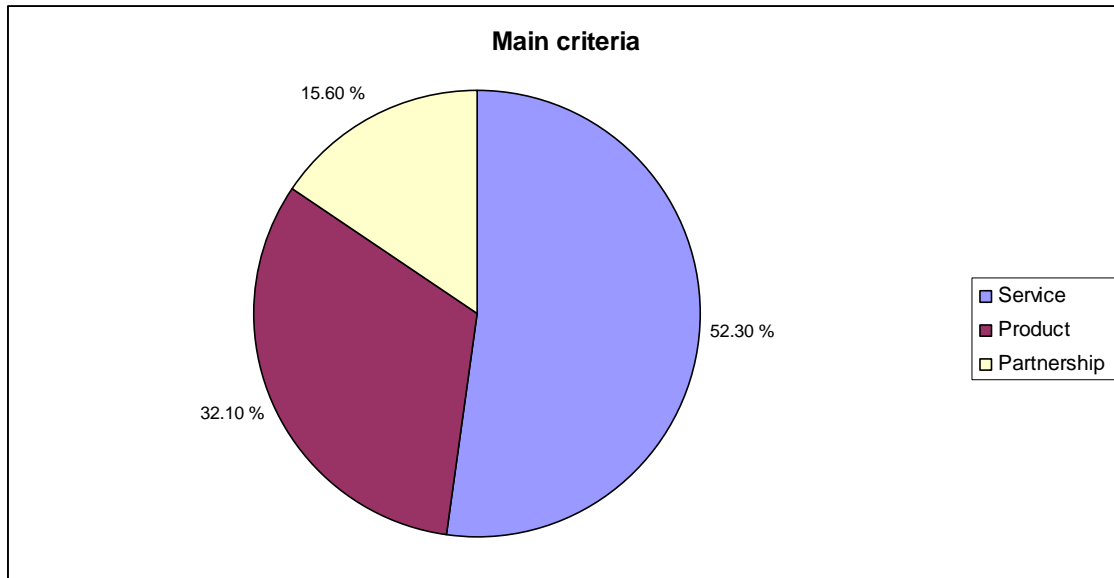
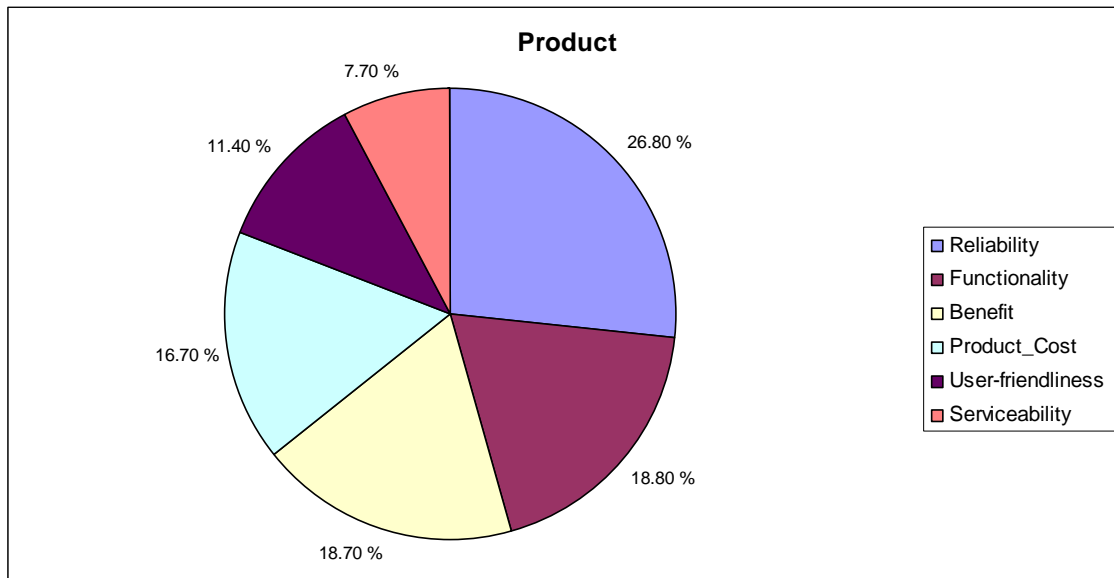


Chart 5 customer main criteria

The customer main criteria presented in chart 5 had an inconsistency of 0.10. Similar to internal criteria, the most important main criteria for customers was service dimension with 52.30 % significance, while product dimension had 32.10 % and partnership 15.90%. The distribution of the importance of the criteria corresponds quite well with the internal view. The analysis can be made that the main emphasis between offering dimensions is seen correctly on case company. Thus with the market and products in question the service operations should bear half of all the actions to be made to correspond this.



### 8.2.2 Product dimension, customer



**Chart 6 customer product criteria**

The sub-criteria of the product dimension criteria are displayed on chart 6 with inconsistency of 0.16. The customers judged the importance of the criteria slightly differently compared to the case company such as judging the reliability with 26.80 % weight as the most important criterion while the case company had the benefit top ranked. However, one must note that both parties have judged the reliability, functionality and benefit as the three most important criteria with combined importance of over 60 % of the total weight. The other notable matter is that the criterion product cost has the widest gap between the groups. The customers judge the product cost as fourth with 16.70 % of importance while the case company has it last with 8 %. This feature can result of separate way of thinking. While customers tend to perceive the price as an important criterion, the provider may focus themselves more on the benefit aspects and explaining the higher cost level with better benefits towards the customer. However the customers' point of view should be taken into account especially if there are any unsolved issues on other criteria which may have an effect on particular criterion such as product cost.

It must be noted, however, that the inconsistency within this criterion was above the limit and it may distort the outcome on some extent and these figures must be used with caution. Should there be more judgement from the customer, the inconsistency caused

from some sub-criterion judging such as on reliability and product cost, should abate and settle to acceptable level. The presumption naturally is that there is a common opinion of these matters within the customer base. Should there be continuation of the inconsistency after receiving more data, the customers' way of thinking differs too much for general analysis. Then the data received from the customer should be put under group analysis, sorted and analyzed accordingly. And contradiction to this inquiry, the mentioned procedure would require somewhat non-anonymous inquiry.

