HELSINKI METROPOLIA UNIVERSITY OF APPLIED SCIENCES

Master's Degree in Industrial Management

Master's Thesis

VALUE PROPOSITION FOR SOFTWARE UPGRADE SERVICE OF PATIENT MONITORING SYSTEMS FOR HOSPITALS

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PREFACE

I am excited about this opportunity with this Master's Thesis to step out from my comfort zone located in product engineering into the field of marketing and external customer contacts with a subject that has been challenging to be addressed earlier in the case company. I hope I could deliver a quality outcome and food for thoughts regarding future organizational development to all the internal stakeholders, who suggested me this subject, who have shown great interest to the subject and who contributed to the study by reserving time for interviews and progress review meetings in the organizational environment with continuous hurry.

I gratefully thank the faculty of Helsinki Metropolia University of Applied Sciences for the trust they expressed to me on my capability to progress with my study. I address my special acknowledgement to Marjatta Huhta, who facilitated the thesis writing workshops, for her persistent touch and steering in the writing process. I acknowledge also Jonita Martelius, who checked the language of the study.

Helsinki, May 3, 2010

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ABSTRACT

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This Master's Thesis explores how the service of software upgrades could be offered for medical devices to hospital customers in a value adding, compliant and profitable way. The study utilizes action research method including the diagnosis stage as current state analysis implemented through external customer and case company internal stakeholder questionnaires and internal stakeholder interviews. The planning of action consists of development of a value proposition. The implementation consists of sending the value proposition to external customers focus group for evaluation. The reflection stage relies on the feedback of the external customer focus group on the value proposition. This feedback is evaluated for further improvements of the value proposition. The implementation of the action consists of several organization development suggestions in order to facilitate the value proposition in sustaining, compliant and profitable ways.

The suggestions consist of considerations for introducing well-defined cross-selling culture with the related role of cross-selling manager and cross-selling processes together with fair, reliable and motivating performance metrics and various types of incentives that would satisfy both the device sales organization and service sales and the delivery organization. The study covers the implementation of a customer relationship management system with related program management and related processes for developing identification of prospects and new sales opportunities with the existing customers. Process development suggestions for more predictable software releases are introduced in the study. Special attention is paid to the framework of integrated service innovation that could align various functional organizations to deliver customers total service solutions that would meet customer demand and enable sustainable growth in business.

Key words: Medical device, value proposition, cross-selling, customer relationship management, integrated service innovation

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OPINNÄYTETYÖN TIIVISTELMÄ

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Tämä päättötyö tutkii kuinka lääkinnällisten laitteiden ohjelmistopäivityspalvelu voidaan tarjota sairaala-asiakkaille lisäarvoa tuottavasti, laillisesti ja kannattavasti. Tutkimuksessa käytetään toimintatutkimuksen menetelmää sisältäen diagnoosivaiheen ulkoisten asiakkaiden ja kohdeyhtiön sisäisten sidosryhmien kyselyillä ja kohdeyhtiön sidosryhmien haastatteluilla nykytila-analyysinä. Toiminnan suunnittelu koostuu arvolupauksen kehittämisestä. Arvolupauksen lähettäminen ulkoisten asiakkaiden kohderyhmälle arvioitavaksi on suunnitelman toteutus. Ulkoisten asiakkaiden kohderyhmän palaute muodostaa heijastearviointivaiheen. Tätä palautetta arvioidaan arvolupauksen jatkokehittämiseksi. Toteutus sisältää useita organisaation kehitysehdotuksia, jotta arvolupaus voidaan toteuttaa kestävillä, laillisilla ja kannattavalla tavoilla. Ehdotuksiin sisältyy ajatuksia hyvin määritellyn ristiinmyyntikulttuurin perustamisesta liittyvine ristiinmyyntipäällikön rooleineen ja ristiinmyyntiprosessein sisältäen reilut, luotettavat ja motivoivat suoritusmittarit ja erityyppiset kannustimet, jotka tyydyttävät sekä laitemyyntiorganisaation että palvelumyynti- ja toimitusorganisaatiot. Tutkimus kattaa asiakassuhteiden hallintajärjestelmän toteutuksen hankepäällikköineen ja liittyvät prosessit mahdollisten uusien asiakkaiden ja nykyisten asiakkaiden lisämyyntimahdollisuuksien tunnistamiseksi. Prosessinkehitysehdotuksia paremmin ennustettaviksi ohjelmistojulkaisuiksi esitellään. Erityinen huomio annetaan yhtenäistetyille palveluinnovaatioiden viitekehykselle, joka voi yhdenmukaistaa useat organisaatiot toimittamaan asiakkaille kokonaisvaltaisia palveluratkaisuja, jotka täyttävät asiakastarpeet ja jotka mahdollistavat kestävän liiketoiminnan kasvun.	
Avainsanat: medical device, value proposition, cross-selling, customer relationship management, integrated service innovation	

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ACRONYMS

AM	Asset Management
ASP	Average Selling Price, Application Service Provider
CCU	Cardio Care Unit
CE	Conformité Européenne
CECOR	Calibrate, Explore, Create, Organize and Realize
CRM	Customer Relationship Management
CRNA	Certified Registered Nurse Anesthetist
CSO	Customer Satisfaction Opportunity
CPU	Central Processing Unit
EC	European Community
ECG	Electrocardiogram
eDHR	Electrical Device History Record
EEG	Electroencephalogram
EMEA	Europe, Middle East and Africa
ES	Engineering Services
EU	European Union
FMI	Field Modification Instruction
HW	Hardware
IB	Installed Base
ICU	Intensive Care Unit
ISO	International Organization for Standardization

IB	Installed Base
IT	Information technology
ITIL	IT Infrastructure Library
KPI	Key Performance Indicator
KTQ	Kooperation für Transparenz und Qualität im Krankenhaus
LPI	Lead Program Integrator
LSA	Lead SW Architect
LSD	Lead System Designer
MDD	Medical Device Directive
MS	Microsoft
NMT	Neuromuscular transmission
NPI	New Product Introduction
NPS	Net Promoter Score
OECD	Organisation for Economic Co-operation and Development
OR	Operating Room
P&L	Profit & Loss
PM	Program Manager
RNA	Registered Nurse Anesthetist
RoHS	Restriction of certain Hazardous Substances
S.M.A.R.T.	Specific, measurable, achievable, resultive and time based
SSL	Strategic Service Leader
SW	Software

1 INTRODUCTION

This Master's Thesis examines how the case company specializing in patient monitoring could bring value to the customers in ways of keeping the patient monitoring product software up to date in conformity with relevant regulations. Conformity is referenced to European Union (EU) legislation in this study.

This study also proposes how various organizations within the case company profit & loss (P&L) unit could be organized in accordance to this value proposition.

1.1 Patient Monitoring Products

Patient monitors are used during surgery for monitoring patients' hemodynamic, gas exchange and level of anesthesia conditions. These conditions are acquired by utilizing patient parameters technologies that are connected to the patient either invasively or non-invasively. Such parameters are for example electrocardiogram (ECG), electroencephalogram (EEG), neuromuscular transmission (NMT), temperature, blood pressure, oximetry, spirometry, etc. The patient monitor analyses the data, shows parameters for the anesthesiologist, and provides various kinds of alarms in situations where the patient's changed condition requires immediate attention. Patient monitors are used also in recovery rooms located next to the operation rooms (OR) and where patients spend some time right after surgery before they are transferred to regular bedside treatment departments. In the bedside departments patient monitoring may not be necessary. The methods of use of patient monitors are relatively short-term uses per patient.

Patient monitors are used also in intensive care units (ICU) where patient monitors are attached to the patients on 24/7 bases in order to follow their hemodynamic and gas exchange trends during long-term healthcare processes for patient in life critical states. When the life critical state is over, patients are transferred to regular bedside treatment departments. Also some other specific intensive health care processes, for example in cardio care units (CCU), require so called step down stages where patients spend some time in patient monitoring before they are transferred to regular bedside

treatment departments. In these bedside departments patient monitoring may not be necessary.

Patient having faced accidents on field are also typically in life critical state where monitoring is necessary during transportation in terrain, offshore and air ambulances. There are specific patient monitor models for these on-field uses. In total, patient monitoring solutions can be segmented into five segments:

1. Stationary high end models having the state of art features
2. Transportable middle class models with rich sets of features
3. Transportable value segment models with a basic set of features for cost critical users interested in only basic value
4. Special environment use transportable patient monitors, which physical endurance is enhanced for tolerating rough field environments
5. Patient monitoring information technology (IT) solutions where a server communicates with bedside patient monitors through wired or wireless local area network and stores patient data in a centralized way. There is also central software that enables among the other features health care personnel to monitor all bedside patient monitors remotely for example during nighttime.

Transportable patient monitors can be used during transports between hospital departments or in ambulances. Transportable models typically have factory installed patient parameters that customers have ordered. They are customized assembly to order products. Stationary models are modular and they have plug in unit parameter modules and the actual configuration of monitoring parameter set can be dynamic based on acute needs. These are more of a pick to order kind of products.

1.2 Global Health Care Sector for Patient Monitoring Market

The United States spends approximately 2,5 times more to health care per person than other OECD countries on average. Norway and Switzerland exceed the OECD average by 50 %. Most of the Nordic and western European countries, as well as Canada and Australia spend more than OECD coun-

tries on average. Mexico, Turkey, southern and eastern European countries, Korea and Japan spend less than the OECD countries on average. Public expenditure on health care is typically higher than private expenditure. In the Unites States, where health care goods and services are typically privately funded, public expenditure is higher than in the OECD countries on average. This is due to the high total spending in health care goods and services compared to other OECD countries (OECD 2009: 160 - 161). Public share of health financing was on average 73 % in 2007, but in certain developed countries it can be up to 80 % (OECD 2009: 170 - 171).

Spending on health care has grown by 4,1 % annually on average in the OECD countries between 1997 and 2007. The peak of growth was reached between 2001-02 in many countries. Average economic growth has been 2,6 % between 1997 and 2007. This means that many countries have increased spending on health. In countries such as Ireland and the United Kingdom national policy objectives address public spend on health. In specific Germany increased expenditure only by 1,7 % per year on average, because of their cost-containment program that focuses on better efficiency of expenditure on health (OECD 2009: 160 - 161).

Curative and rehabilitative care accounted to 60 % of the current health care spending on average in the OECD countries, where as expenditure on medical goods, mainly pharmaceuticals, accounted to 21 % on average. Expenditure on long-term care, for example elderly care, varies from 0,4 % to 26 % of expenditure between countries. The average is, however, 12 %. The rest of expenditure is addressed to collective services like health campaigns and programs (OECD 2009: 164 - 165).

Average employment in the health care and social sectors accounted for nearly 10 % of total employment in 2008 in OECD countries. It was less than 9 % in 1995. The share is the highest in the Nordic countries (15 %) and in the Netherlands and the lowest in Turkey and Mexico (3 %). The share has increased on average by 2,8 % per year in nearly all OECD countries between 1995 and 2008. This is two times the average growth rate of total civilian employment. In most countries, for example in Japan, Spain and the United States, the growth rate continued between 2007 and 2008 despite of recession impacting negatively civilian employment. On the other hand, countries such as Czech Republic, Hungary and the Slovak Republic had

declining employment in the health care sector between 2007 and 2008 (OECD 2009: 62 - 63).

Global market for patient monitoring solutions is expected to grow to $8 billion by 2015 with a compound annual growth rate of 3 % from $7 billion in 2008. Control of rising healthcare costs with reduced budgetary spends in developed countries due to economic downturn and patients having lost their jobs making them less affordable to pay for health care services restrain the growth of patient monitoring market. Aging population increases the number of patients and technological advances make remote patient monitoring possible. Hospitals can also deploy patient monitoring solutions across all units with centralized monitoring solutions (Market Research.com 2009).

1.3 Customer and other Stakeholder Network Setup

The customers of the case company are divided into two main segments, which are publicly funded hospitals, such as university hospitals, which procure according to rigorous regulations for public procurement, and private health care service providers, which do not have the constraints of publicly funded organizations. The external stakeholders of the case company have five identified employee segments, which are doctors, nurses, biomeds, procurement professionals and managers.

The case company has two identified internal organizations for contacting customers, namely the sales organization for pre-sales contacts and the service delivery organization for post-market contacts. In addition to these two organizations, also the service engineering organization can be considered as a stakeholder. The service engineering organization designs service methods and tools applicable to each product during product development. The service delivery organization then conducts on field services according to the methods and tools when the product is modified during the service.

1.4 Regulatory Framework Impacting Medical Device Industry

The business of medical devices is highly regulated in order to ensure patient safety. With respect to European Union (EU) market, Medical Device Directive (MDD) regulates products and they are always Conformité Européenne (CE) marked. Medical software alone is a CE marked medical device, thereby the situation is different from that of for instance consumer

electronics, such as cell phones and personal computers, where the CE marking of the device does not include the software. Also other directives and regulations regulate product attributes in a medical device in EU. There are two directives that define the relevant framework of how long-term commitments to maintain installed base product hardware (HW) and software (SW) up to date could be implemented. MDD ensures clinical competence and patient safety of medical hardware or software products, and the restriction of certain hazardous substances (RoHS) restricts the usage of certain substances in electrical and electronic equipment.

1.5 Research Problem and Research Question

There can be as many patient monitors as there are patient beds available in the premises. With remote patient monitoring there may be even more, which means that the number of patient monitors installed in hospitals can be significant. As time elapses, this installed base (IB) can become heterogeneous with respect to software versions of each patient monitor unit. This makes the work more difficult and error prone, as many different versions need to be taken care of. Therefore some hospitals may want to maintain their patient monitors and systems up to date and in homogenous conditions.

The case company is an outcome of several acquisitions and it has had several product range legacies as well as legacy processes and organizations. These legacies have now merged and it is now a good time to consider this kind of value proposition for new products. Also the regulatory framework is going to change significantly with respect to the new more stringent obligatory management of homogeneous HW materials at substance levels placed on the EU market.

The case company understands that customers would like to purchase service where the case company keeps their installed base up to date by upgrading the patient monitor software on already installed hardware. In order to provide this service to the customers, the following research question with sub questions was stated:

- What would be the value proposition for continuous software upgrade service for hospitals in a profitable and value creating way?

- How should roles and responsibilities between sales and service delivery organizations be divided?
- How should roles and responsibilities between service engineering and service delivery organizations be divided?
- How to manage conformity with medical device related regulations when a CE marked product is upgraded in the field?

1.6 Research Design

The research design is based on an action research model. Action research elements utilized in this study contain evaluation of the present status in terms of external customer and internal stakeholder questionnaires, case company internal stakeholder interviews and regulatory study. The planning of an action consists of utilizing common theories applicable to the research question and outlining a draft service concept for the value proposition. Taking the action consists of proposing the draft service concept for the value proposition concerning the medical device SW upgrade service to external customers focus group. The reflection stage of the action consists of an analysis of the external customer focus group pilot feedback. Managerial implications are given in order to develop the case company organizations and processes to support the production of the value proposition. The research design is illustrated in Figure 1.