### 8.2.3 Service dimension, customer

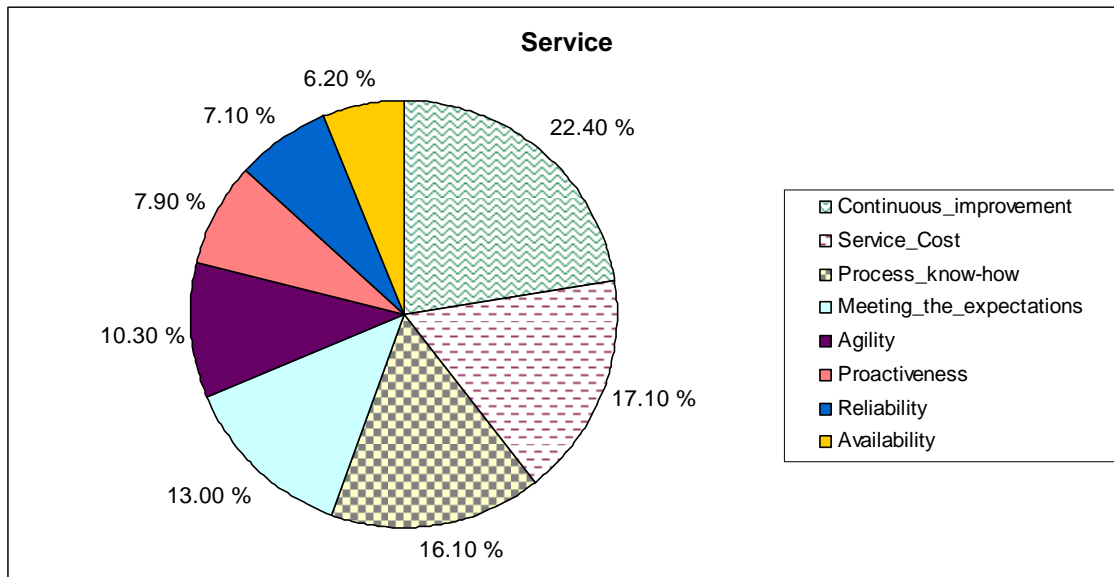


Chart 7 customer service criteria

The customers' sub-criteria of service dimension judging are seen on chart 7. The inconsistency within these sub-criteria was 0.07 which is well within the acceptance limit. These criteria have the most differences between customer and case company point of views. The customer have judged the continuous improvement to be the most important criterion with 22.40 % weight while the case company perceived the same criterion second lowest with weight 6.80 %. The explanations to the gap can be the different point of view to the matter. Where customer sees the continuous improvement of the service as a way to get better and smoother operations and thus more value for their money, the case company perceives themselves to be on the vanguard of improved operations and thus the importance is not seen as critically importance. This conclusion is backed also

by the weight of the process know-how which was the most important criterion according to the case company.

The second most important criterion with 17.10 % weight was service cost. There is a big difference compared to the case company result of 10.70 % and being sixth of the eight criteria. This can also be an outcome of different mind set. Customer perceives the service cost as driver when making decisions and the criterion will play thus significant role on way of thinking whereas the case company may see that the cost level is minor issue compared to the outcome of the processes and the benefits it creates. Both parties value the process know-how quite high which can implicate that even e.g. the cost level is playing important role, the actual input into service processes is appreciated as well.

The criteria weighted as insignificant have also some major differences compared to the case company. With the weight of 6.20 % the availability was judged as least significant criterion whereas in case company the availability was seen as the second most important criterion. The customer value is somewhat surprising since the theories are heavily stating that in order to compete successfully, the organization needs to stay available in times of customer needs. This reasoning is also seen on case company weighting. One possible explanation to the issue can be that the customers taking part on this inquiry are receiving so well organized and scheduled service from all of their service providers that the issue of unavailability hasn't risen to be any major issue. Thus all competitors of the case company can provide the sufficient service in time of need.

Also the criterion reliability is weighted by customers rather low with value of 7.10 %. The weighting seems to be systematic and not a criterion mix up since the similar criterion meeting the expectations was weighted also quite low with value of 13.00 % The customers tend to implicate that the service reliability doesn't play almost any role in their decision making which is, at least to some extend, surprising. Or then again the explanation can be that the services the customers are receiving are all at the level where these criteria do not come up as a diminishing factor. These two criteria should be however put into more detailed examination and verified also from another data survey.

### 8.2.4 Partnership dimension, customer

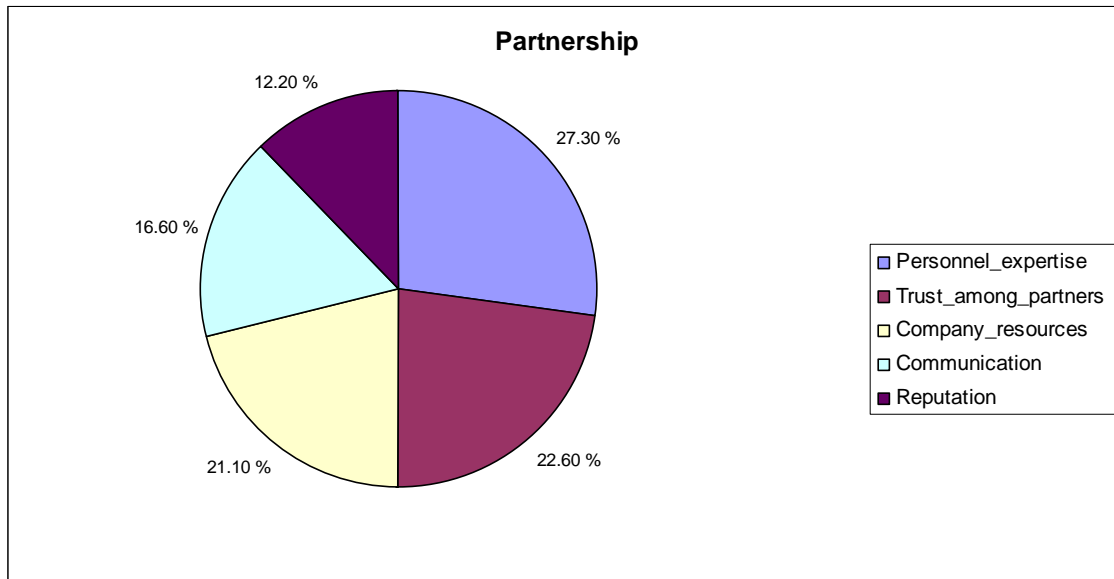


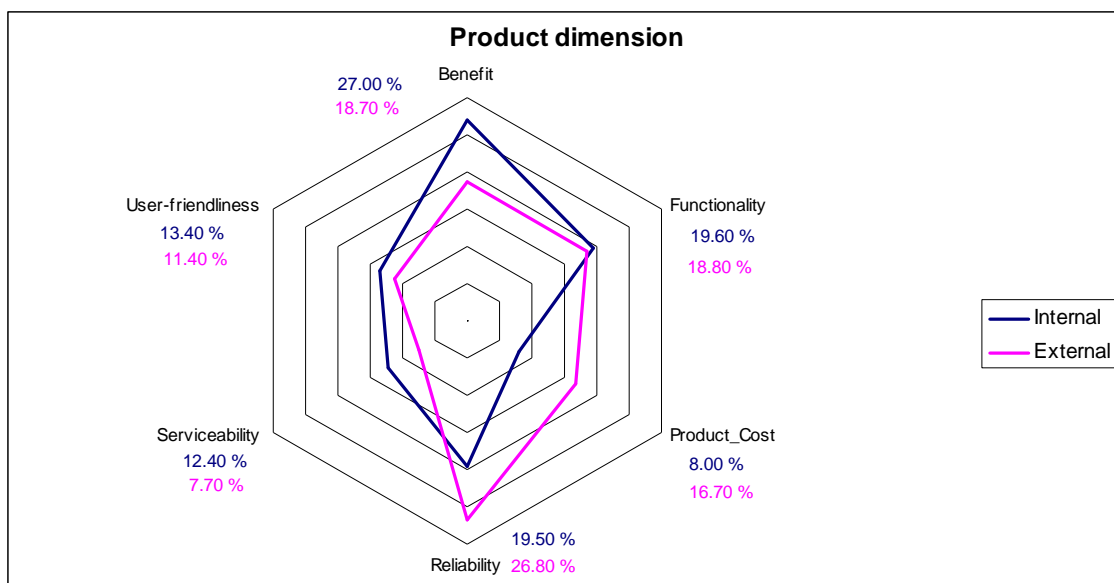
Chart 8 customer partnership criteria

The sub-criteria of partnership dimension with inconsistency of 0.11 are shown on chart 8. The criteria judged can roughly be divided on two main groups where personnel expertise, trust among partners and company resources are seen as an important criterion and communication plus reputation less important. Again there is a major differences compared to the case company. Where customers judged the trust among partners as second with 22.60 % weight, the case company had the same criterion as last with 10.60 % weight. The issue might be linked to other criterion, reputation, which was ranked by customers last with 12.20 % of weight whereas the case company ranked the same criterion clearly most important with weight of 36.90 %. With these two criteria, a channeling effect might be occurring. The customers see the trust as an important factor in partnership dimension and thus creation. This is quite logical and is in accordance with e.g. the value space theory by Mittal et al. Thus in order to develop beneficial relationship there must be a mutual trust and respect between parties. However, the case company replies indicate, that the respondents may have a point of view that the reputation of the company acts as a certificate towards the customers that the company itself is a trusted partner and that the individual trust is formed when interacting with the customers.

Both parties see the personnel expertise as an important criterion and the customers as the most important. As far as the partnership dimension is concerned the criterion is quite naturally seen among the vital criteria. The know-how of the processes in question and the ability to discuss about these matters on the customers knowledge level will be a huge advantage in trust and later partnership creation.

### 8.3 Query conclusions

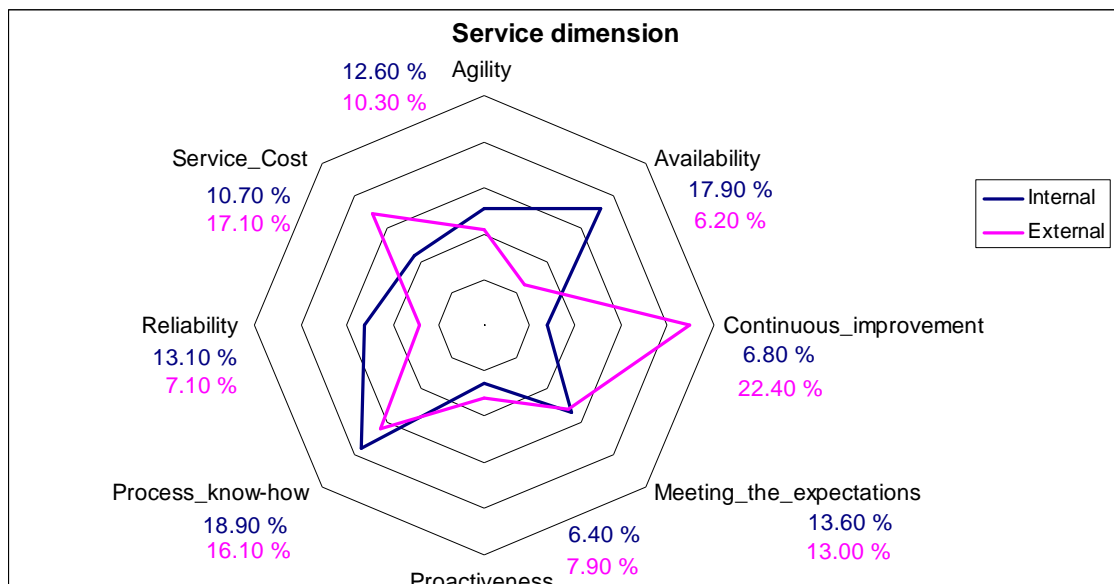
The discussed criteria data was combined to radar charts shown in charts 9, 10 and 11. The radar chart type was chosen for pointing out and summarizing the differences on case company and customer replies. Should the radar area be congruent the offering dimension criteria are seen similarly both by case company and by the customers. The differences on their behalf form a dissimilar shape and the emphasis can be viewed and evaluated accordingly.



**Chart 9 combined product dimension criteria**

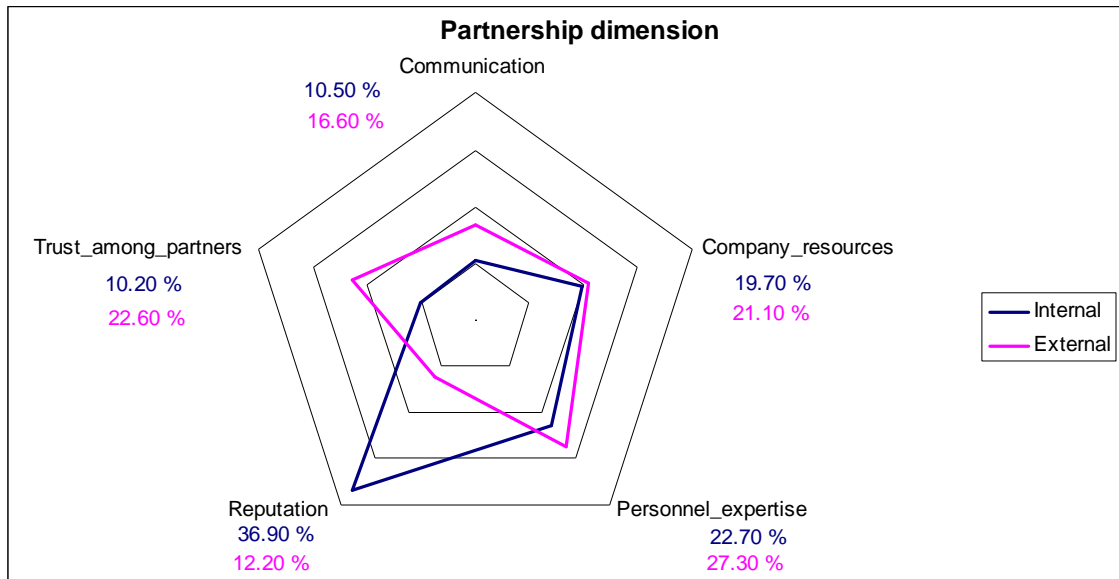
As can be seen on product dimension criteria on chart 9, the customers emphasize more the reliability and the cost of the product than the case company whereas the case company tends to focus more on benefit and serviceability. So when planning the products is question, the case company should be aware that it is able to unquestionably turn the

focus from direct product cost to the benefits the product is providing. If this fails the danger is that the customers will keep the product cost as a decision driver and the target costing of the product offered is too high. The criterion reliability should be considered from customer's point of view. The reliability of the products should systematically meet the demands of the customer. The challenge is that the reliability standards can vary significantly between customers; some customers can accept or even praise the level that another will keep totally unacceptable. So finding the correct level can be both problematic and time-consuming since the product standards are defined in design phase.