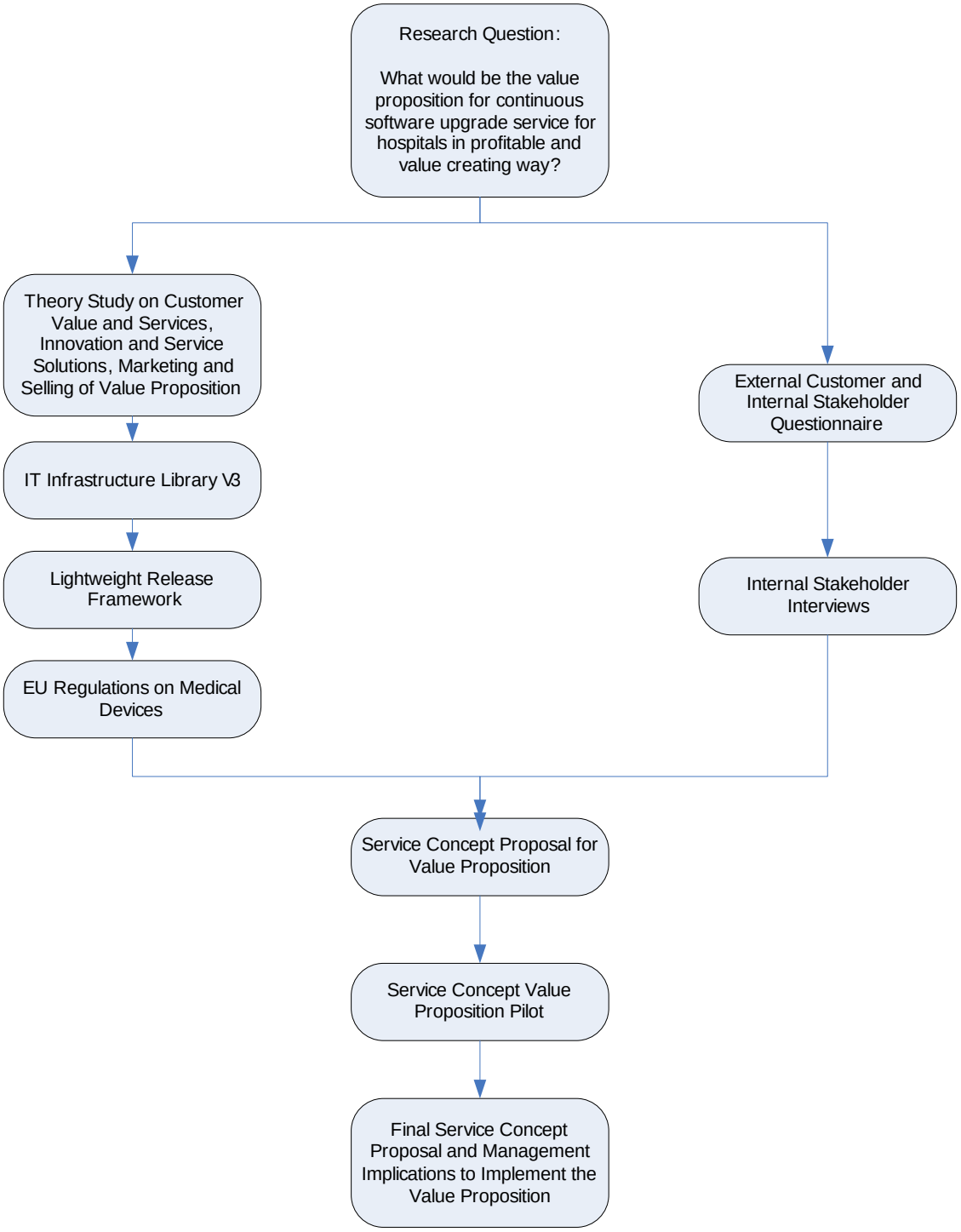

Figure 1. Research Design

The conclusions of this action research study are based on the external customer and internal stakeholder questionnaires, where the questions are based on theories by several authors of business articles and literature. Conclusions are based also on internal stakeholder interviews performed and documented. Literature and regulatory documents are referred to. And

finally the conclusions are based on evaluation outcomes given by the external customers.

This study contributes to provide the case company a proposal to implement a medical device SW upgrade value proposition to offer to its customers. It also suggests how to facilitate the value proposition within the case company.

First the theory of action research method is introduced. At the same time characteristics, features and attributes of the present study are commented within the framework of the action research model. External customer and internal stakeholder questionnaire questions are introduced in reference to the theories from literature. Methods to conduct internal stakeholder small group interviews and external customer focus group pilot are explained next. The methodology section is completed by reliability and validity analysis.

The literature review on theories and best practices is introduced after the methodology section. This is followed by results and analysis of external customer and internal stakeholder questionnaires and internal stakeholder interviews. The value proposition is introduced next and is followed by results and analysis of and conclusions drawn from the external customer focus group pilot. Then managerial implications and suggestions for organizational development are introduced prior wrapping the entire study as contribution in the reflection to the research question.

2 METHOD AND MATERIAL OF THE STUDY

The following sections outline the research methods used in the study. The theory for the overall research method for the present study is based on Costello's theories. The theories for reliability and validity considerations for the study outcome are based on Patton's.

2.1 Action Research

Action research is a practical research method where practitioners or professionals investigate current professional practice and reflect it critically in order to identify problems. Implementing systematic and rigorous enquiry research provides information for issuing an action plan that is supposed to translate findings into practical action to fix the identified problems. Finally action is taken to fix the identified problems. This should instigate a chance (Costello 2003: 11). Action research is an iterative process where taken action is then observed and evaluated for its affectivity. Should there be room for further improvements, successive research is taken in order to outline a new plan for action that is then finally taken (Costello 2003: 1 - 13). The four iterative stages of the action research method, as named by Costello, are shown in Figure 2. Other naming of the four stages exists depending on different sources. For example, observation stage can be called diagnosis stage and acting stage can be called implementation stage.

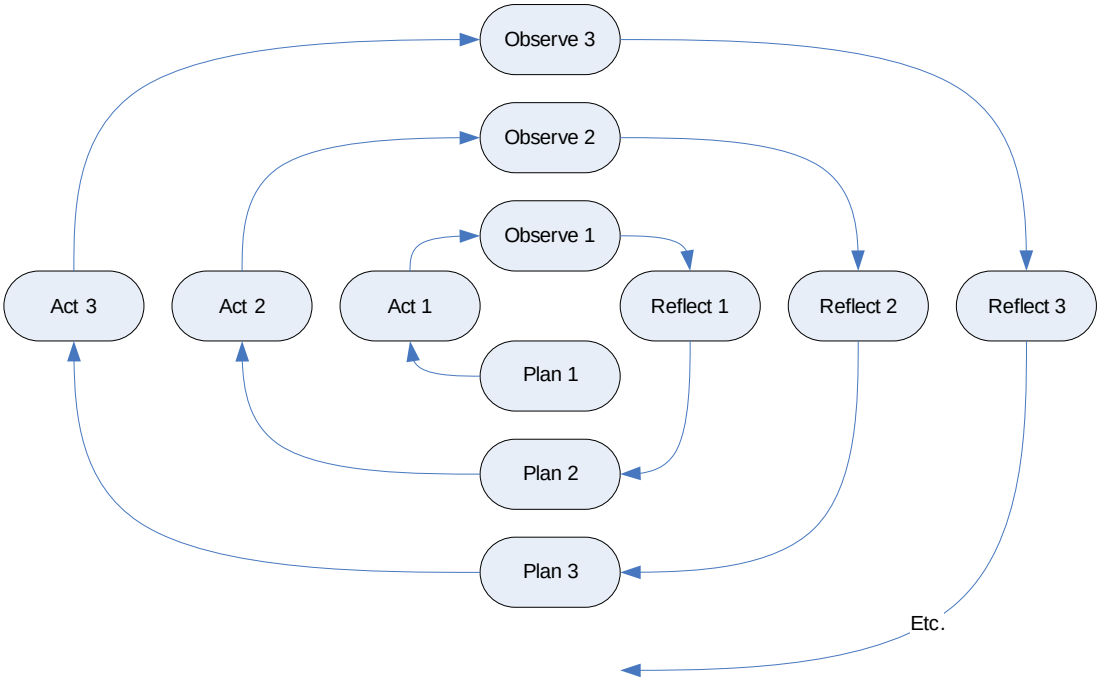

Figure 2. The four iterative stages of Action Research method (Costello 2003: 8)

This study is based on this action research model. The research question establishes the research problem for the study. The observation or diagnosis stage consists of current state analysis with respect to the research question. It was conducted in the forms of external customer questionnaire and internal stakeholder questionnaires and internal stakeholder interviews. The objectives are to understand what kinds of expectations and demands external customers have on this kind of value proposition, how the case company leaders understand the same value proposition concept, what kinds of gaps there may exist between the two parties. Then the case company stakeholders were interviewed in order to understand the case company's current possibilities to offer the value proposition to the customers. Analysis of the results from these questionnaires and interviews forms the initial reflection stage.

The planning stage consists of a theory study in order to outline a value proposition in the form of a service concept that would meet the customer demand. The implementation stage consists of sending the value proposition to external customers focus group for evaluation. Feedback from the external customers focus group is analyzed for value proposition improvement. This forms the second reflection stage. The implementation stage also con-

sists of outlining suggestions for managers in order to facilitate the service concept.

Action research enables researchers to relate theory and practice together. Practitioners can also have more a visible role in collecting research data and reporting findings on a regular base, and practitioners develop themselves professionally and the organizations they work for (Costello 2003: 15 - 26).

Action research studies can be divided into theory driven and data driven studies (Costello 2003: 15 - 26). This action research study is more theory driven than data driven research. The objectives are to understand what kinds of practice theories exist in various industries in order to outline the value proposition for customers and in order to propose improvements to the background processes in the case company. Actual actions in this research are therefore two-fold. First the actual value proposition to customers is developed based on theories and customer demands. Then organizational improvements are proposed in order to make it possible to the case company to offer such a value proposition in effective ways.

An action researcher should be aware of research impacts on their colleagues. Also organizational issues in relation to their research should be considered, such as confidentiality issues and personal implications of the research. The reporting style and problem statement should avoid strongly pointing defects or flaws in the existing organization. Action researches can be classified into either rational reactive and intuitive proactive in their scopes. The former identifies a clear challenge and tries to find a solution to it, the later does not necessarily have any clear challenge, but an opportunity identified for proactive improvement (Costello 2003: 39 - 47).

Action research can be quantitative or qualitative research, although typically it is qualitative in nature and focuses holistically on a small-scale context. The researcher is personally present and may therefore accidentally introduce researcher bias, which is not desirable. Quantitative research in turn is a large-scale research focusing on numerical data and defined research design. The researcher can stay detached from the context. Therefore action researchers should build up trustworthiness of their research outcome by paying special attention to validity, reliability and generalizability of the re-

sults. Validity threats can be mitigated by prolonged involvement in the study, by conducting triangulation, by implementing negative case analysis and by providing audit trail with good documentation. Internal generalizability refers to the context specific generalizations while external generalization should apply outside the researched context. This can be challenging for small-scale action research. Quality of the research conclusions can be improved by using multiple sources of data, testing own assumptions, seeking exceptions on agreements, explanations on disagreements, and challenging own ideas both in general reading and during fieldwork (Costello 2003: 39 - 47).

The present action research study is more qualitative than quantitative in nature. Questionnaires contain free input open-ended questions, and the interviews conducted in good and respective manner provide qualitative data, too. However, some questionnaire questions provide also quantitative data. This is also a case company specific small-scale research, of which the results cannot be generalized outside the context. Validity and reliability of the research outcome are discussed in a separate clause.

Quantitative research data should be supported by reasons, evidences and arguments. Qualitative action research data can reveal themes, incidences, patterns and trends. Based on this data an action plan can be outlined and implemented. Implementation is then reflected in order to consider whether a new cycle is needed. All data should be discussed in research report or omission explained. More detailed data can be given in appendices (Costello 2003: 57 - 71).

All qualitative data is analyzed for themes, patterns, incidences and trends and the analysis results are discussed in the research report. The research report is addressed to the case company experts, managers and leaders as well as to the faculty of the university of applied sciences. Since, according to Costello, when writing action research report the target audience should be identified and considered what kinds of requirements and guidance they may provide. Other practitioners and stakeholders read the report. Different kinds of action research contexts can have different requirements for the report template. Quotations and citations can be done by paraphrasing other's work or by showing them as examples to the points made. In general humble attitude in reporting is a virtue (Costello 2003: 73 - 83).

2.2 External Customer and Internal Stakeholder Questionnaires

This subsection details the data collection. The case company has a few records of external customer contacts, which have previously provided their acceptance to be approached by a product research and development related surveys and questionnaires. The two records consisting total of 187 contacts were used for approaching external customers with a questionnaire related to this study. The target groups of the questionnaire were clinical professionals, senior managers, medical device maintenance professionals, and professionals working in procurement. The questionnaire was planned and implemented in order to understand what kinds of service needs customers have for the case company on this value proposition and how internal stakeholders at the case company share the understanding of the value to the customers. Several survey questions were based on theories from relevant literature as explained in the following. Appendix 2 shows the whole questionnaire and relevant references to literature.

The first customer questionnaire and stakeholder questionnaire question intents to verify how people outside the case company and inside the case company understands the concept "Continuous SW Upgrade Service". It is essential to understand whether these two parties share the same understanding on this key concept. A good value proposition cannot be made to the customers if service provider understands the concept differently from its customers. Once common ground on basic terminology is established and calibrated, then the real value of the named value proposition can be analyzed.

Several articles and books discuss customer value and services providing customers value from different aspects (Anderson 2008; Anderson, Narus, and Van Rossum 2006; Berry 1999; Donath 2007; Gale 1994; Harrington and Tjan 2008; Peppers, Rogers and Dorf 1999; Salvador, Martin de Holan and Piller 2009; Spirek 2001; Thomke and von Hippel 2002; Zeithaml, Rust and Lemon 2001). The customer questionnaire questions two and three and stakeholder questions two and three ask directly how customers could describe the value from this value proposition. It is vital to understand what would be the service attributes and their values to the customers. This understanding is the basis for defining correct service attributes and pricing schemes for the service offerings. Therefore the question number two pro-

vides qualitative free text input field for the customers to describe in their own words what attributes would be important to them. The question number three in turn intents to verify quantitatively what attributes the stakeholders inside the case company consider important to the customers within the context of the value proposition. The question number four addresses the basic technology concern of the case company with respect to the evolution of software (SW) system requirements. Asking this same question from both external customers and internal stakeholders looks for mutual understanding.

Some basic respondent demographic questions follow to let the case company understand wherefrom the responses came from and from which kinds of hospitals and what kinds of professions provided insights (numbers 5, 6, 7, 8, 9 and 10). The question 10 asks the respondents for their exact occupation category in order to redirect respondents further to more occupation specific questions. These are questions for senior management as well as for biomeds and procurement professionals.

Question number 11 addressed to the senior management of hospitals intents to provide understanding on what kinds of quality systems hospitals implement. It is a common assumption that for the sake of patient safety hospitals function under rigorous quality systems. This may be reflected as quality system requirements to any external service providers, whose product and service offerings are associated with direct processes of patient health care, such as patient monitoring systems. The question number 12 in turn belongs to the demographics area, but the senior management may better answer addressing differentiation factors of hospitals. Differentiation is the competitive advantage also to hospitals when they provide health care services. Zeithaml et al. discuss customer pyramids where customers are categorized into four categories of platinum, gold, iron and lead customers (2001). Customer pyramid is suitable in situations where service resources, including employee time, are limited, when customers want different services or service levels, or when customers are willing to pay for different levels of services. Or when customers define value in different ways, i.e. in one of the four ways including low price, anything that customer values in a product or service, quality divided by price, or all that is got for a price. Or when customers can be separated from each other in order to approach them differ-

ently, when service differentials can lead to upgrading customers to another level, and when they can be accessed either as a group or individually (Zeithaml et al. 2001). This information about the case company's customers may have impact on the design of the case company's value proposition.

When the case company's value proposition could be based on networking of devices for remote SW deliveries and could include also full life cycle management of devices, as Allmendinger and Lombreglia introduce such theories in their article that is paraphrased in detail in the clause 3.2, hospital's own biomeds may loose some of their work tasks. The question number 13 intents to enquire how senior management would utilize biomeds for other tasks than software upgrade deliveries or device hardware configurations.

Question number 14 intends to provide insight on how hospitals have organized their information technology (IT) types of operations. Basic options are that biomeds maintain medical devices separately from IT people, who maintain regular IT network and workstations. In case the value proposition is seen as one type of IT service, references to the IT Infrastructure Library V3 framework and Application Service Providers may come apparent.

Questions from 15 to 20 are again demographic type of questions that biomeds and procurement professionals can respond to the best. The questions number 21 and 22 are fundamental questions that will impact the contents of the value proposition. Assumptions exist that publicly funded hospitals use capital budget for equipment purchases and a leasing model may not be possible. Capital budgets may not be used for acquiring services. Those may be purchased only from cost budget. Thus the purchase of services limits the hospital's purchasing power addressing consumables necessary for hospitals.

The questions numbers 23 - 30 enquire some preferences and practices related to purchases of the value proposition. One-to-one marketing, also called relationship marketing and customer relationship management, means that a company identifies its customers, differentiates them, interacts with them and finally customizes a product or service to fit into each customer's needs. Each interaction event increases knowledge about the customer, as the customer teaches the company, and competitors find it difficult

to follow this. Customer differentiation means that the company addresses differently each customer's needs and creates a tailored level of value each customer is looking for. This saves company resources in general and enables focusing resources to the customers that bring in the most value. Customizing product or service means that each customer receives an offer that meets his specifications to the extent possible to the company (Peppers et al. 1999). Value propositions can be classified into three categories (Anderson et al. 2006). All benefits contain all imaginable benefits that an offer can deliver to customers. This category requires the least customer knowledge and may suffer from benefit assertion where such values customers do not need are highlighted. Also the values could be shared with competing products as points of parity instead of points of difference, which jeopardizes the benefit of value proposition. Favorable points of difference highlight the actual differences that the company's offer has compared to other suppliers. If the supplier does not know exactly what the customer values, the supplier can provide less important values called value presumption. Resonating focus is the ultimate goal of value propositions and requires customer value research. This research should answer to the question, which addresses the most important features of the offer that customers should keep in mind. Suppliers can provide the best simple and powerfully captivating value proposition on a few vital areas that the customer actually needs and prioritizes. They can also document and communicate the values skillfully to the customer. With this kind of value set the supplier is ready to argue their competitiveness over points of parity and points of difference situations and they can even utilize these points effectively in their value propositions. However, the customer and supplier can mix these two points up, and managing this possibility of points of contention not occur is challenging (Anderson et al. 2006).