**Chart 10 combined service dimension criteria**

As discussed in chapter 8.2.3, the service dimension had major differences in weighting the criteria. Also on the customers' weighting the inconsistency was above the limit. As discussed in chapter 8.2 and displayed in chart 10, the main issues for the customers are the continuous improvement and the cost of the service. On these criteria the case company had notably lower significance value whereas on availability and reliability criteria the weighting was vice versa thus in order to provide the optimum offering the case company should check whether the service cost level is at the correct level and is the degree of provided availability over-appreciated. See also the analysis for the competitors' comparison on chapter 9 regarding this matter.

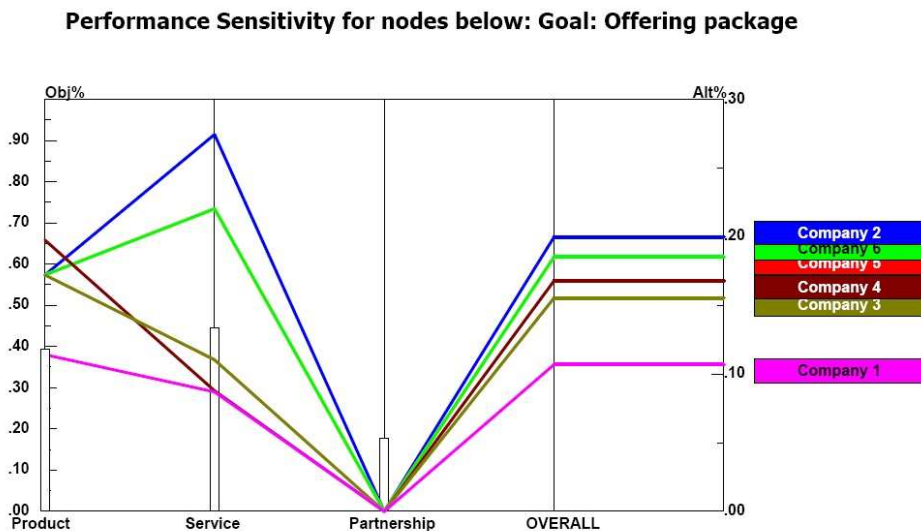


**Chart 11 combined partnership dimension criteria**

The main difference between the case company and customers judgement was the weighting of trust among partners and reputation. As discussed in chapter 8.2.4, the difference may result from different perspective and internalization of the matter. The case company can however, pay attention to performing as promised and to increase the factors that assists the creation of trust between parties. As Mittal et al. stated in chapter 2.3, this must be done in steps and within long period of time and the case company should assure that the communication with the customer is in adequate level since it is earlier step in personalization expander. Otherwise the criteria concerning the partnership dimension was rather coherent between parties.

## 9 COMPETITORS COMPARISON

While in the first part of the questionnaire was to define, judge and weight the criteria used, the second part was the comparison between the case company and the main competitors. The judging was done between six companies which operate in the business area in question. The names of the companies were the actual brand name in the questionnaire but are coded in the thesis for competition reasons. The comparison was made in similar fashion than the judgement of the criteria thus pairwise comparison with differences explained on chapter 6.2. The competitors comparison was done both by internally in the case company and by customers.

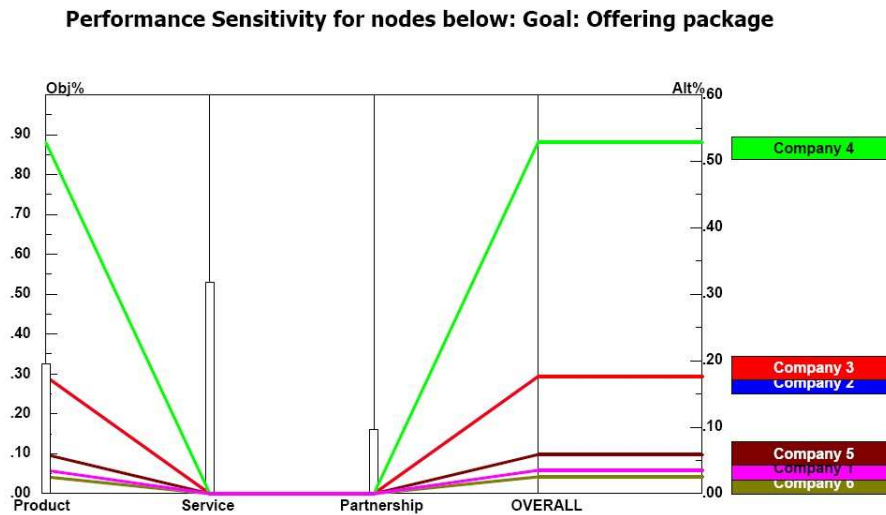


**Figure 18 case company judging**

The case company judged the companies to have the most suitable offering package and thus the most desirable option for the customer as seen in figure 18. On different sub-criteria level the preferable company changes in different criteria. For example the case company judged the company 4 to have most suitable product related offering whereas the company 2 had clearly the best service offering model. It is also notable that the partnership dimension was seen to be equally effective in all companies so according to the case company it wouldn't give any company leading edge. One must also keep in mind the weighting of the criteria themselves. As seen also in chart 1, the service dimension criterion was the most important criterion with weight of 43.90 %. This taken



into account and since company 4 was judged as a third best option in the service dimension, the best total offering package according to the case company is provided by company 2.