Question number 31 addresses directly a hospital's potential preferences to have an IT service type of value proposition provided within any common quality standard framework. Presumption for the standard reference is ITIL V3, but this is not proposed to the customers in the question. The intent is to know whether hospitals have any requirements on this issue, and if they had, which standard reference should be applied. Therefore this question is a free field question.

If hospitals utilize application service providers (ASP), they may be familiar with periodic payments (Spirek 2001). The question number 32 enquires about customers' preferences on periodic payment frequencies. ITIL V3 framework also addresses asset management (AM) possibilities on behalf of the customer as part of IT services. AM is important to the service provider in order to enable service provider analyze customer asset configuration prior service actions on customer's installed base. For mission critical medical devices this is a feature worth emphasizing. Therefore the customer's position on letting the service provider to maintain asset management is asked in the questions 33 and 34. The question number 34 also promotes self-services as one method of bringing value to the customer and as part of service delivery cost management as the literature references suggest (Frei 2008; Peppers et al. 1999; Salvador et al. 2009; Spirek 2001; Thomke and von Hippel 2002).

Questions 35 and 36 for external customers and questions 5 and 6 for internal stakeholders intent to get from the respondents any other ideas that may enable the case company to differentiate from competition or otherwise improve the value proposition. Harrington and Tjan (2008) write about customer feedback opportunities that would enable better future product and service design.

Questions 37 - 39 ask for the respondents how the case company can approach them in the future. Customer privacy is important in customer relationship. Customer relationships are beneficial to both the company and customers. Trust based customer relationships contain three elements, which are structural solutions, friendship rules and continuous learning. Structural solutions are well-organized service offers in company service delivery system that are not employee dependent and therefore bind customers to a company instead of an employee. Friendship rules honor customers for their privacy, confidentiality and are tolerant to other friendships of customers. Positive customer experiences include also delights and positive surprises from the company. Continuous learning includes anything that could be used to receive and store inputs from customers for service delivery improvement in an information technology aided manner. There are various levels of commitments in relationship. Relationship between a company and a customer is

based on trust, and trustworthiness is the key attribute of a great service company (Berry l999: 147 - 155).

2.3 Internal Stakeholder Interviews

The second questionnaire is targeted to key experts, managers and leaders working for global marketing, product engineering, manufacturing, service engineering, sales and service delivery organizations and human resources. They are interviewed in order to understand their viewpoints on the value proposition and associated tools and processes needed within the case company. The interviews are carried out after the external customer questionnaire response time has ended.

The interviews contain two modules. First the interviewee is asked to respond to the internal stakeholder questionnaire in order to evaluate how well they are aligned with the external customers on the actual value of the value proposition. If the interviewed working typically in back office expert roles does not have formal influencing power on the contents of the value propositions, the questionnaire was not addressed to them. Then one to one or one to two interview meetings are conducted. The case company being a large multinational company it is an extremely busy organization and it is difficult to book even one hour meeting times with the key stakeholders with relatively short notices required by the research schedule. In order to gain most information out from the interviewed, the following interview strategy is implemented.

The interviewees are introduced to the research problem in generic terms. Then an opening question or statement is given to open a discussion where the interviewed expresses his or her viewpoints on the subject from his or her functional organization point of view. The interviewer makes keynotes about told themes, statements, opinions, and viewpoints while listening. The interviewer directs the discussion in a way that all intended subjects are covered during the one-hour meeting. Promptly after the meeting the interviewer finalizes the interview log and sends it to the interviewees for their review by e-mail. The interviewee reviews the log and confirms whether all information reflected and written in the interview log is as they intended to advocate it. In case there are needs for corrections, the interviewee provides them in his or her acknowledgement e-mail. In case any of the interviewee

does not acknowledge anything to interview log after reminder e-mail, the discussion log is deemed fairly correct and silently approved by the interviewee for the purposes of this study. Some can be so busy with traveling, meetings, reporting and workouts that they may not have time to prioritize and review the discussion log. These reviewed interview logs are then used for conceptualization and triangulation of findings on the intended subjects. Finally, as the amount of information in the logs is lengthy, the conceptualized findings are paraphrased in the study report. Refer to Figure 3 for the overall internal stakeholder interview process used in the study.

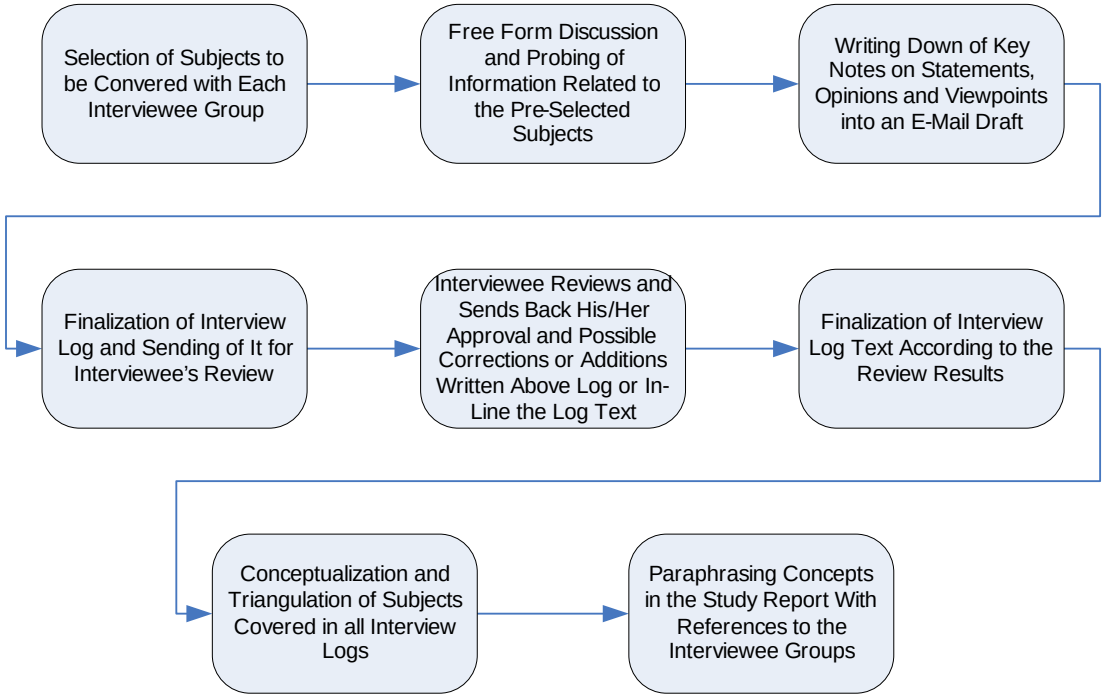

Figure 3. Interview process of internal stakeholders

This procedure described above enables fluent knowledge transfer in a relaxed atmosphere and eliminates stiffness resulting from predefined exact questions. It also prevents the interviewer from time consuming typing in the answers word by word during the meeting. Also recording of the interview meeting for later transcription would make the interviewees too precautious to express all their viewpoints, which could impact negatively the validity and reliability of interview results. See Appendix for details of each interview meeting, key subjects areas and for the approval status of each interview log.

2.4 External Focus Group Pilot

The external customer questionnaire contains a few questions that enquire the respondent's willingness to be approached later for possible more detailed questions and for participating in the focus group that would evaluate the draft value proposition and provide feedback on it.

The draft for value proposition is a pdf rendered PowerPoint presentation built on the case company's own logo template. In order not to reveal the identity of the case company, the pdf file does not appear in the study report. The pdf file is then sent to the focus group representatives by e-mail. It consists of two modules. The first module reflects the key results from the initial external customer questionnaire so that the focus group member knows what customers demand for the service. The second module explains the draft value proposition and its main elements and service attributes. With this information the focus group participant can understand what other customers have demanded and how the draft value proposition would meet these customer demands.

The focus group representatives are asked to enter their feedback through another questionnaire. This questionnaire asks a few free input open-ended questions. One question is a position type of question where a respondent will provide his or her evaluation on each service attribute on the scale of from 1, meaning full dissatisfaction, to 5, meaning full satisfaction. These results are analyzed and feedback information is taken into account when the final value proposition proposal is outlined.

2.5 Reliability and Validity Considerations

According to Patton, a description of the researcher's experience and relations to the subjects and samples studied are to be reported for gaining credibility (Patton 1999: 1199).

Bias of the author can be considered minimal, because he has worked almost eighth years in a reliability and compliance expert role in an engineering function of the case company. In this role the author has good cross-functional visibility, but can still stay detached from the daily business of the other functions. Also with respect to the engineering function the author is not directly working for software development. Considering the author's posi-

tioning to the stakeholders involved in this study, the author has good overall understanding on the business of the stakeholders, but does not bring any specific personal bias to the viewpoints of the functions because of a low level daily involvement to the functions. This can be considered improving the objectivity of the study.

Conceptualization and explaining patterns and exceptions from questionnaire and interview data are essential to perform in order to find common trends and themes. The testing for rival patterns and explanations from the data set is important in case the data set could provide alternative outcome. Negative cases in the data set in turn provide understanding of potential valid exceptions (Patton 1999: 1190 - 1192).

The customer questionnaire and internal stakeholder questionnaire have a few open-ended questions. These questions are analyzed for patterns and exceptions by grouping them into themes. The free field responses are so clear that no rival patterns could be found. Also negative cases are few, but they did not bring any specific information for further conclusions.

Triangulation typically contains interviews, observations and document analysis (Patton 1999: 1192). The methods consist of triangulation with different ways to collect data, triangulation of sources with the same collection method, analyst triangulation with multiple analysts, and theory or perspective triangulation with multiple theories to interpret data (Patton 1999: 1193). Combining these increases validity and reliability of qualitative analysis. Triangulation of these two data types is comparative analysis that can reveal interesting findings during the consideration of the degree of convergence, thus increasing reliability (Patton 1999: 1194).

This study consists of questionnaires to customers, interviews with internal stakeholders and literature research. The external customer questionnaire and internal stakeholder questionnaire share partly the same questions so that triangulation of sources could increase reliability on the key concepts of the value proposition and service preferences and levels. The internal stakeholder interviewees responded to the questionnaire prior to their interviews so that comments about external customer questionnaire results during the meeting would not impact their initial understanding of the customer needs and concepts. The purpose is to identify and understand any differences in

comprehensions between external customers and internal stakeholders when they use the same words and concepts. Many internal stakeholder interviews probed for the same subjects from different interview groups. This forms triangulation for the current state analysis on the organizations, processes and methods in the case company. This can be seen as multiple interview group references in the paraphrased texts discussing certain subjects. In order to ensure good theory reference for the study, special attention is paid to the quality of literature references used.

Triangulation of qualitative data sources consists of comparing observational data with interview data, comparing what people say in public and private, checking consistency of what people say over time, and comparing perspectives of people from different points of view. This data can also provide non-converging results and understanding the differences provide more information and increase reliability (Patton 1999: 1195).

Having worked for the case company for approximately eight years no specific fluctuations in what people have said over times compared to what they said in the interview meetings are identified. The messages seem to be consistent. Personal observations made over the years also support the interview findings.

The external customer questionnaire and internal stakeholder questionnaire have also choice questions that provide quantified data. With respect to the statistical reliability of the data the external customer questionnaire has a low overall response rate and even a lower rate for certain specific occupational groups. However, the total population of health care professionals around the world forming a global statistically reliable opinion is so vast, on average 10 % of all employees (OECD 2009: 62 - 63), that it does not matter for the reliability of this questionnaire whether there were 30 or 3000 respondents. The sample group should be higher in order to narrow the error margin. For the reliability of results it is more important to analyze what the respondents answered, i.e. what their message is, and how those answers map to the theories obtained from literature sources. With this respect the responses can be considered having good quality for the purposes of the study and theories from literature support the findings.

The following specific observations apply to the external customer questionnaire. One of the respondents is a case company employee in Japan. This respondent advocates his or her opinions as a case company employee, but they also include experience based observations how customers could value this value proposition. The questionnaire information technology based facilitation had one error that should not have been possible. One respondent managed to proceed with the questionnaire without answering to the mandatory country question with a pull down list of countries. The failure mode is unknown. The respondent did not provide contact information, but the name of the hospital is given. Having skills in the Swedish language and knowing the key names in the Swedish royal family it is easy to conclude that the hospital called “Drottning Silvias barn o ungdomssjukhus Barn operation plan 6” is located in Sweden. Therefore the respondent was from Sweden and the chart representing countries responded was fixed accordingly.

Regulations as written documents can sometimes be difficult to understand as to what was the intent of the specific article or clause. Sometimes the text is written illogically, the key terms used may not be consistent, definitions given in regulations may not be sufficient, and not all specific situational cases in real world were considered when politicians outlined the regulation. These all leave room for interpretations, which can turn out to be false when the first court trial occurs. This is a specific concern in this study as it proposes a new way to declare products to the European market. The proposal given in this study should therefore be considered as an initial proposal for further discussions among legal experts and regulative affair experts.

3 CUSTOMER VALUE AND SERVICE INNOVATION THEORY FOR PATIENT MONITORING MARKET

The research question can be addressed by a literature review on theories and practices applicable for creating a value proposition. Theories and practices are mostly from various industry sectors other than health care equipment and service vendor sector in order to fertilize the health care sector equipment and service development and business models. At the end of the day, the research problem is not unique to the health care equipment and service vendor sector and reflections to other sectors can be made in order to incorporate compelling theories and practices into the health care equipment and service vendor sector.

The basic theories on customer value and service are based on two studies by Gale and Berry each addressing specifically either of these two subjects. Then various business articles are used to address certain additional subjects of value propositions and service offerings. After these customer value and service theories service innovation theories are introduced more in detail. This is followed by an introduction to an interesting and worth considering methodology to ensure deliveries of software releases on time. IT Infrastructure Library (ITIL) framework is introduced as well as certain European Union (EU) regulations. These both subjects are important in product and service innovations in order to enable the value proposition.

3.1 Customer Value and Services

Gale writes that customers buy value (1994: 29). He defines value consisting of quality that is relative to price. Value in turn consists of non-price attributes that are product and customer service. Quality, price and value are relative (Gale 1994: 29). Product and customer service attributes have their own life cycles that customer values (Gale 1994: 134). Latent attributes are those that are not yet visible or apparent. Desired attributes are those that are known, but currently not supplied. Unique attributes are those that are currently supplied only by one pioneer. Pacing attributes are those that are getting weight and one supplier, possibly the pioneer supplier, has got lead compared to competitors. Key attributes are those that define competitiveness. Niche key attributes address one segment needs while power key attributes address multiple niches. When competitors catch up the key attrib-

ute leaders or the attribute is losing weight, it is a fading attribute. When all suppliers can offer an attribute, it is a basic attribute. But if performance with this kind of attribute is declining, customer can abandon the supplier (Gale 1994).

Managing product and service attributes effectively through rapid cycle innovations that are in alignment with business and technology strategies is essential to profitability and growth. Cycle times of developing new products, services and attributes define innovation leadership and responsiveness to anticipated customer needs of a company. Gale writes that rapidly developed (development cycle time less than 12 months) products achieve 10 % of sales while slowly developed (development cycle time more than 60 months) contribute only to 6 % of sales. Being first in the market with new offering also brings competitive advantage. Companies can end up to innovations when they foster free market for innovation, they listen to customers, who complaint competitors' performance, in order to understand customer future wants, shortening development times of products, services, processes and their attributes, ensuring that funding decisions for development are not biased in favor of short-term costs compared to long-term benefits from the innovation, and by performing customer value analysis from technologies introduced by competitors (Gale 1994: 200 - 205).

Customer value management consists of four stages (Gale 1994: 9). The first stage is conformance quality where a company conforms to the requirements, does things right for the first time and efficiently by reducing waste and rework. The next stage is customer satisfaction where a company is customer driven by being close to the customers and by understanding their needs. The third stage is market-perceived quality and value relative to competitors where a company is market driven and tries to be closer to its own and competitors' customers than any competitors in order to understand how company performs from customer perspective compared to competitors and in order to understand why orders are won or lost. This stage completes the total quality management' that is expanded by customer value management with stage four. In this stage a company transforms its organization, people and processes, with evolving needs of the target market by using metrics and tools, like quality profiles, price profiles, customer value maps,

won/lost analysis, key events time lines, head-to-head area charts, and what/who matrixes, for customer value analysis (Gale 1994: 208 - 238).

Operating effectively while growing rapidly and competing on price while still retaining the entrepreneurial spirit of the younger and smaller company are the main three challenges for a company, whose services are labor-intensive (Berry 1999: 10). "Service companies sell a promise", states Berry (1999: 11). If customers lose their confidence on the service company for being able to meet the promise, it is fatal to the company. Value and cost are not the same for customers. Value is seen by the customers as the benefit received compared to burden endured. This burden has two components, which are price being monetary component and everything else non-monetary that customers can see as burden related to the service. For example, burdens can be difficult access to the service or an unknowledgeable service provider. When customer experience is sacrificed in favor to lower costs, this typically decreases the value customers see. When price competition is strong, total customer experience should be emphasized to be retained at the competitive level in order to retain the customers for the service supplier, because customers select service suppliers based on the total value they see, and this is not based only on the monetary value of the service (Berry 1999: 12 - 13).