**Figure 19 customer alternatives judging**

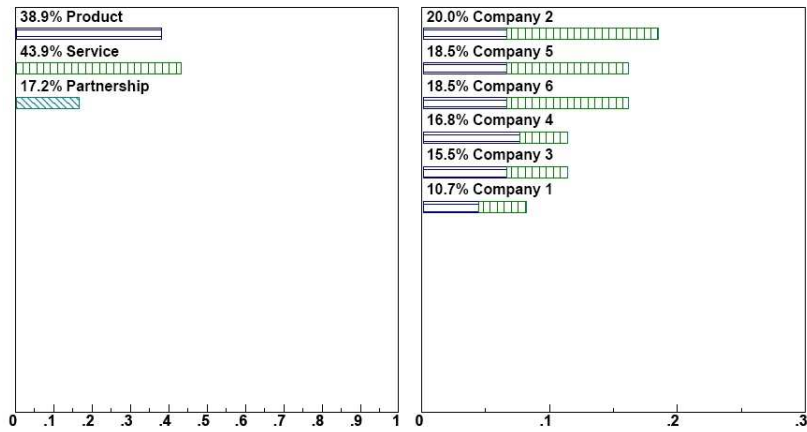
However, the customers ranked the companies in totally different fashion. First, the variance between results is greater within criteria thus the customers have judged the attractiveness of the companies with deeper scale. Secondly the judgements differ from the case company judgements not only by the ranking but also the emphasis. As displayed in figure 19, the three criteria were given similar emphasis thus service being the most important and so on than the case company but the customers judged the competitive edge of the companies differently. The customers estimated similarly that there was no distinguishable competitive advantage on partnership dimension but also that within service dimension no real advantageous position is gained by any of the companies. This fact leads to the point that only differentiation is done by product dimension factors.

### 9.1 The company compare

Within customers' product dimension judging the variance between different companies was quite high compared to the case company insight as displayed in figures 20 and 21. While case company judged three companies, company 2, 5 and 6 to have almost simi-

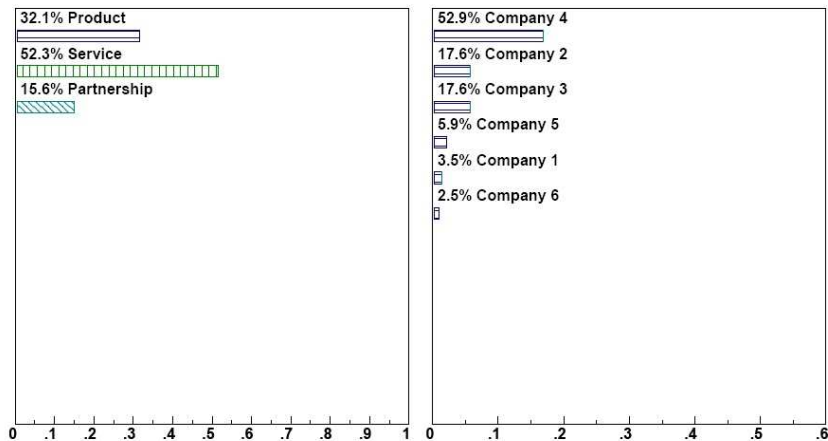
lar competitive factors, the customers weighted the companies significantly differently. If the consideration is focused only on product dimension, the case company judged company 4 as having the leading edge, followed by companies 2, 5, 6 and 3 with equal outcome. The customers weighted the company 4 to have a significant competitive edge with three times more beneficial product offering than companies 2 and 3. This taken into account with the fact that opposite to the case company, customers didn't give any companies any advantage on other two offering dimensions, it is quite obvious that company 4 received significant competitive edge on total product offering package.

**Dynamic Sensitivity for nodes below: Goal: Offering package**



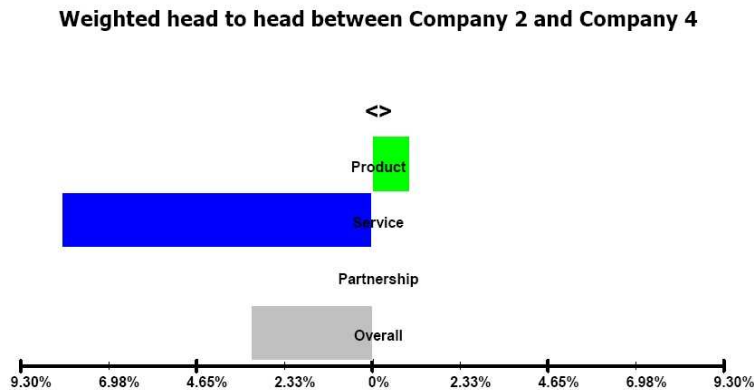
**Figure 20 case company results**

**Dynamic Sensitivity for nodes below: Goal: Offering package**

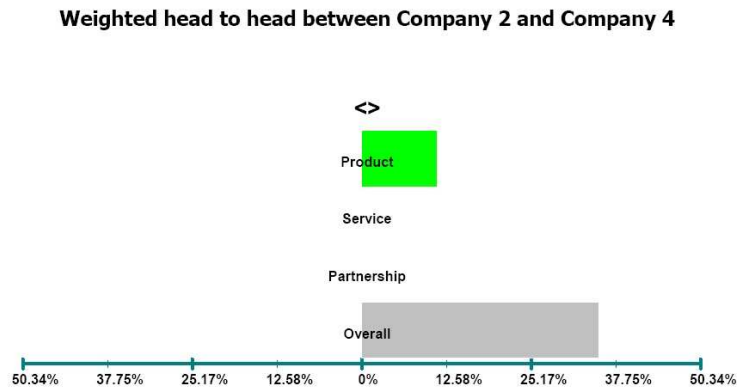


**Figure 21 customer results**

## 9.2 Pairwise comparison



**Figure 22 Case company weighting**



**Figure 23 Customer weighting**

When comparing pairwise the company 2 which was judged as having the best total offering package by case company and company 4 which gained similar status from the customer, the factor mentioned earlier can be seen clearly. While both respondent groups stated that on the product dimension the company 4 has the advantage, the service dimension is the deciding factor. Even though the customers judged the service dimension as the most important, there are no distinguished differences between companies in question. This can be again a case of standard acceptance level of expected and performed service operations thus every company providing the service will exceed the acceptance level, but none is really using service as value expander or the customer doesn't value the more comprehensive service operations on this business area and with products in question. The latter is somewhat in contradiction to the customers' sub-criteria judgements on the service dimension where continuous improvement was

judged as the most important criterion. The phenomenon may be derived back to the statement made by Sipilä on chapter 3.3 on service offering paradox where customer is expecting customized and ample services but isn't willing to pay for them and thus the focus is shifted to cost level of the product dimension. If this case is in effect it would be quite hard to compete with service dimension factors if the product dimension factors are unbeneficial to the company.

## 10 OPEN QUESTIONS

The last part of the questionnaire was five open questions. The amount of these questions was intentionally kept in minimum so that they would be easy to answer and also that the main focus stayed on the AHP-questionnaire. The questions were formulated so that they could both enlighten the background of the customer way of thinking and give the respondents the forum to formulate their thoughts to longer, more specified answers. The questions consist of;

- What the case company should do to be/to stay as first choice?
- What areas of operations are functioning best?
- Which areas require improvement? On which part?
- Is the case company offering the process optimization with adequate product range?
- Other comments on automation products offered by the case company.

Due to the fact that some of the answers contained information which are business sensitive and may reveal some of the competitive edge issues, the open questions are handled in this thesis briefly and essentially.