As operations grow, formal management processes and bureaucracy take place, which can impact negatively service employees' motivation to serve customers. Also weak company strategy can impact negatively employees' motivation (Berry 1999: 12 - 13). Berry supports strongly value based leadership that addresses also employee needs for teamwork, respect, joy, social profit, integrity, innovation and excellence in service organizations (1999: 23). Strategically focus is important for a service organization. A company should have a core strategy that defines what the business is for the company. This core strategy is supported by integrated sub strategies that define what the individual business designs are to meet the core strategy. These sub strategies together with excellence in execution form the market offer for a service company. And this in turn is the total service product that customers experience with the company for their definition of the actual value from the service (Berry 1999: 70).

Strategies, and especially integrated sub strategies, evolve as business environment evolves. Innovation is the key method to meet the changes in the business environment. Companies should listen to their customers for innovation. Only customers can lead to offer radically new ways of creating value to them. Customers may not be able to articulate their needs, but they can comment on existing products and services, which can reveal unspoken needs. Occasional customer surveys are not enough. Instead continuous listening processes should be in place. These processes provide data that form information, which increases learning in a service company. This new knowledge is used for innovation. (Berry 1999: 73 - 79).

Execution starts with possessing correct types of employees to meet the strategy. For services this means service oriented people, who can interact with the customers. Services are intangible and they still should be evidencable by service attributes. Services should be flexible to meet customized needs and varying capacity needs. Customers should be actively listened to. There are several methods (Berry 1999: 100 - 102). Service improvement processes should be in place in order to meet the voice of customers (Berry 1999: 80 - 109). Companies can enhance businesses with services by attracting new customers, increasing business with existing customers and by retaining them (Berry 1999).

Customer relationships are beneficial to both company and customers. Trust based customer relationships contain three elements, which are structural solutions, friendship rules and continuous learning. Structural solutions are well-organized service offerings in company service delivery system that are not employee dependent and therefore bind customers to a company instead of to an employee. Friendship rules honor customers for their privacy, confidentiality and are tolerant to other friendships of customers. Positive customer experiences include also delights and positive surprises from the company. Continuous learning includes anything that could be used to receive and store inputs from customers for service delivery improvement in an information technology aided manner. There are various levels of commitments in a relationship. A relationship between a company and a customer is based on trust, and trustworthiness is the key attribute of a great service company (Berry l999: 147 - 155). Berry writes that customer success is a function of employee success (1999: 181). This means that a company

should maintain a working environment that keeps the employees satisfied and motivated to serve customers (Berry 1999: 156 - 181). Although a company may be a large one, Berry suggest that the company should approach customers and their customer service employees in a small company ways. This would maintain customer relationships more intimate as well as help customer service employees work in a small company environment that enforces better team work and personal accountability that is positively reflected to customer relationship. (Berry 1999: 195).

There are four stages of service management maturity (Shelton 2009). Product-centric manufacturer has me-too types of products among competitors where differentiation diminishes. Customers see product-centric manufacturers having distinct product sales and after-sales services for repair and maintenance. As-needed service providers provide small value adding services, but this does not contribute to revenues more than 15-20 %. Customers are happier for getting solutions, which they need not implement by themselves. As an example, SW upgrade services for personal computer belong to this category. Full-line service experts provide a full line service levels for customer life cycle needs with differentiated offers. These service providers are typically own profit & loss (P&L) with high senior management attention to service quality and reliability and they contribute to 30 - 40 % of total sales revenue. Customer satisfaction and commitment increase on this stage. Integrated solutions providers take care of customer life cycles on a from cradle to the grave bases. They co-develop services together with customers and they understand deeply the customer business. They organize themselves in a way that boundaries between manufacturing, sales and services as well as financing are invisible to the customer. Senior management follow up this business, because it can contribute to more than 50 % of the revenues and 2-3 greater service margins than in the as-needed services (Shelton 2009).

The two later stages require that services be co-developed with the products having customer needs in mind. A product-centric company can evolve maturity levels by utilizing three best practices. At first by expanding value proposition beyond existing products, then by creating an integrated organization to combine technology and business model innovation, and by devel-

oping robust partnerships to support the expanded value proposition (Shelton 2009: 40).

Expanding value proposition requires deep understanding on customer needs that go beyond what they actually say (Shelton 2009). This enables service innovation. This service innovation should be a dedicated unit that glues technology, manufacturing and business model innovation together. Shelton writes that typically this does not exist, or if existed, it is highly under resourced compared to technology and manufacturing resources. Therefore companies are not able to innovate and implement integrated services. Partnership is a feasible solution instead of hiring own resources. Service innovations typically call for open innovation scheme for gaining external ideas and an ecosystem of business partners, who implement components of services. The current ecosystem for identifying parities in products and services should be analyzed, structured idea generation sessions held for developing novel value networks to meet customer needs, and modeling tools to assess strengths and weaknesses of this new partnership model. When integrated services should be offered, traditional separate products and services mindset should be abandoned, organizational barriers should be removed between product and business model innovations, and suitable partners should be found for creating missing parts in the new product-service offering (Shelton 2009).

Innovations are divided into two groups each having three factors. Technology innovation consists of product and service offerings, process technologies and enabling technologies. Business model innovation consists of target customers, value propositions and value chain. All these should be optimized (Shelton 2009: 42).

Research road maps are needed for supporting executive decision-making on a continuous basis. Research road maps are like a research design for one study, but the road map shows how the research is done over several individual research projects (Wyner: 2005).

There are a few questions that help to outline research road maps. At first the types of research needed should be defined. Researches can be grouped into categories of foundational, testing, performance measurement and issue specific research (Wyner: 2005: 6). Foundational research forms

the basis for other research needed. Foundational research is qualitative and answers to questions such as profilization of consumer requirements and then quantitative in segmentation of the requirements for specific customer segments and targets. Aside of this research proper and effective key performance indicators addressing customer and brand metrics should be set for continuous monitoring purposes. Market variability defines what sources should be used for monitoring and how much should be monitored. This metrics is associated to company or brand levels rather than to a specific one time marketing initiatives. Once these are in place, the actual ongoing research program can be initiated. Testing research is used for proving new concepts and go-to-market approaches before actual marketing of them begins (Wyner 2005).

Different kinds of research can be linked together by first asking who is a customer and by defining it well. Wyner writes that this is not easily done because customer attributes and customership scenarios can vary a lot in-between businesses and industries. Segment definitions are also used for research linking and comparison purposes. Time span specific market response studies can be compared together with company's own research on corresponding marketing costs incurred for determining effectiveness. Individual customer survey results can be compared to wider research results for correlation analysis over customers. Meta-analysis methods across multiple studies with a same kind of structure and measures can be used for finding generalized results and patterns from customers, thus increasing quality and reliability of results for future offering designs (Wyner 2005).

When research road map addresses key performance indicators and other metrics important to the business, executives can do "what if" scenarios when comparing different options forward with offerings and marketing strategies. And when this research is continuous based on the research road map, it provides continuous data that is used for refining the metrics, assumptions and attributes by executives (Wyner 2005).

3.2 Innovation of Service Solutions for Patient Monitoring

A component specialist provides individual components and the level of bundling and integration is minimal. In this model the customer designs and builds his or her own solution. Bundler provides sets of individual compo-

nents so that a customer gets some sort of ready designed total solution. Integrator provides individual components that are glued together by an umbrella solution. Solutions provider composes together a customer specific solution by using ingredients from the pieces of components, bundles and glued systems (Roegner et al. 2001: 95)

Products should be designed to support self-diagnosing and connections to networks such as the Internet so that products could indicate their statuses to the service organization (Allmendinger and Lombreglia 2005). The service organization can then pre-emptively provide timely services. In best cases services can be made remotely. Companies should analyze which product life cycle states would be suitable to implement smart services (Allmendinger and Lombreglia 2005: 136).

There are four business models to utilize within the framework of intelligent services. Embedded Innovator conducts the most traditional way of providing products and related services. Added value can be provided to customers with networked products. For example downloadable SW upgrades. Solutionist provides “keys to hands” services around a product. These include financing services for the product for starting with and ending up to full life cycles maintenance and upgrades for the product. Customer needs just to use the product in his own processes. Synergist provides products that have standardized interfaces and protocols to communicate vital data of the statuses of the devices. A synergist gets boost in his product business due to the increased demand for products that can integrate and network. Aggregator analyses data from multiple products and can then provide superb services to customers. These services can control devices remotely in order to optimize their usage for the customer’s benefit (Allmendinger and Lombreglia 2005: 136).

Networking of devices is recommended when devices process critical information, defects in devices have critical consequences, networking would enable preventive maintenance in order to ensure availability of devices use and would also enable cleverer utilization of maintenance resources that would bring economical benefits, networking can be facilitated cost effectively, networked device model is not in use too short or over-long times aging technically out, when devices are difficult to access, and when a device

could obtain valuable business information (Allmendinger and Lombreglia 2005: 136).

Product standards for supporting data collection via networks should be in place. Obstacles to this new era of services lie in the massive amount of data that could be collected. Data should be analyzed and algorithms developed to find best service opportunities. Company management of traditional product companies may also have old-fashioned attitudes that prevent support for developing these new services models (Allmendinger & Lombreglia 2005: 144-145).

Companies can no longer rely on their own research and development in order to create innovations that would bring success (Chesbrough 2003). Not all companies even do their own research. Being the first in the market with a new innovation may not be as valued as having a correct business model to run. External research and development can create value while own research and development can still claim portion of total value. Intellectual properties are objects for trade. A company may license rights to implement intellectual properties if that will bring added value to the business model. And company can sell licenses to others to let them utilize intellectual properties (Chesbrough 2003).

Innovation investors finance innovations for gaining financial benefit from the innovation once commercialized. Innovation benefactors fund research in its early stages (Chesbrough 2003: 38 - 39). There exist four types of innovation organizations. Innovation explorers mainly do innovations for innovations sake. Innovation merchants aim to get best financial value out from their innovations that are typically technologically narrowed in scope. Innovation architects outline innovative system frameworks and other organizations can then develop compliant subunits into it. Innovation missionaries do not care about financials related to the innovation. Their main objectives are to get new technologies into use (Chesbrough 2003: 39 - 40).

There exist two types of commercializes for innovations. Innovation marketers analyze market needs for new innovations and they will find out sources of innovations that could meet the demand with successful business. Innovation one-stop centers channel innovations to customers through well-defined interfaces (Chesbrough 2003: 40 - 41).

Service concept is defined as the way how the service is delivered, how the customer experiences it, what benefits and results the service provides to the customer and what value the service provides to the customer as a delta between benefit and costs of the service. The main components of the service concept are what the service is for marketing purposes and how the service is delivered and how these two aspects are integrated. Service concept is a mental picture not only at customers, but also at employees and designers of the service, which can lead to gaps between service expectations and service delivery if alignment among these stakeholders is not properly taken care of (Goldstein et al. 2002: 123 - 124). Service concept should be used for designing service recovery systems on the same what and how bases as the actual service are designed. Also strategic intent and performance measurements should be considered for a service concept being successful (Goldstein et al. 2002: 132).

Thus the service concept could be based on a networked software delivery method added by value adding services. These value-adding services could implement open innovation principles. Ultimately the service concept could be a total solution type of offer.

3.3 Lightweight Release Framework of Software

In order to achieve on-time, high quality releases consistently to deliver value to the customers and partners, discipline within the management team is needed. The management team should reject any requests for exceptions on planned release schedule during the first two releases. This simplifies the process and allows the product owners to focus on prioritizing feature deliveries in order to deliver as much value as possible in the time frame available to them. The scope of release and scope of work for each software design team related to the release has to be negotiable. All teams working for the release are to be equally controlled and also all software features are to be equally valued so that no feature, important or not, will delay the release (Farrow and Greene 2008: 224 - 225).

The framework is to promote visibility and optimization of the whole release, or the product functionality that is delivered to the customer. Global priorities are to be consistent and clear to all design teams in order to maintain quality of the release throughout the development cycle. The priorities include main-

taining existing functionality and quality of the overall code line. All automation regression tests should pass at 99 % passing threshold on every check in. In order to maintain this code line stability building new functionality is a secondary thing. This rigor helps also teams (Farrow and Greene 2008: 225).

The framework establishes certain milestones. The first of them is release kickoff. It provides alignment from the start for the next release rhythm, because the purpose of the meeting is to provide visibility to the release plan for each team, introduce dependencies and generate excitement about new functionality of software. Senior leaders introduce those by explaining the release's business objectives and value to the customers. Chief product owners present the release plans to their teams in practical terms, which then should deliver in short time team specific plans concisely and effectively considering interdependencies of teams. They can also foresee impacts of interdependencies so that those can be planned more effectively. In this framework model the release kickoff meeting lasts 1,5 hours. After the release kickoff the release plans are available for all teams (Farrow and Greene 2008: 225).

Feature freeze milestone marks the end of the product development and the product is considered done. This milestone is also the start of the release freeze phase. Teams become clear about their goals and they have had sufficient time to organize their work for accomplishing the goals during the phase between the release kickoff and feature freeze milestones. A release freezes milestone means that the overall release has moved from a potentially releasable state to a releasable state. The last milestone is release, which actually releases the new software version. The framework consists of sprints according to the scrum discipline. There are four sprints each lasting one-month in this framework, thus releases occur in a four month cycles. This kind of rhythm provides visibility and reduces dissonance and waste across teams (Farrow and Greene 2008: 225 - 226).

Release managers in traditional waterfall processed software companies manage the late phases of the waterfall stages and are not involved in the early stages. Handing off the outcome to the release managers at the late phases can cause blames and frustrations when problems occur delaying the release. In this framework the release manager is involved from the very

beginning and acts as a help servant to the teams on their course to the goal. The release manager is also an ambassador to the rest of the organization with respect to the release and its visibility, schedule, quality and health of the processes. This includes also resolving systemic release issues slowing down the release process (Farrow and Greene 2008: 226).

Some practical tweaks to make this framework effective are to keep the release schedule visible by posting it visibly to the workplace. The schedule should increase awareness, communicate clearly and be a quick reference to the organization about how the release pieces fit together and it should provide insight to the overall mechanism for the delivery. Also release health and quality gets visibility by posting aggregated key metrics of the release progress daily by the release manager. This metrics originates from team leaders and is visible to the teams. Successive releases are compared in order to see how the current release is progressing compared to the previous ones. This also reveals quality hot spots, systemic obstacles and provides an input for the coaching the release manager carries out. Communication of the release status is the responsibility of the release manager that meets the teams weekly for bi-directional communication. Finally the teams themselves indicate to the release manager when they consider their output ready for release (Farrow and Greene 2008: 226 - 228).

Challenges with this framework include confusion of roles of the release manager and team leaders that are called scrum masters in this agile software development discipline. It should be clear that the team leader is responsible for the team while the release manager is responsible for the whole release. In one example provided by Farrow and Greene product owners continued to demand changes to the release dates if the features they wanted were not ready to the level of their desire. This challenge was overcome by emphasizing the customer value that on-time releases have even with fever product features. After a few release cycles this kind of demand dissipated (Farrow and Greene 2008: 228).

Finding the correct balance between the degrees of team self-organization and rigid structure is the key for the success of this framework. This requires openness and sufficient amount of flexibility (Farrow and Greene 2008: 228).

3.4 Introduction to IT Infrastructure Library V3

IT Infrastructure Library (ITIL®) V3 is a quality management system framework for IT services. Hospital customers may require that utilizing quality system principles should provide the software upgrade service for medical systems. Therefore the basic theory of ITIL is relevant to the study.

The framework consists of five main elements each having several subjects that should be analyzed for their relevance in each service offering case (Materna 2008: 4 - 7). These together implement ISO/IEC 20000 quality standard intended to information technology related services. ITIL model is a fully scalable model that can be applied to simple service offerings as well as to large corporate wide information management systems. Simpler applications can omit certain elements and subcategories as necessary, or they implement them in light ways. Larger systems implement all elements and subcategories to the fullest and can provide sophisticated services.

The main focus is given to two objectives in ITIL model (Materna 2008: 5). One of the objectives addresses good design of services that address business strategies, roles and responsibilities, and robust implementation practices within functions in order to create value to the customer. The other objectives addresses continuous improvement that removes identified service flaws and facilitates learning organization principles. There is also industry sector, organization type, operating model and technology architecture specific guidance available (Materna 2008: 6).

There are five publications that address various aspects of the ITIL model. These publications explain how things could be done and documented by following best practices that include also templates for documentation. These five basic elements, each having a dedicated publication, are service strategy, service design, service transition, service operation, and continuous service improvement (Materna 2008: 4 - 7).

Service strategy addresses financial management and return of investment, service portfolio management, and demand management (Materna 2008: 8 - 9). Service design addresses the topics of service catalogue management, service level management, capacity management, availability management, IT service continuity management, information security management, and supplier management (Materna 2008: 10 - 14). Service transition covers

transition planning and support, change management, service asset and configuration management, release and deployment management, service validation and testing, evaluation, and knowledge management (Materna 2008: 15 - 19). Service operation has event management, incident management, request fulfillment, problem management, and access management (Materna 2008: 20 - 23). Service operation functions consist of service desk, technical management, IT operation management, and application management (Materna 2008: 23 - 24). Continuous service improvement element has 7 Steps, which are named as ‘define what you should measure’, ‘define what you can measure’, ‘gathering the data’, ‘processing the data’, ‘analyzing the data’, ‘presenting and using the information’, and ‘implementing corrective actions’ (Materna 2008: 25 - 26).

3.5 EU Regulations on Medical Devices Impacting the Value Proposition

A medical device is defined as an appliance or software used alone or in combination for the purpose of monitoring of a disease, injury or handicap, and which does not achieve its principal intended action in or on the human body by pharmacological, immunological or metabolic means, but which may be assisted in its function by such means. Placing on the market is defined as the first making available in return for payment or free of charge of a device with a view to distribution and/or use on the Community market, regardless of whether it is new or fully refurbished (the European parliament and the council 1993: Article 1). Member States ensure that devices may be placed on the market and/or put into service only if they comply with the requirements laid down in the directive (the European parliament and the council 1993: Article 2). Devices considered to meet the essential requirements must bear the CE marking of conformity when they are placed on the market (the European parliament and the council 1993: Article 17). When the devices are subject to other directives concerning other aspects and which also provide for the affixing of the CE marking, the latter indicate that the devices also fulfill the provisions of the other directives (the European parliament and the council 1993: Article 4).

The commission proposal for the new Restriction of certain Hazardous Substances (RoHS) directive lays down rules on the restriction of use of hazardous substances in electrical and electronic equipment with a view to contribute to the protection of human health and the environmentally sound recov-

ery and disposal of waste of electrical and electronic equipment (Commission of the European Communities 2008: Article 1). The RoHS directive applies to electrical and electronic equipment falling under the categories set out in Annex I and as specified in Annex II to the RoHS directive (Commission of the European Communities 2008: Article 2). The Annex II to the RoHS directive defines medical devices as electrical equipment within the scope of Directive 93/42/EEC (Commission of the European Communities 2008: Annex II). Member states ensure that electrical and electronic equipment including spare parts for its repair or its reuse placed on the market does not contain the substances listed in Annex IV to the RoHS directive. The maximum concentration value by weight in homogeneous materials as specified in Annex IV to the RoHS directive is tolerated. Homogeneous material means a material of uniform composition throughout that can not be mechanically disjointed into different materials, meaning that the materials cannot, in principle, be separated by mechanical actions such as unscrewing, cutting, crushing, grinding and abrasive processes (Commission of the European Communities 2008: Article 3).

This restriction applies to medical devices, which are placed on the market from 1st January 2014. The substance restrictions do not apply to spare parts for the repair or to the reuse of the medical devices placed on the market before 1st January 2014, or to electrical and electronic equipment, which benefited from an exemption and was placed on the market before that exemption expired. The substance restrictions do not apply to the applications listed in the Annexes V and VI to the RoHS directive (Commission of the European Communities 2008: Article 4). The Commission will, for the purposes of adapting the annexes to scientific and technical progress, adopt measures to include materials and components of electrical and electronic equipment in Annexes V and VI to the RoHS directive where their elimination or substitution via design changes or materials and components, which do not require any of the materials or substances referred to in Article 4(1), is scientifically or technically impracticable, the availability and reliability of substitutes is not ensured, or when the negative environmental health consumer safety or socio-economic impacts caused by substitution are likely to outweigh the environmental, health or consumer safety and/or socio-economic benefits thereof. Commission adopts measures to delete materials and components of electrical and electronic equipment from Annexes V and

VI to the RoHS directive where the conditions set out for inclusion are no longer fulfilled. These measures have a maximum validity period of four years and may be renewed. The Commission decides in due time on any application for renewal that is submitted no later than 18 months before an exemption expires (Commission of the European Communities 2008: Article 5).

Manufacturers ensure that when placing their products on the market they have been designed and manufactured in accordance with the requirements set out in Article 4. Manufacturers draw up the required technical documentation and carry out the internal production control procedure set out in module A of Annex II to Decision No 768/2008/EC, or have it carried out. Where compliance of electrical and electronic equipment with the applicable requirements has been demonstrated by that procedure, manufacturers draw up an EC declaration of conformity and affix the CE marking (Commission of the European Communities 2008: Article 7). Member states presume electrical and electronic equipment bearing the CE marking as conforming to the RoHS directive (Commission of the European Communities 2008: Article 16).

Any natural or legal person, who puts devices bearing the CE marking together within their intended purpose and within the limits of use specified by their manufacturers, in order to place them on the market as a system or procedure pack, draw up a declaration by which he states that he has verified the mutual compatibility of the devices in accordance with the manufacturers' instructions and has carried out his operations in accordance with these instructions, and that he has packaged the system or procedure pack and supplied relevant information to users incorporating relevant instructions from the manufacturers, and that the whole activity is subjected to appropriate methods of internal control and inspection. Where the conditions are not met, as in cases where the system or procedure pack incorporate devices which do not bear a CE marking or where the chosen combination of devices is not compatible in view of their original intended use, the system or procedure pack is treated as a device in its own right and as such be subjected to the relevant procedure pursuant to Article 11 of Medical Device Directive (MDD). The system products themselves do not bear an additional CE marking. They are accompanied by the information referred to in point 13

of Annex I, which includes, where appropriate, the information supplied by the manufacturers of the devices, which have been put together. The declarations are being kept at the disposal of the competent authorities for a period of five years (the European parliament and the council 1993: Article 12).

Where appropriate, the instructions for use must contain information if the device must be installed with or connected to other medical devices or equipment in order to operate as required for its intended purpose, sufficient details of its characteristics to identify the correct devices or equipment to use in order to obtain a safe combination, all the information needed to verify whether the device is properly installed and can operate correctly and safely, plus details of the nature and frequency of the maintenance and calibration needed to ensure that the devices operate properly and safely at all times, and details of any further treatment or handling needed before the device can be used (for example, sterilization, final assembly, etc.) (the European parliament and the council 1993: Annex I (13.6)).

All the above mentioned is relevant to the value proposition when considering the CE marking of hardware and software of medical devices. Software upgrades incorporating new product features require renewals of the EC declaration of conformities previously issued. The dynamic nature of the RoHS directive complicates the declaration process and this should be considered for the value proposition.

4 THEORY FOR MARKETING AND SELLING OF THE VALUE PROPOSITION IN THE CASE COMPANY

Software upgrades are an example of cross-selling, therefore the following sections introduce cross-selling theories from various aspects, followed by theory of pricing services.

4.1 Cross-Selling

Boe defines cross-selling as following:

> Cross-selling is nothing more than team-selling with other specialists within your company, all working in partnership on behalf of the customer's best interest. It is a proactive, ongoing sales process designed to provide your existing customers with a full range of your company's products and services (Boe 2009: 19).

Unlike commonly believed, customers like cross-selling as means to offer a full range of products and services in a convenient way. Cross-selling works if a salesman analyzes customer needs and indicates that the salesman is representing other specialty instances of the company. The salesman should provide customers easy transfer to the specialists (Boe 2009). Sales and marketing barriers as well as educational barriers in companies result in poor eyes to see customer needs for referral sales, thus causing ignorance in sales potential of existing customers while all funds is spent on prospective customers (Wilson and Loerzel 2004). Salesmen often also have insufficient understanding about value propositions of service delivery organization, which results in that customers may not know what services the company could offer to them. Cross-selling is successful when employees understand that cross-selling is customer service where existing and new customers are valued for new sales opportunities (Wilson and Loerzel 2004).

4.2 Cross-Selling Methods

Decentralized customer data preventing identifying potential cross-selling and up-selling opportunities and lack of formal processes for team-selling and customer referrals prevent successful cross-selling (Wilson and Loerzel 2004). Cross-selling opportunity identification method has simple steps that

include creating a cross-selling matrix, e.g. by using MS Excel tool. The cross-selling matrix consists of all customers in rows and all services they currently have. Then meetings with other stakeholders are held for identifying potential clients for cross-selling opportunities and for agreeing on the strategies for each client contacts. A company internal tracking system for referral events is established as well as a system to track centrally customer contacts in cross-selling events for marketing communication management reasons (Wilson and Loerzel 2004). This complexity brings in need for a standardized SW in order to track compliance with the program and for coordinating cross-selling activities (Boe 2009). Customer satisfaction shall also be monitored, because if cross-selling fails, customers become unsatisfied and leave backdoor open to competition (Boe 2009).

Customer relationship management (CRM) system is not only a data tool, but also a strategic tool to manage customer information in order to identify cross-selling opportunities, new prospects, new profitable existing customers, new services, conflict of interests and independence issues. CRM systems were introduced in 90's, but they did not become popular, because companies did not develop and implement strategies relating to clients. CRM requires a customer-focused culture where customer satisfaction is the objective, customer information is shared and this data converted into knowledge. This knowledge contains customer contact employee data that addresses also their functional and decision influence roles in the customer organization as well as can be used to better understand the customer's concerns in each role. CRM also tracks customer demographic data with various attributes related to industry, financial system, regulatory framework and location of customer sites and overall value of the customer to the company. This data is used for profiling and benchmarking of customers as well as for identifying new business opportunities (Lassar et al. 2008: 68 - 69).

Transactional data in CRM tracks all relevant historical events with customers and records what kinds of products and services a customer already has from the company and why certain offerings were rejected by the customer. Relationship data tracks all relations of the company with the customer as well as all identified customer's key relationships with their own stakeholders in order to maintain cross-functional referrals and leads for cross-selling op-

portunities and generic coherent management of customer relations including understanding of potential conflict of interests (Lassar et al. 2008: 70).

Client intelligence is not just data in records, but deeper understanding what is currently known and what is not known about the client, and what is believed to be known about the client. In order to maintain client information reliable and company operations effective, records must continuously be maintained as part of process rigor. This requires process orientation in the sales organizations where attention to automation of workflows should be paid for. A CRM solution is then built on the predefined processes. People are trained primarily for the process, secondarily for the technology (Lassar et al. 2008: 70 - 72).

In order to implement CRM systems leaders should provide sufficient resources to acquire the technology and related human resources, they need to promote the system to all stakeholders, they need to address the use of CRM system in the incentive system, they need to promote CRM in their own behavior, they need to use CRM being role models to others, they need to be patient to see CRM system emerging in organizations, and then they need to be persistent in using the system. A CRM system needs a dedicated CRM manager, who is intimately involved in the CRM program and ensures its success with the support from the leaders (Lassar et al. 2008: 72 - 73).

For successful cross-selling an elevator speech for each service offering should be created, examples of clients having multiple services should be provided, client profiles for each service offering should be analyzed and documented and been educated to the salesmen, a short initial survey for tax interviews should be prepared, a short and easy survey should be prepared for salesmen to conduct with their customers in order to identify prospects for the cross-selling opportunities, and step by step instructions should be created for identification of prospects and for referring prospects within the organization (Wilson and Loerzel 2004). This incorporates keeping list of all company's product and service offerings and mapping their potentials to the answers of the open-ended questions that are used in customer need analysis stage. In the best cases a salesman behaves like a planning partner to the customer to address his needs (Boe 2009).

4.3 Cross-Selling Management

Leadership barriers in terms of low commitment on cross-selling and poorly constructed incentive and performance tracking prevent cross-selling and customer need fulfillment (Wilson and Loerzel 2004). Cross-selling should have a senior manager, who is accountable for cross-selling. There are two groups of goals for a cross-selling program. Short term and long term goals (Sandenaw 2009).

The short-term goals include getting started by the senior management (Sandenaw 2009). Senior management establishes the cross-selling champion and establishes cross-selling project description including specifications of measurement system for cross-selling, and ways to recognize change in company culture. Then the senior management should train salesmen to actually cross-sell. Also items to be cross-sold should be defined. Cross-selling goals should be included in the annual performance evaluations and decisions made what to do to those, who cannot perform. Cross-selling should be measured for recognition. The initial object for starting cross-selling should be established. Incentive bonuses can be paid monthly and recognized publicly. New employees should be selected based on their skills in cross-selling. Expectations should be set, trained, performance goals agreed and successes recognized (Sandenaw 2009).

The long-term goals include establishing formal training program on cross-selling as well as establishing organizational roles and responsibilities on cross-selling activities. Marketing customer information files should be used for identifying potential customers for cross-selling campaigns. Conducting customer research should identify products and services, which the most customers would be interested in. Customer research could utilize focus groups. Also customer events and seminars provide good ways to identify customers' life cycle needs and opportunities to implement cross-selling accordingly. Cross-selling is a strategic long-term goal with S.M.A.R.T. (refer to the acronym list) properties (Sandenaw 2009).

4.4 Cross-Selling Incentives

A successful cross-selling program includes a strong incentive system based on personal recognition and financial rewards (Boe 2009). Up-selling and

cross-selling big deals to existing customers and for service delivery organization should be rewarded (Wilson and Loerzel 2004).

Giddings introduces a case where a company called Nortel gives 15 % rebate for resellers if they meet cross-selling objectives. Their program includes training on offering cross-segment products and selling services for these products (Giddins 2006). Cross-selling incentives contain 'finder's fee' among employee benefits within agency businesses. Long-term incentives should keep top performers in-house and reward those, who continuously grow their sales books and their total value. Other recognition types of incentives include all sorts of reward prices (Cunningham 2007).

Health care personnel use web based self-service toolkit to enroll to work shifts eligible to point rewards (Lackey 2009). This lowers the administrative burden to plan for staffing of difficult shifts. Points reward system is spreading to other industries including banking sector. Rewards are something else than monetary payments, as is the method in airline mileage point systems. Point gifts are an easy way to show others that the job was well done. Especially when an employee can choose the reward. Monetary gifts do not work in a similar way to increase visible work pride. Lackey quotes an interviewee claiming that correctly used incentive system increases productivity from 25 % to 45 %. Toolkit based scheduling of shifts increases employee satisfaction as it enables 24 h accessibility to the scheduling system instead of paper work. Typically more points are given than are actually redeemed by the employees. Also point rewards are bought only when they are claimed and no unnecessary purchases are made. This further reduces costs when incentives are not paid in monetary units. Based on this, Lackey writes that several hospitals in Hawaii have managed to lower down human resources costs. Rewards are taxable. Points based rewards can be used in various situations as long as system is well defined and features eligible to the points communicated (Lackey 2009).

Three performance measure properties including risk, distortion and manipulation exist. Risk includes both controllable and uncontrollable risks, and ideally an employee has opportunities to react to the controllable risks that dominate the risk base. Distortion in turn falsifies the performance measurement by biasing performance indicators towards individual vital attributes on the costs of the other vital attributes. And manipulation is intentional adul-

teration of performance indicators. Good performance indicators are hard to manipulate (Gibbs et al. 2007).

Typically an incentive system consists of base salary together with up to three formula-driven bonuses and single discretionary bonus. Cooperation between units is encouraged when indicators were established in different departments or above manager's unit and has broader scope. Indicators within the units increase competition among the units. Also manipulation is lower when indicators are held in other departments. In general indicators are maintained properly. Performance incentives should be based on controllable risks and should avoid problems of noise, distortion and manipulations. If primary incentive system had flaws, there should be another secondary complementing incentive system so that the objectives of the incentives can be met (Gibbs et al. 2007).

4.5 Pricing Service Solutions

Services should be measured and controlled in order to identify waste, variances and inefficiencies and to eliminate them by utilizing best practices (Harmon et al. 2006). Measuring is done against own performance and internal benchmarks, because external benchmarks are poorly defined and they omit important details for comparison purposes. Real root causes of expenses should be identified and a broad cost measurement system should be in place so that cross-functional cost impacts in total costs could be better managed. Measuring variances between similar operating units can be difficult if the metrics is not defined in a similar way. Or where services are different, the metrics should take this into account. Service level agreements should be written to reflect the intent of the service. Client specific work environment impacting to the total costs of their service calls should be specified. The volume of work done for each client should be specified for metrics (Harmon et al. 2006).

Metrics should be so good that it serves both finance accounting and executive management purposes for improving productivity (Harmon et al. 2006). This can be achieved by implementing well structured deep and broad enough costs trees that also reveal cost drivers and help identify cross-functional impacts. Company overheads that are not directly impacting service productivity should be omitted from this metrics in order to identify the

cost drivers that can be tuned. When data is collected, the methods and processes of collections and reporting should be well defined and trained. Certain triggers for unusual data deviations should be defined. Implementation of data collection should be monitored in early stages in order to verify that collection happens correctly. This metrics should be institutionalized in organizations and compensations should become bound to it (Harmon et al. 2006).