### **10.1.1 Major findings from open questions**

The major findings include the customers seeing room for improvement both on service dimension and on product dimension related issues. As far as the service dimension is concerned, the insight was that the case company needs more resources on this business especially within two areas. First on service operations and secondly on project management. The respondents were concerned, that in case of emergency the customers can be served within acceptable time-frame with sufficient scope. Some replies indicate that the solving of open issues will take too long even they are started with quite good reaction time. Some of the respondents were also worried that the agreed projects cannot be conducted as promised within time-frame and cost level because the resources are scattered around and with the global business in question the management is stretched around the globe with minimal country presence. These issues are contradiction to the criterion judgement where customers stated that the availability was not very important

factor for service dimension and should be affecting to the case company judging towards to the other providing companies. Other analysis would be that all providing companies are facing similar issues and the resource issues are not catastrophically bad on any company. The knowledge transfer was also seen challenging and more education plus additional educative updates would be hoped for and appreciated.

Customers also had an opinion that upper level automation features are not functioning optimally and that compared to the competitors are less attractive alternative. The optimization products and tools were in some extend seen to be outdated especially concerning the guidance techniques. The software and the interface with the operations systems of the mill were stated to have issues and inoperativeness in certain positions. The questions of how well the software and its output interfaces have been tested were also present. Some of the abovementioned critic is raised from the occasional reliability problems, when unexpected issues shut down the operations. These replies are coherent with product criteria weighting where the customers judged the reliability as their most important feature.

Certain automation products were seen to have a competitive edge towards competitors, but some of the respondents pointed out that the products in question have still some teething problems to be solved before wider acceptance on the market. Some replies also indicate that the cost level of the case company is seen to be higher than the main competitors especially on service operations. Some customers also did not see the added value in the service agreements, but forced partnership during the agreement period. These can also be seen quite logical since the customers weighted the product cost to have clear significance.

## 11 RECOMMENDED ACTIONS

The survey exposed some issues that are in unoptimized state or are having features that can hinder the smooth business operations. The main issues can be divided into two main categories; the issues related to product and its features such as software and the data transfer protocols and issues related to the service and management actions for the customers. For the recommended actions the AHP-survey data acts as an underlying foundation from where the data received from open question and direct customer feedback is based.

### *11.1 Product*

The customers valued the reliability of the product the most critical product dimension factor and both competitors' comparison and open questions revealed that the products of the case company are not the most reliable ones. Most of the hindering factors arise from the software related issues involved with the products. To ensure the maximum reliability of the software the functioning of the core algorithms and system hierarchy must be verified. These issues must be solved and verified by testing the whole system beforehand thus certain testing protocol should be founded and implemented. The issue may also require freezing of the tested operational software to certain features. The later upgrading should be implemented via sufficient testing procedure ergo the protocol of regression testing.

The other factor hindering the reliability is the connection protocol issues. In some mills the linking to the main automation system causes the data transfer problems. Most of the cases the data is not retrieved by the receiving software. The problem is occurring mainly on targets where OLE for Process Control (OPC) standards is used. The wide variety of available specifications within OPC creates a possibility and risk of mismatch and non-functioning when linking together software with slightly different hierarchy. The OPC alternatives should also be put under sufficient test and should be frozen to certain working choices or technical protocol should be implemented in a way that cer-

tain output types are guaranteed to the customer. Should there be deviation to this, these cases must be handled and invoiced separately with required reprogramming.

The accurate functioning of the products themselves must be ensured by maximizing the rigidity and solidness of the core product. The impact of disturbance factors should be reviewed and mitigated by careful product planning. In some areas of application the data gathered or the process controlled contains lot of variability both in conditions and process features. This is especially the case when dealing with the process input that are taken by measuring the emission levels. The disturbance in emission levels by operations themselves and by other measuring points are fairly well mitigated at the moment, but the secondary features e.g. bearing condition variances confuses the primary measurement. The increasing of the amplitude causes the loss of resolution power and should the intensity be adjusted accordingly, the resolution scale is not sufficient. The optimization of the proper data gathering must be secured by re-evaluating the data gathering points and gathered information. Also the business model thus what features are measured with particular settings should be defined. Should the customer also require additional measurements, the additional measuring tools are installed and perhaps sold separately.

Since the customer seemed to value significantly the cost level issues of the product, the marketing strategy of the products in question should be evaluated. Are the shown and guaranteed benefits exceeding the price level factors and customer is accepting the higher purchase price or is the product designed with excessive cost level? Also the profit level of the products should be checked against competition and competitors' solutions since some of the customers claimed that the products of the case company are priced as premium but the received quality is average.



## 11.2 Service

Since the service operations were seen to be the most important criteria of the offering package, but none of the service providers gained any advantage on these criteria, a review should be done, is there any possibility to gain competitive edge from enhanced service operations. As some respondents stated the excellent service on the other products offered by the case company has been the deciding factor why the company is chosen even the product hasn't been the principal choice. But as discussed in the chapter 9 the level of service provided by all the providers tends to be at least on adequate level so the advantage can be hard to achieve. The valuation of service dimension was on the continuous improvement and on the service cost, so being able to provide slightly more comprehensive or more value adding service operations might give the advantage. The possible options may include the widening of the service to cover the remote diagnostic services, on-line adjustment of the process measurements or the utilization of the process know-how to the process adjustment. One particular feature would be the utilization of process data for the life-cycle management in the woodyard equipment and processes such as knife change interval for the chippers.

Price level competition is other way to gain the edge and some advantage may be achievable from global presence. The travelling cost and the time consumption will localize the service resources significantly, but regionally the combined service tasks may produce savings especially with the service specialists. However, in order to serve the customers properly and right-timed, the local presence is needed even though the level of availability must be checked. Since there was a contradiction on customers' AHP valuation and between open questions replies concerning this matter, it needs further investigation

The service resource should also be evaluated. Some replies indicate that there might be a risk in current resource arrangement. The main concern is two-sided. First, the insight was that some of the specialists are in such great usage that it is hard to have them in the time of need. Also when these people are unavailable e.g. on vacation, the proficient substitutes are virtually non-existent. Some of these specialists are also working via subcontractor, so the knowledge base within the case company is limited. Secondly, the

insight was that the management is stretched to handle too many issues and cannot always act properly on the managerial issues. This includes the business negotiations with the customers and project handling. However, the contradiction mentioned in previous section relates also on this matter and should be investigated further.

The recommendation is that the resources should be checked, evaluated and if necessary adjusted. Together with the abovementioned process the knowledge transfer and preservation plan should be made to ensure the existence of sufficient knowledge base within the case company. Also with the sufficient resource, the focus can be transferred more on well planned service operations and on proactive operations which was pointed out and desired on some open question replies.

## 12 CONCLUSION

The outcome of the survey performed was elaborate. On the other hand the amount of replies received from the customer base was disappointing and some of the replies given were inconsistent thus lowering the validity of the questionnaire. On the other hand large amount of useful information was received and the survey revealed some major and unexpected discrepancies on which criteria the different parties' value. Also the comparison between the main competitors among these criteria provided vital information on how to compete and improve the performance of the case company towards its customers. The AHP was a new method both to the respondents of the case company and to the customers as well. It received interest and the easiness of reply was acknowledged even though some respondents stated that the novelty nature of the method might cause resistance towards the query. With the more familiar query form one wouldn't need to read the instructions but directly fill in the form.

The relatively small sampling and the narrow regional presence on customer answers would suggest that some of the issues found in this thesis should be evaluated, reformulated and re-enquired with another survey. First, the service dimension issues and criteria should be re-evaluated, adjusted and perhaps defined in more detail in order to solve the inconsistency risen from customers' replies. The fact supporting the illogical factors in some replies is the findings of the open questions, so if possible, the next survey should be done as Saaty describes the optimum approach with direct interaction with the customer. This gives the opportunity to discover immediately if the replies of particular respondent possess inconsistency and can be adjusted accordingly as described in chapter 5.1.2. Secondly some of the points of views are quite heavily region related so some of the criteria may vary significantly when the replies cover wider regional area. The questionnaire was sent to certain regions such as Central Europe and South America but the response rate from these was zero so in order to have a global picture on the offering, the region data should be retrieved by additional survey. On its current form the survey covers the Nordic countries and the outcome cannot be extended to cover whole business.

On the other hand the data received both from AHP-model and from open questions and direct feedback provided useful and vital information on what issues are not functioning optimally or are having risk potential included in current way of operating. As far as the obtained results are concerned, the main issues noticed are that the product may require actions concerning its reliability and the service had issues with cost level and resources.

The product dimension was weighted to be the second most important criteria by both parties. Within the dimension the sub-criteria were weighted differently since the case company emphasized the benefit and functionality whereas the customers weighted the reliability and product cost as prime criteria. The customers' requirement of reliability arises more on the software basis issues but some concern was also on the direct technical features and fundamentals of the product and its suitability to certain processes. Also some indications were received that the cost level of the product is seen rather high since the shown benefits are not exceeding the investment.

The service dimension was stated by both parties as the most important dimension but the weighting within the dimension varied significantly. While the case company saw the process know-how and availability as the leading criteria, the customers weighted the continuous improvement and service cost as the most important ones. For the service dimension issues the main stress was on the resource allocation and the cost of the services. There was contradiction in AHP-model weighting and open question replies concerning this matter and it is recommended that this contradiction is investigated more profoundly with additional survey.

When comparing the case company to its competitors, it was discovered that the customers valued the service and partnership dimension packages as equally competitive and the differences comes from the product dimension factors. The customers taking part to this survey weighted one particular company to have a significant competitive edge on product dimension factors and thus for the whole offering package. Two companies followed side by side and the rest were judged close to the same level.

Despite the factors mentioned, the thesis managed to map the criteria useful for the total offering package of the business in question, to define the differences in weighting between the criteria by the case company providing the offering and the customer consuming it. It also measured the case company's offerings to its competitors and pinpointed the factors that are perceived by customers to have room for improvement or adjustment. However, before making the adjustments on offering package the inconsistent weightings and the contradictions should be evaluated and re-examined with possible another survey.

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<http://en.wikipedia.org/wiki/Agility>



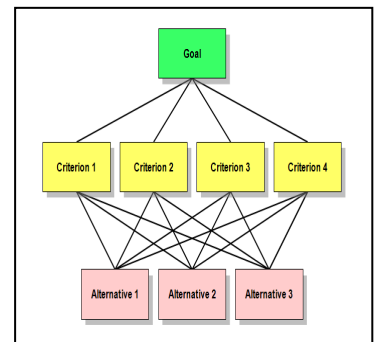
## APPENDIX 1

### Questionnaire instructions

The Analytic Hierarchy Process (AHP) is one of the most famous tools for decision making especially when dealing with multicriteria and multidimensional issues. The rationality and intuitive approach makes the model useful also in cases where objects in question are hard to measure or they contradict towards each others. The core of the AHP is paired comparisons, where each alternative is measured pairwise towards others. The respondent chooses the more important one and defines the magnitude of the margin by using the scale of 1-9. By means of these comparisons weights are calculated for each alternative. The weight is then used to calculate the preference rankings of the alternatives and consistency of the response.

#### I Intensity scale of the alternatives:

- 1 = Two alternative or criteria contribute equally to the objective.
- 2 = *weak*
- 3 = Experience and judgment slightly favor on alternative
- 4 = *moderate*
- 5 = Experience and judgment strongly favor on activity
- 6 = *Strong plus*
- 7 = An alternative is favored very strongly over another.  
The dominance demonstrated in practice
- 8 = *Very, very strong*
- 9 = The evidence favoring one alternative over another is of the highest possible order of affirmation



Pic. 1; Example structure of AHP-model

#### II Questionnaire instructions:

1. Please fill the questionnaire by using above mentioned scale. The whole scale is usable the even values (e.g. 4) being intensifier for the uneven values. Should there be criteria row from which you do not have sufficient knowledge, please feel free to leave the row unmarked.
2. On chapter I please evaluate pairwise the criteria. (e.g. functionality – serviceability) The criteria have been divided in three main class; product, service and partnership related issues. Each class have been coloured.
3. On chapter II please evaluate business operators in your market area by given criteria. Should there be unknown operators, leave the row unmarked.
4. On chapter III are stated five open questions to which you can give your comments. The purpose of these questions is to deepen the questionnaire and to give a forum for respondent to point and focus attention to issues that she/he sees important.
5. The questionnaire is done by purpose in Excel-format to avoid computer system mismatches and to ease the answering procedure. You can fill the questionnaire either electronically by bolding the desired value on each row or by printing and circling the values. Return the questionnaire to [mikko.vaisanen@student.uwasa.fi](mailto:mikko.vaisanen@student.uwasa.fi) or to postal address;

Mikko Väisänen  
Case company Oy  
Street address

## APPENDIX 1

### III Criteria description

#### Product

**Functionality** is covering the aspect of how the product is working. The main criterion is that the product works as planned on operations it was acquired for.

**Reliability** is measuring the reliability of the product output meaning that it gives the data and/or manages the defined process correctly. The criteria cover also the amount of unplanned actions or shut-downs.

**User-friendliness** measures the easiness of usage. Personnel can easily manage the control function of the product and e.g. menus are clear and understandable.

**Benefit** measures is the product giving added value to the process. Weighting factor on this criterion is also that the added value can be measured or is noticed otherwise from the process.

**Product cost** is cost level of the product.

**Serviceability** is covering the easiness of maintenance by two ways. First, the product can be maintained so, that certain parts can be replaced without major shut-downs or without dismantling whole system. Secondly, if required, daily services can also be done by operators than vendor's experts.