Customer needs define solutions that are also designed to meet these needs (Roegner et al. 2001). Strong co-operation with customer and supplier ensure solutions that lack alternatives. This enables suppliers to gain premium prices from their solutions while customers save time and effort in integrating components by themselves. Pricing is dependent on the value that the solution brings to the customer. This value can be priced through a three steps process (Roegner et al. 2001: 95 - 96).

At first price range limits are defined over the standard level of the solution. The minimum level is defined according to the sum of the values of the individual solution elements added by meaningful margin to cover costs of overhead and costs of capital of supplier. The maximum price is got when net present value of the solution is calculated over its assumed use life taking into account the increases of revenue and level of cost savings to the customer, and compared this to the value brought by customer's legacy solution. This value is subtracted by customer's operating and capital costs over the period. Finally impacts from competitor's solution are taken into account to tune the maximum price of the solution to the correct level. Then the maximum price is adjusted downwards based on the business strategy of the supplier and taking into account customer's perception of risky investment on the new solution. The minimum price is lifted upwards based on the level of the technology excellence that the solution represents in the market. The third step is to customize the price point based on each individual customer. In this adjustment deep understanding about customer's business profile is essential (Roegner et al. 2001: 95 - 96).

Communication of the value and price of the solution should be addressed to the level of customer's management, which is enabled to make strategic decisions on new solution investments. Software centric solutions should be priced from Software value point of view so that the typical price erosion of

hardware will not have a negative effect on pricing structure. The actual method of pricing enforcement depends on how customers value the solutions over time. Types of pricing models vary from one-time payments at the time of purchase up to various kinds of periodic payments that can occur over time as value is created to the customer by the solution (Roegner et al. 2001).

5 DEVELOPMENT CHALLENGE ANALYSIS OF STAKEHOLDER GROUPS

The following clauses report external customer and internal stakeholder questionnaire results, key findings from the internal stakeholder interviews, and reports what kind of a draft value proposal was given to the external focus group for their evaluation for piloting purposes.

5.1 Questionnaires

The following sections report the results and conclusions from the external customer and internal stakeholder questionnaires.

5.1.1 Questionnaire Findings

30 responses from 16 countries were given. They represent global customer coverage as shown in Figure 4.

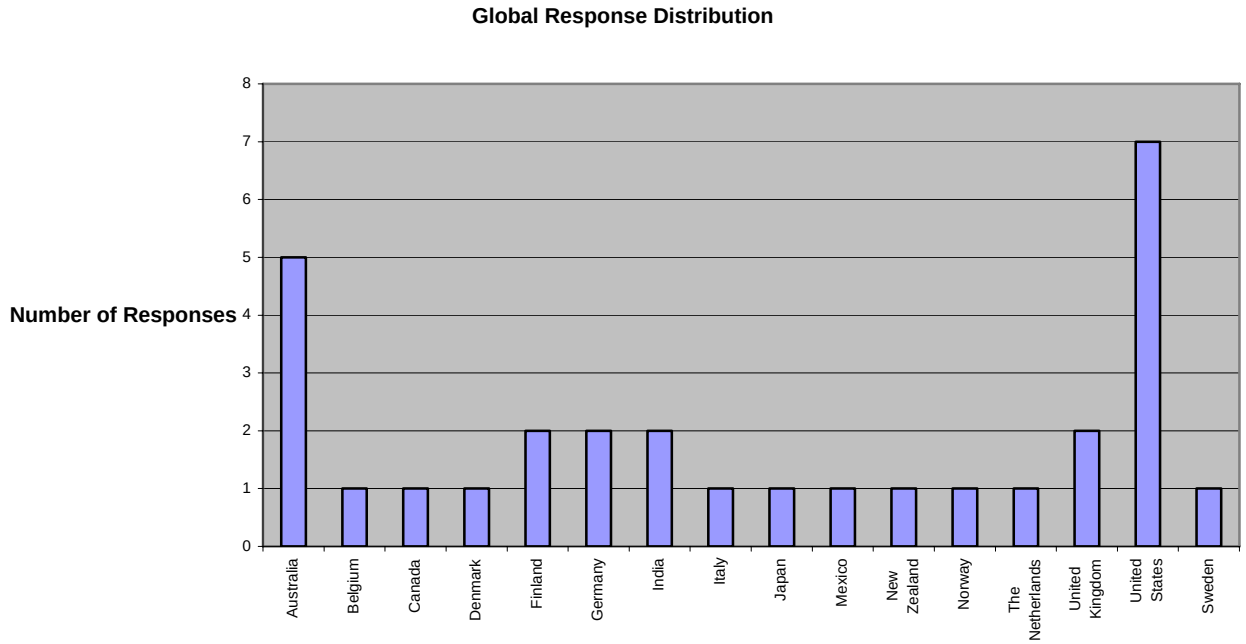

Figure 4. Country distribution (total number of responses is 30)

Most of the hospitals are publicly funded, as 23 responses came from publicly funded hospitals and only 7 responses came from private entities. Therefore most of the hospitals have over 100 patient beds and a significant number of patient monitors in use, as shown in Figure 5.

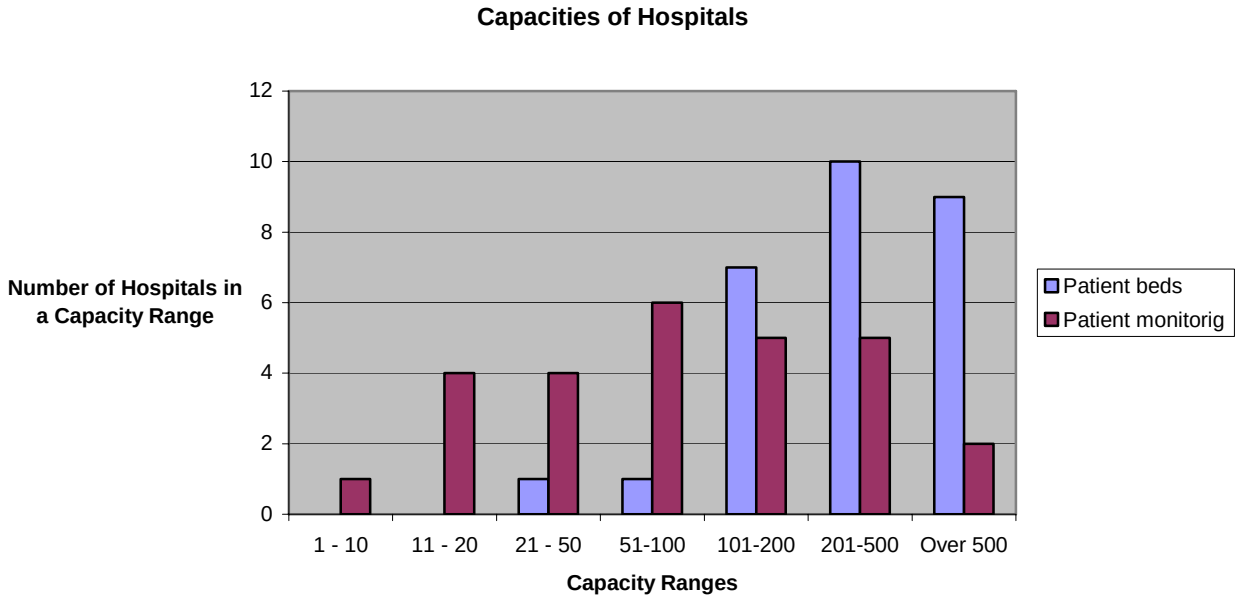

Figure 5. Capacities of hospitals

As Figure 5 shows, most respondents work in large hospitals. This is no surprising, because publicly funded entities are typically large organizations.

Respondents' professions are medical doctors and nurses, as shown in Figure 6.

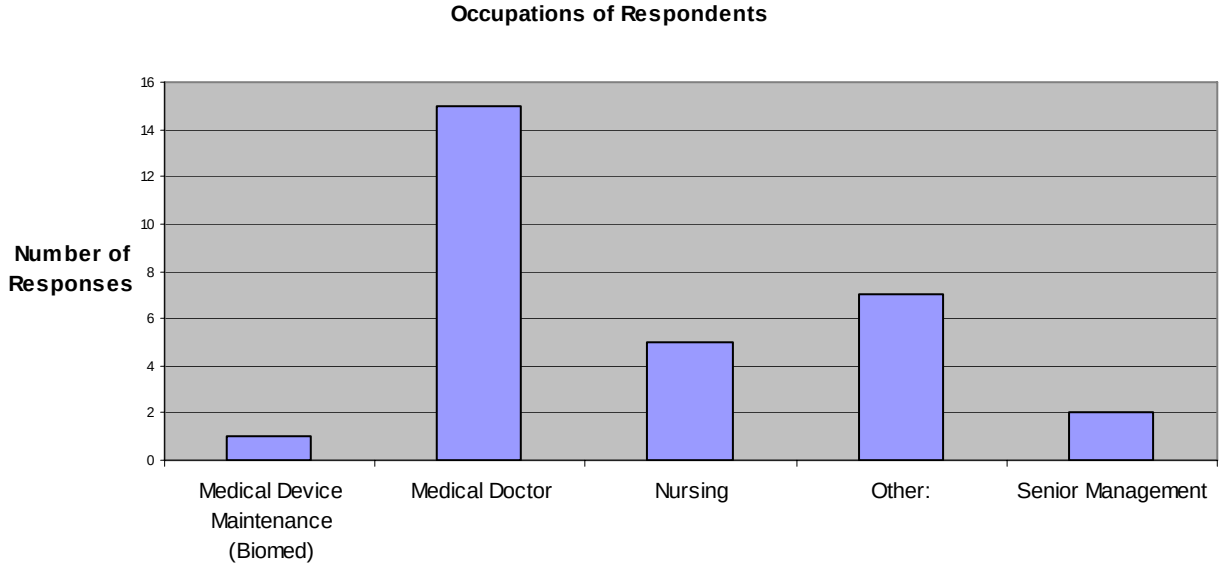

Figure 6. Occupational distribution of respondents

The other professions consist of one anesthetic manager and a technician, one registered nurse anesthetist (RNA) and two certified registered nurse anesthetists (CRNAs), and one representative from middle management of a hospital. One respondent is a representative from a marketing organization of the case company's corporate.

This means, as Figure 7 illustrates, that most of the respondents work in pre-operative units, operating rooms (OR) and post anesthesia care units (PACU). Respondents work also in intensive care units (ICU). Patient monitors are one of the key tool types in these units.

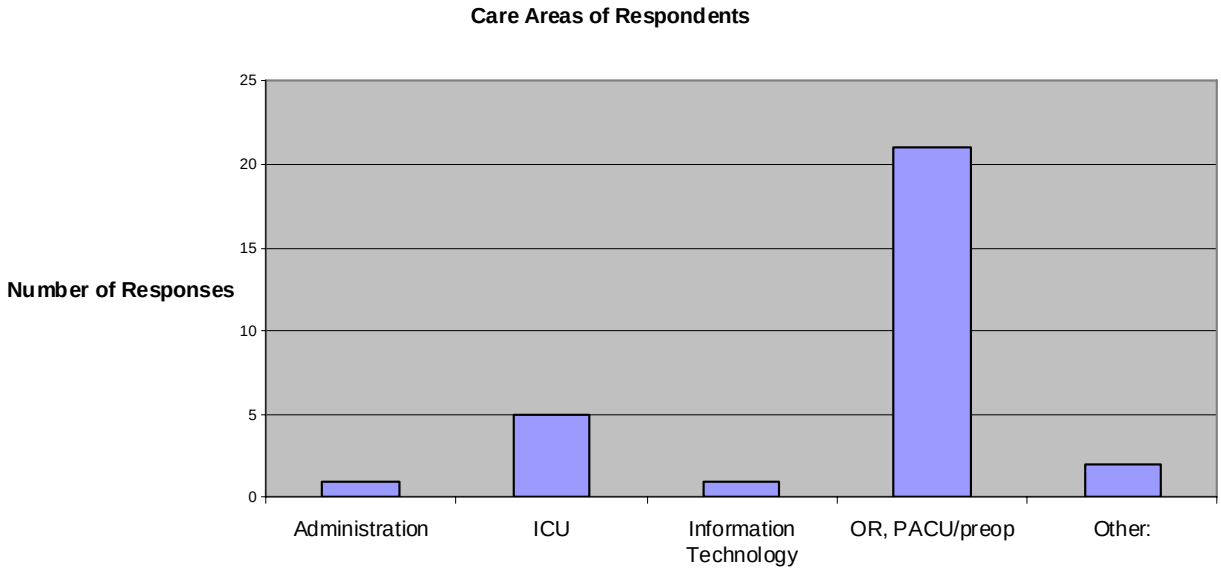

Figure 7. Distribution of care areas of respondents

The other care areas were defined as combination of both OR and ICU as well as one care area being anesthetic in general.

Figure 8 shows how external customer respondents understand the concept of "Continuous SW Upgrade Service".

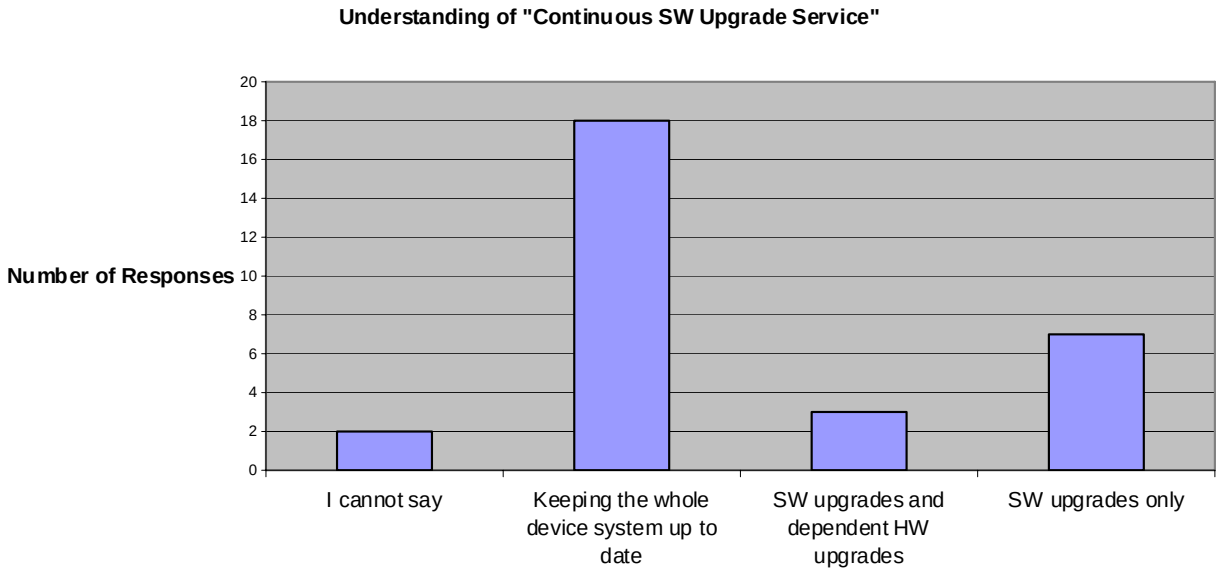

Figure 8. Distribution of understanding the concept "Continuous SW Upgrade Service" as understood by external customers

As Figure 8 shows, most respondents consider Continuous SW Upgrade Service as service where the whole device system is kept up to date. Minority of the respondents considers it as keeping only the SW up to date, and a few consider it as device specific service where both HW and SW are kept up to date.

There are 8 internal stakeholders, who responded to the internal stakeholder questionnaire as part of their interview.

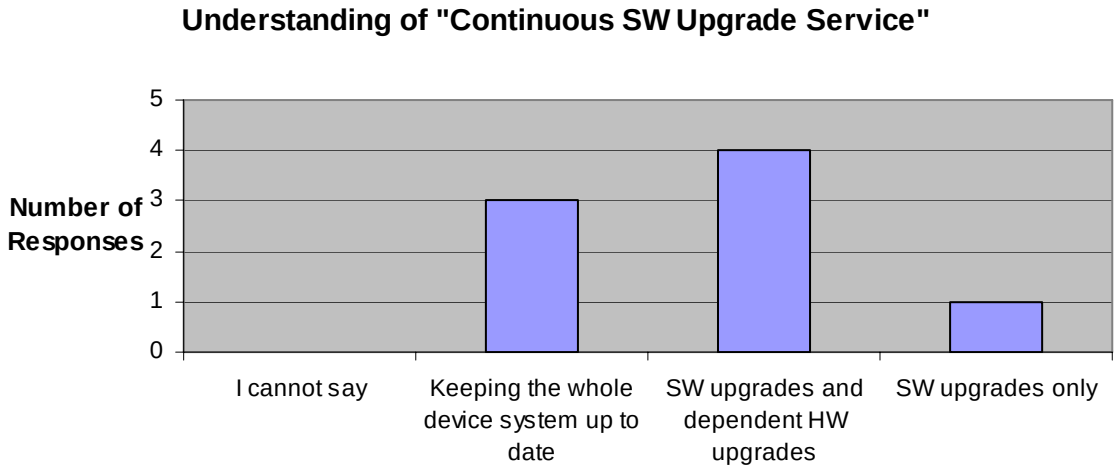

Figure 9. Distribution of understanding the concept "Continuous SW Upgrade Service" as understood by internal stakeholders

Figure 9 confirms that there are significant differences in how external customers and internal stakeholders understand this concept. While internal stakeholders consider service consisting of upgrades of dependent HW upgrades, the external customers consider the service covering keeping the entire device system up to date. Also external customers consider slightly more often that service would cover only SW upgrades.

Figure 10 and Figure 11 show that internal stakeholders are well in alignment with external customers as to how they tolerate heterogeneous software installations.

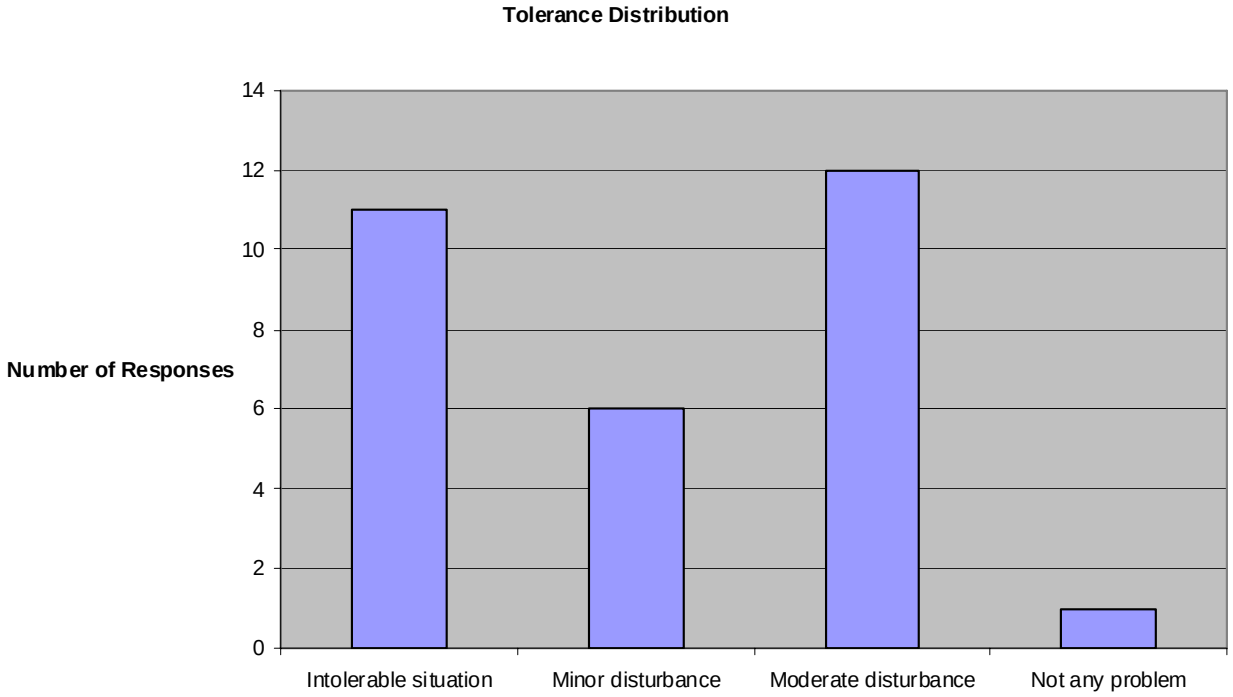

Figure 10. Distribution of external customers' tolerance to heterogeneous software installations on their equipment base

As illustrated in Figure 10, most of the external customers do not tolerate heterogeneous software installations.

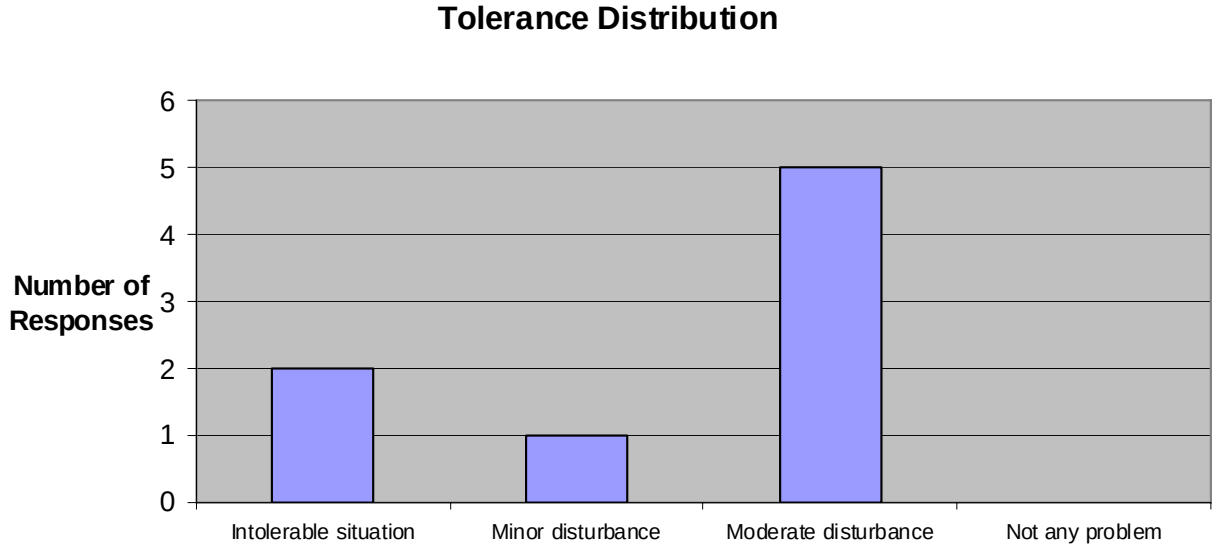

Figure 11. Distribution of internal stakeholders' understanding on external customers tolerance to heterogeneous software installations on their equipment base

As seen in Figure 11, internal stakeholders consider that heterogeneous software installations would cause only moderate disturbance to the customers.

Figure 12 and Figure 13 show that internal stakeholders are quite well in alignment with external customers regarding service attributes that are considered important. Alignment with external customers means that the value proposition for the service concept can be designed without major concerns about priorities of service attributes.

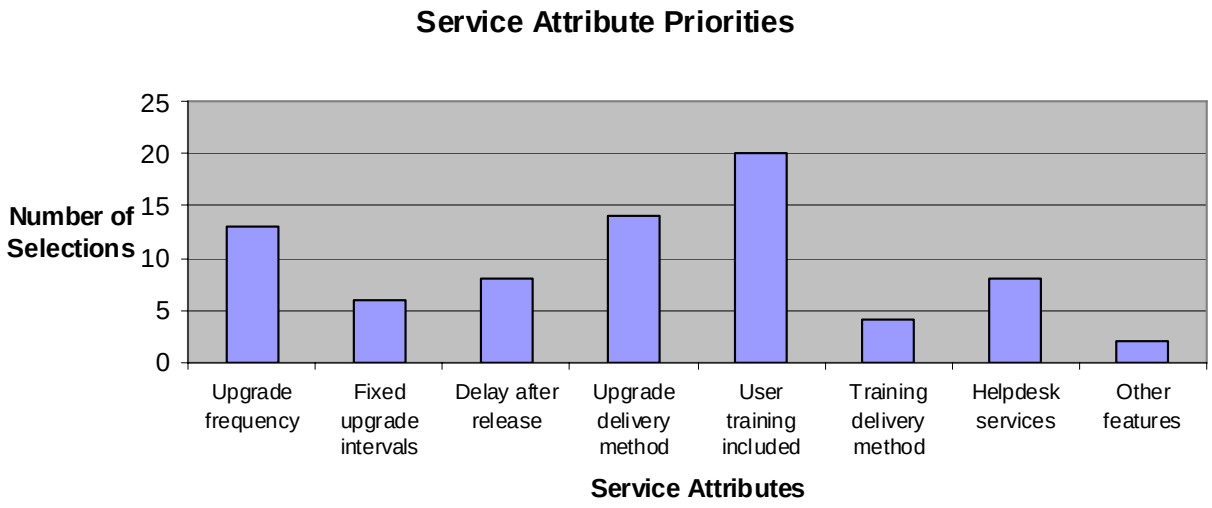

Figure 12. Distribution of external customers' priorities over certain service attributes

Figure 12 shows that external customers consider user training, upgrade frequency and delivery methods as important service attributes.

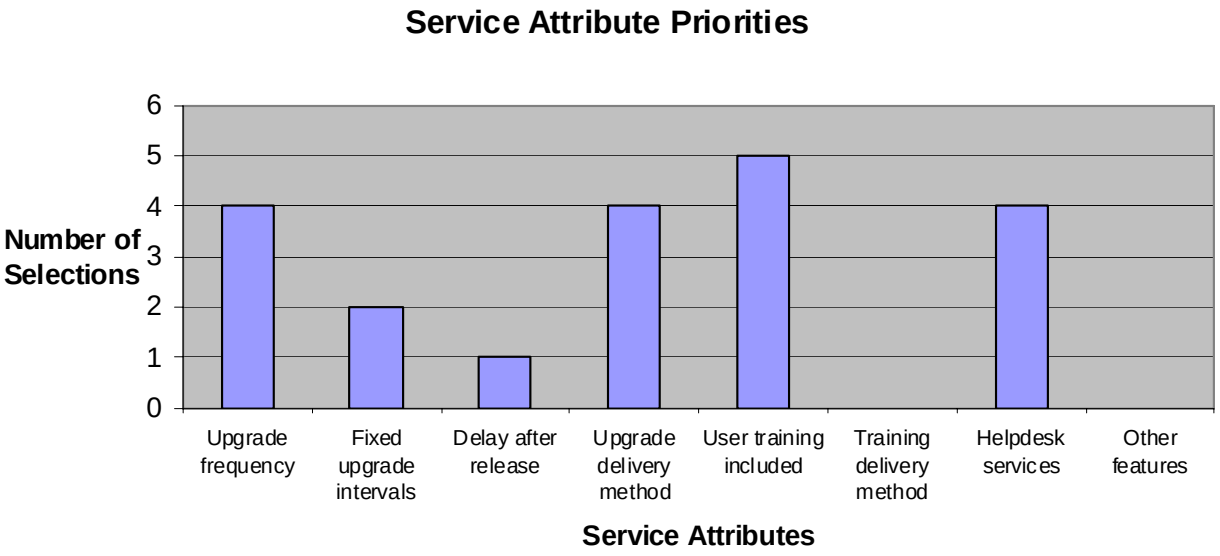

Figure 13. Distribution of internal stakeholders' understanding on external customers priorities over certain service attributes

Figure 13 shows that internal stakeholders do not pay attention to the delivery method of user training.

One of the external customer respondents indicated a possibility to roll back the software version to the older version as an other service attribute in case the new release had such a bug that bug fixes could not be waited for. The other external customer respondent indicated that none of these attributes were important to them. None of the internal stakeholders considered training delivery methods being important to the external customers and none of them identified any other important service attributes that external customer may find important.

There is just one biomed respondent, who answers to the procurement specific questions. Due to this, a biomed not being a procurement professional and only one viewpoint received, analysis of the procurement specific questions is excluded from this study. Two of the external customer respondents work for senior management. One of them indicated that they have separate personnel for maintaining the information technology (IT) system and for maintaining medical devices. They both responded that they could utilize biomeds well even if the medical device software is remotely upgraded. Both also responded that their hospital quality system is based on accreditation.

One of the respondents from Germany indicated that it is Kooperation für Transparenz und Qualität im Krankenhaus (KTQ).

Approximately one third of hospitals have accredited themselves and most of them have accreditation from their national accreditation system KTQ. KTQ system addresses the areas of patient orientation, staff orientation, safety, management of information, governance, and quality management (Nichterlein and Hilgenfeld 2010).

The questionnaires for the external customers and internal stakeholders have three open ended questions where respondents can provide free input. These questions enquire the value of the service, differentiation factors and any other ideas and comments. The responses from external customers and internal stakeholders can be grouped into themes, as shown in the following mind map figures where samples from responses are also given. Figure 14 shows what external customers value in the service.

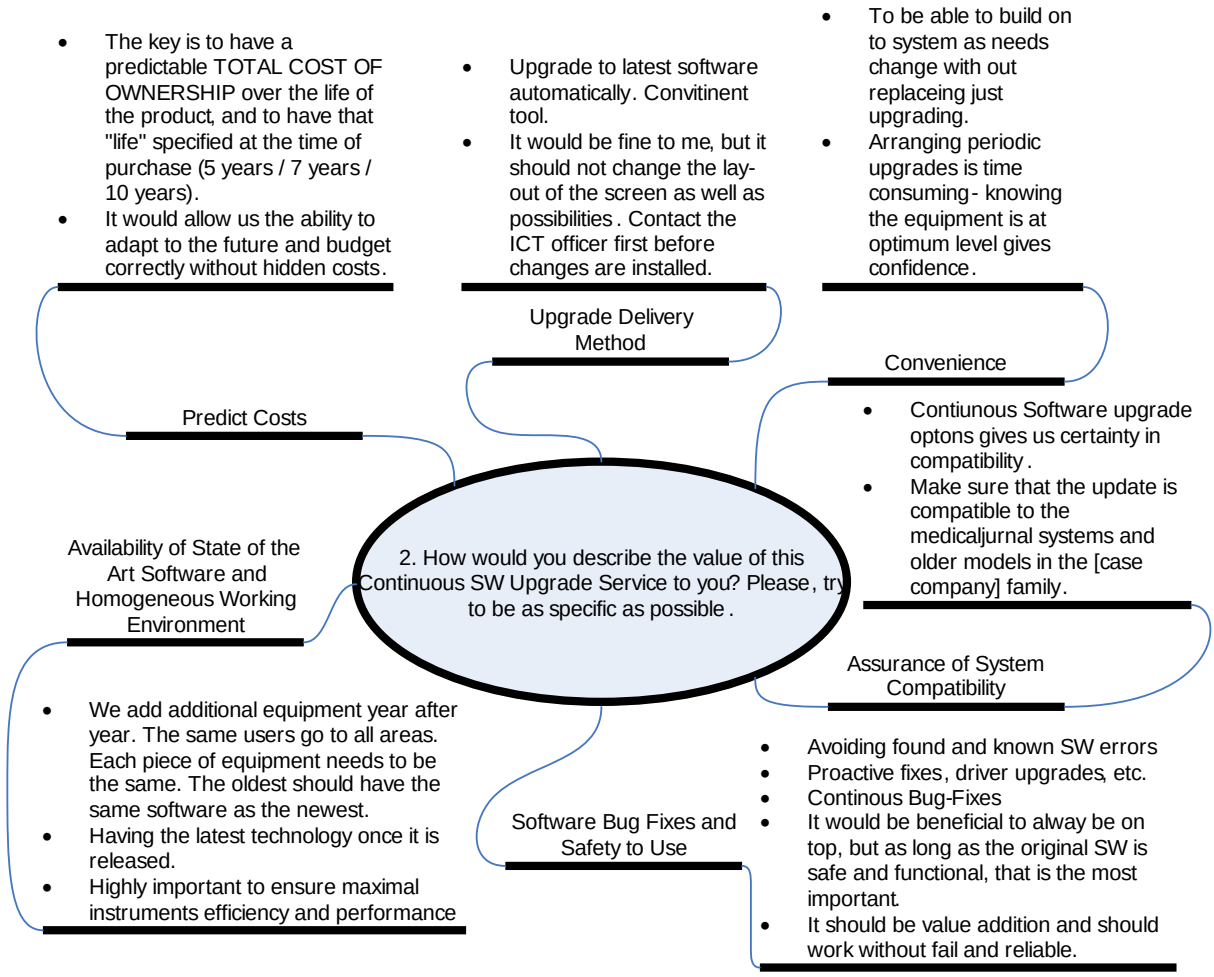

Figure 14. Value of the service to the external customers

Software (SW) bug fixes and safety to use software in clinical processes, availability of state of the art software and homogeneous working environment across devices, assurance of system compatibility, convenience with software upgrade delivery method specific issues and with predicting costs are important values to the external customers. It is worth noticing that customers can express their ideas by using common concepts related to business life, such as “total cost of ownership”. Three short responses evidence that the service is seen more important than non-important.

Figure 15 shows how internal stakeholders consider the value from the service.