#### Service

**Availability** criteria is representing that service provider is available to perform service actions whenever customer needs. One must note that for the 100 % availability ability, the provider should have unused capacity for the unexpected needs.

**Proactiveness** stands for taking active and pre-emptive role thus service provider doesn't just reacts on issues, but proactively seeks solutions to the customers problems. In order to perform proactive work, there must be certain level of trust between parties.

## APPENDIX 1

**Reliability** measures that service provider performs what have been agreed, right timely and right scoped.

**Meeting the expectations** covers the issues that service provider meets or exceeds the need and wishes of the customer concerning the service in question. (Note; Price is not included in this criteria)

**Service Cost** is the cost of the services invoiced separately e.g. additional upgrades, adjustments etc.

**Process know-how** measures service providers' know-how of the products, the systems and also customers' processes.

**Agility** Service providers' ability to adapt quickly on the changed business environment. The agility is combination of knowhow, company culture, flexibility and adaptability.

**Continuous improvement** Service provider seeks to improve its performance constantly. It is an on-going process together with customer.

### Partnership

**Trust among parties** The trust level between business partners. How much business processes are revealed to the partner.

**Communication** The informality of the communication between parties.

**Personnel expertise** stands for the expertise of the supplier's personnel on issues concerning the processes of the customer. The ability to discuss with customer at customer's perspective and at customer's level.

**Company resources** measure the supplier's resources to perform tasks in particular customer. Key account management implementation between parties.

**Reputation** covers supplier's reputation on market.

## APPENDIX 2

### Intensity of importance

- 1 = Two activities or criteria contribute equally to the objective  
 3 = Experience and judgment slightly favor on activity  
 5 = Experience and judgment strongly favor on activity  
 7 = An activity is favored very strongly over another. The dominance demonstrated in practice.  
 9 = The evidence favoring one activity over another is of the highest possible order of affirmation

| Criteria           | 1 Product                   | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Service                  |
|--------------------|-----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--------------------------|
|                    | 2 Product                   | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Partnership              |
|                    | 3 Service                   | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Partnership              |
| <b>Product</b>     | 1 Functionality             | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Reliability              |
|                    | 2 Functionality             | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | User-friendliness        |
|                    | 3 Functionality             | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Benefit                  |
|                    | 4 Functionality             | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Product_Cost             |
|                    | 5 Functionality             | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Serviceability           |
|                    | 6 Reliability               | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | User-friendliness        |
|                    | 7 Reliability               | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Benefit                  |
|                    | 8 Reliability               | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Product_Cost             |
|                    | 9 Reliability               | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Serviceability           |
|                    | 10 User-friendliness        | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Benefit                  |
|                    | 11 User-friendliness        | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Product_Cost             |
|                    | 12 User-friendliness        | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Serviceability           |
|                    | 13 Benefit                  | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Product_Cost             |
|                    | 14 Benefit                  | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Serviceability           |
|                    | 15 Product_Cost             | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Serviceability           |
| <b>Service</b>     | 1 Availability              | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Proactiveness            |
|                    | 2 Availability              | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Reliability              |
|                    | 3 Availability              | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Meeting_the_expectations |
|                    | 4 Availability              | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Service_Cost             |
|                    | 5 Availability              | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Process_know-how         |
|                    | 6 Availability              | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Agility                  |
|                    | 7 Availability              | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Continuous_improvement   |
|                    | 8 Proactiveness             | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Reliability              |
|                    | 9 Proactiveness             | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Meeting_the_expectations |
|                    | 10 Proactiveness            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Service_Cost             |
|                    | 11 Proactiveness            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Process_know-how         |
|                    | 12 Proactiveness            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Agility                  |
|                    | 13 Proactiveness            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Continuous_improvement   |
|                    | 14 Reliability              | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Meeting_the_expectations |
|                    | 15 Reliability              | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Service_Cost             |
|                    | 16 Reliability              | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Process_know-how         |
|                    | 17 Reliability              | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Agility                  |
|                    | 18 Reliability              | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Continuous_improvement   |
|                    | 19 Meeting_the_expectations | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Service_Cost             |
|                    | 20 Meeting_the_expectations | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Process_know-how         |
|                    | 21 Meeting_the_expectations | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Agility                  |
|                    | 22 Meeting_the_expectations | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Continuous_improvement   |
|                    | 23 Service_Cost             | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Process_know-how         |
|                    | 24 Service_Cost             | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Agility                  |
|                    | 25 Service_Cost             | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Continuous_improvement   |
|                    | 26 Process_know-how         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Agility                  |
|                    | 27 Process_know-how         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Continuous_improvement   |
|                    | 28 Agility                  | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Continuous_improvement   |
| <b>Partnership</b> | 1 Trust_among_partners      | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Communication            |
|                    | 2 Trust_among_partners      | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Personnel_expertise      |
|                    | 3 Trust_among_partners      | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company_resources        |
|                    | 4 Trust_among_partners      | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Reputation               |
|                    | 5 Communication             | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Personnel_expertise      |
|                    | 6 Communication             | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company_resources        |
|                    | 7 Communication             | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Reputation               |
|                    | 8 Personnel_expertise       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company_resources        |
|                    | 9 Personnel_expertise       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Reputation               |
|                    | 10 Company_resources        | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Reputation               |

APPENDIX 2

- 1 = Two activities or criteria contribute equally to the objective
- 3 = Experience and judgment slightly favor on activity
- 5 = Experience and judgment strongly favor on activity
- 7 = An activity is favored very strongly over another. The dominance demonstrated in practice.
- 9 = The evidence favoring one activity over another is of the highest possible order of affirmation

**Product related criteria**

| Functionality     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
|-------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------|
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| Reliability       |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| User-friendliness |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| Benefit           |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| Product Cost      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| Serviceability    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2         | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |



## APPENDIX 2

- 1 = Two activities or criteria contribute equally to the objective
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- 7 = An activity is favored very strongly over another. The dominance demonstrated in practice.
- 9 = The evidence favoring one activity over another is of the highest possible order of affirmation

### Service related criteria

| Service related criteria        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
|---------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------|
| <b>Availability</b>             |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| <b>Proactiveness</b>            |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| <b>Reliability</b>              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| <b>Meeting_the_expectations</b> |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| <b>Service_Cost</b>             |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| <b>Process_know-how</b>         |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| <b>Agility</b>                  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| <b>Continuous_improvement</b>   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2                       | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |

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### Partnership related criteria

| Trust among partners |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
|----------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------|
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| Communication        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| Personnel expertise  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| Company resources    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |
| Reputation           |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |           |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 3 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 4 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 5 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 6 |
| Company 2            | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Company 1 |

## APPENDIX 2

### Open Questions

1 What the case company should do to be/to stay as first choice?

2 What areas of operations are functioning best?

3 Which areas require improvement? On which part?

4 Is the case company offering the process optimization with adequate product range?

5 Other comments on automation products offered by the case company