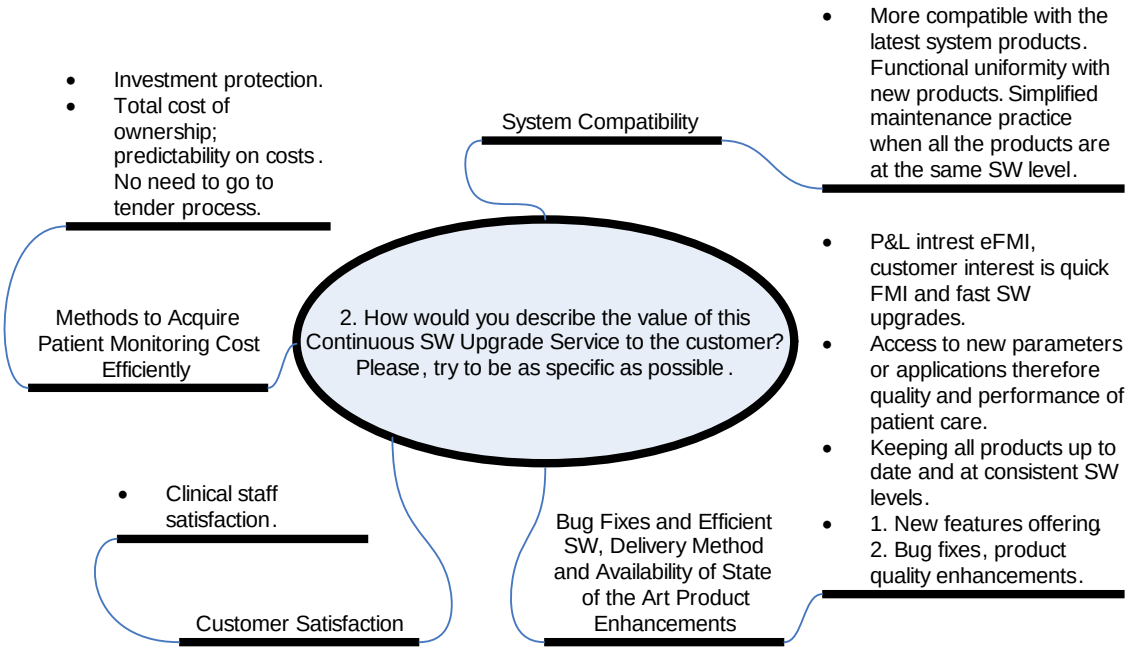

Figure 15. Value of the service to the external customers as understood by internal stakeholders

Figure 15 shows that bug fixes, efficient SW delivery methods, state of the art product enhancements, system compatibility, acquiring patient monitoring cost efficiently, and customer satisfaction are seen as results from the value proposition.

Figure 16 shows what ideas external customers suggest for differentiation from competition.

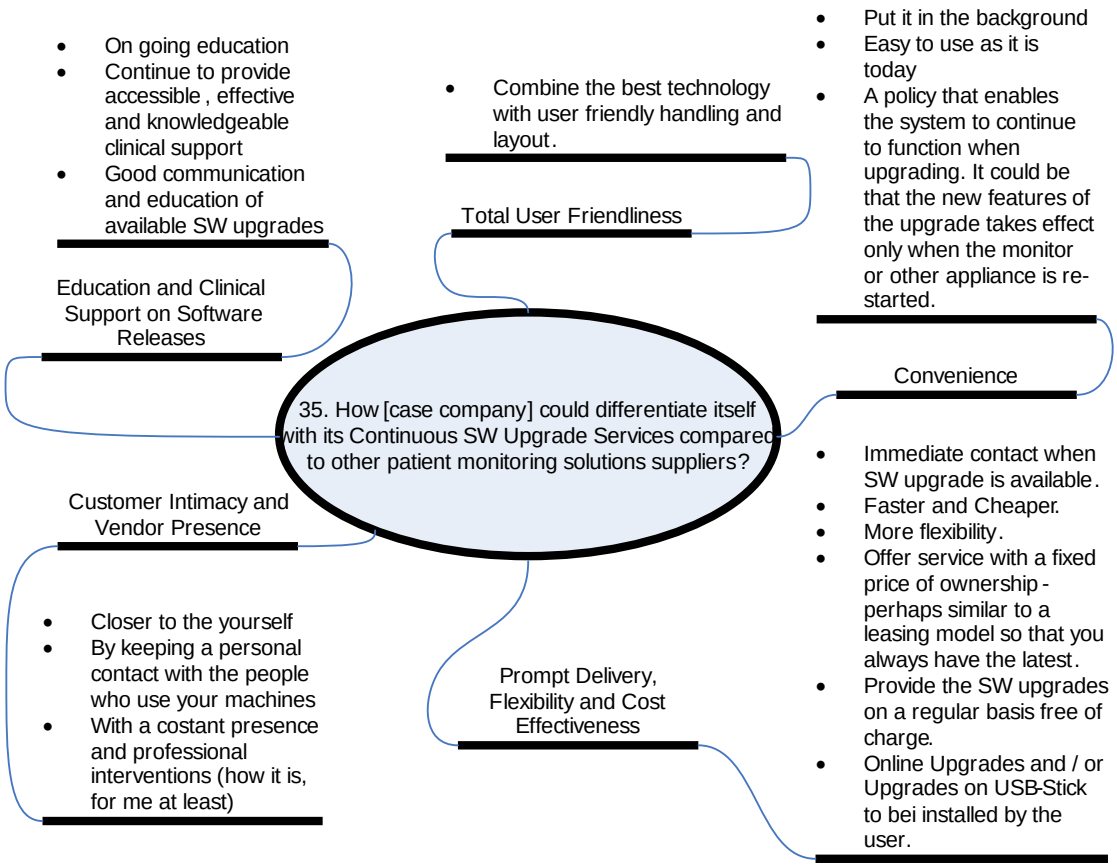

Figure 16. External customers' suggestions for differentiation

As illustrated in Figure 16 prompt deliveries, flexibility and convenience can form differentiation from competition. Also total user friendliness of devices, customer training and clinical support on software releases are considered differentiating from competition. Customer intimacy and vendor presence, and cost effectiveness of new software releases are popular differentiator factors by external customers. Software upgrades are not to come into effect when a patient is attached to the device, but upgrade process can still be functioning background. One of the respondents was a case company employee and provided insight to the business potential of the service to the case company.

The opinions of respondents, when asked how they consider differentiation factors from competition, are as shown in Figure 17.

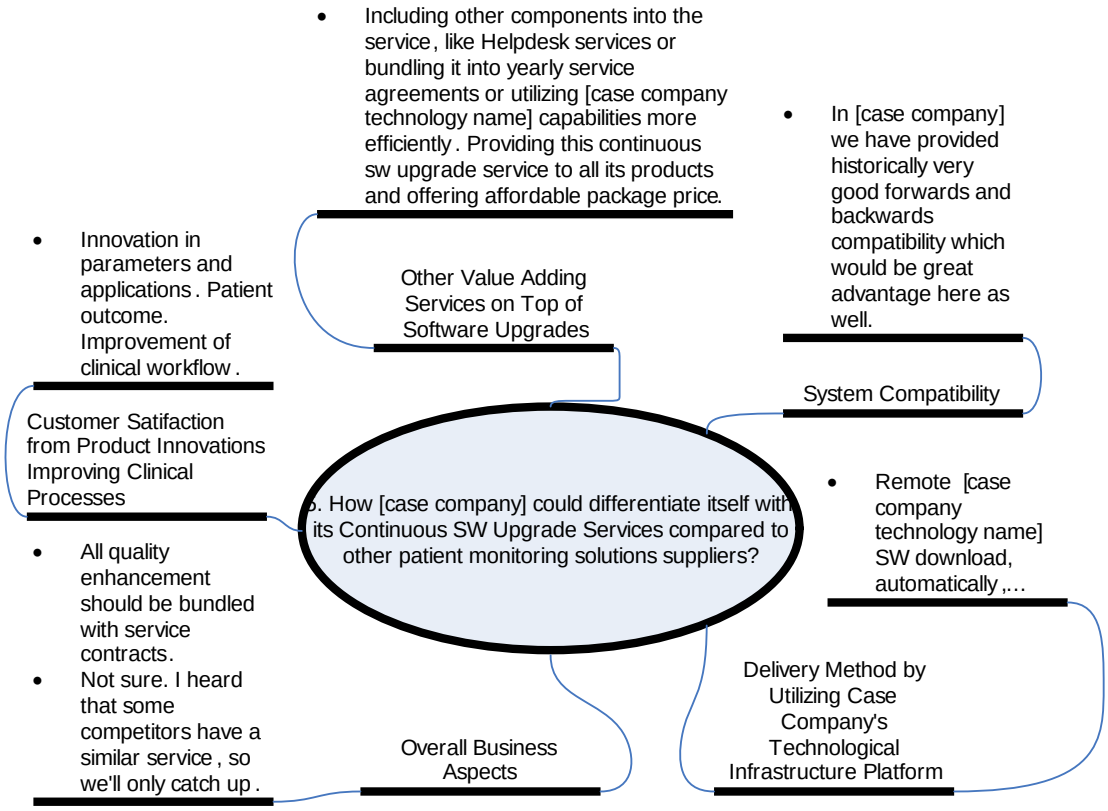

Figure 17. Internal stakeholders' suggestions for differentiation

Figure 17 shows that the delivery method by utilizing the case company's technological infrastructure platform and system compatibility is considered differentiating from competition. Also customer satisfaction from product innovations improving clinical processes and other value adding services on top of software upgrades are seen differentiating factors by the internal stakeholders. Two responses do not provide ideas for differentiation, but consider overall business aspects.

External customers also provide some other ideas on the desired service, as suggested in Figure 18.

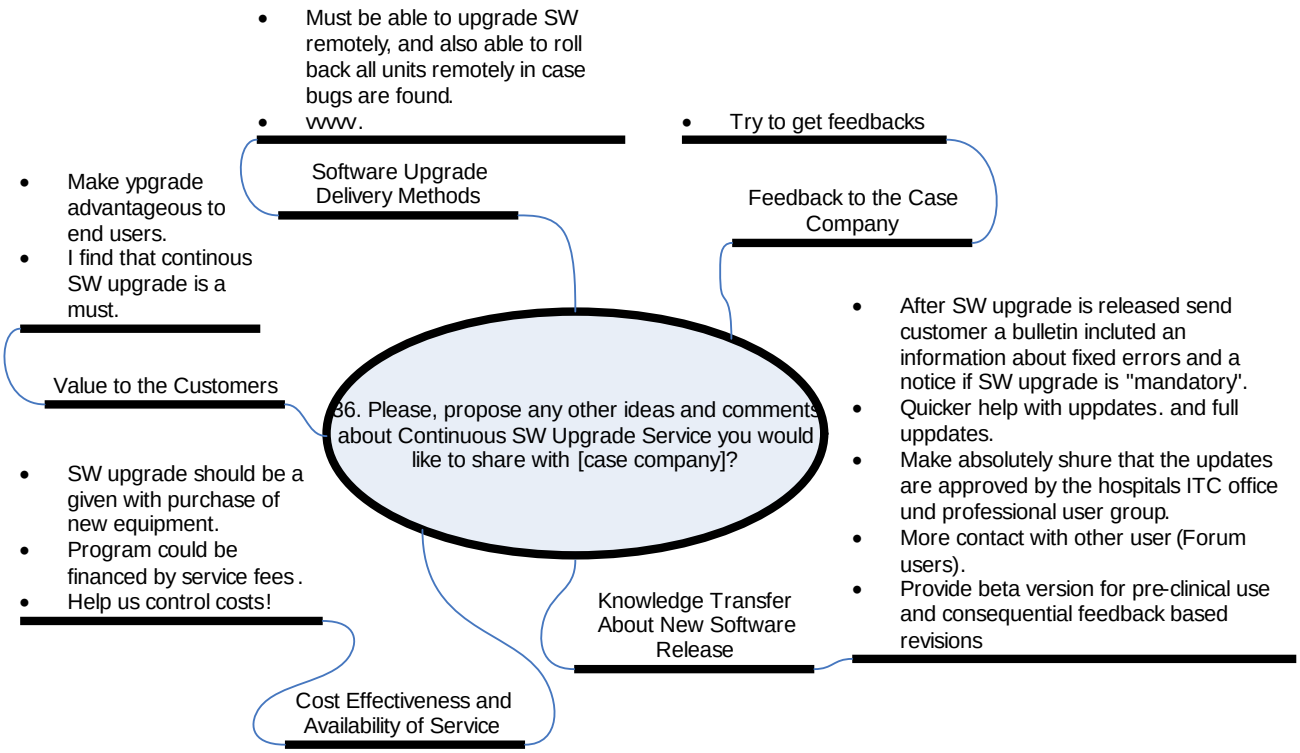

Figure 18. External customers' other ideas on the service

Figure 18 shows that knowledge transfer about new software releases, software upgrade preauthorization by customers, and possibility to provide feedback to the case company on the release are external customers' other ideas for the service concept attributes. Also external customers prefer the case company to receive feedback in general. Software upgrade delivery methods, cost effectiveness, and availability of service are other ideas from external customers. External customers feel that a roll back possibility is necessary. Figure 19 summarizes what other ideas internal stakeholders have on the service.

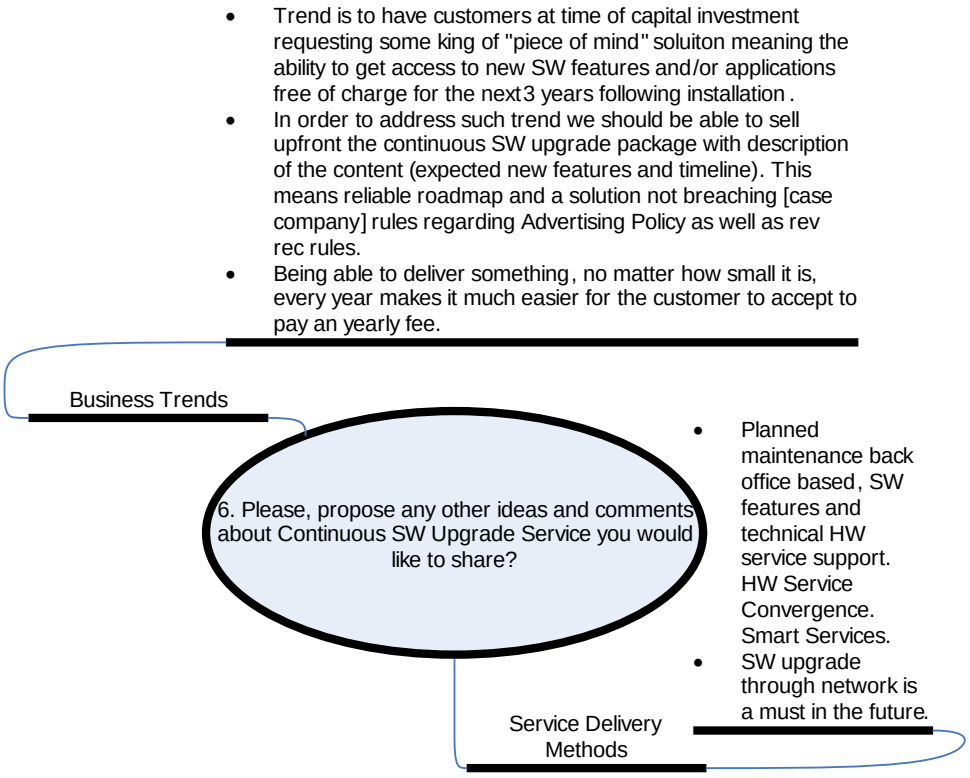

Figure 19. Internal stakeholders' other ideas on the service

As shown in Figure 19 service delivery methods are subjects for other ideas from internal stakeholders. Internal stakeholders also provide considerations about the business trends.

5.1.2 Conclusions from Questionnaires

Customers regard the software upgrade service promoting product and patient safety. Devices within health care areas should be at a homogeneous state of the art condition. Software releases should be frequent and delivered promptly to the customers. Software upgrades should be accompanied with good release communication and user training. Users should be provided with a possibility to preauthorize each software upgrade. In case the software release contains disturbing bugs, users should be able to roll back the devices to the previous software release version until the case company can provide bug fix release to the software. Users would like to provide feedback to the case company, which should also be more present and available to the customers. Users would like to receive the service as part of a new device purchase, as part of a leasing model or as part of an overall

service contract. Software upgrades should be delivered via Internet or by using any other convenient method.

The case company internal stakeholders address slightly more strongly technological capabilities to deliver software bug fixes and new software releases than the external customers. Many consider delivering new software features through the software upgrade service. Some consider even added value services on top of software upgrades. Major discrepancies cannot be identified between comprehensions of the external customers and case company internal stakeholders on the “Continuous SW Upgrade Service”.

5.2 Internal Stakeholder Interviews

Group interviews were carried out with several experts, managers and leaders. A complete interview diary is given in Appendix 1. Each group consisted of either one or two persons. When there were two persons in a group, they both represented same subject area and they formed their opinions, viewpoints and statements together. Since each group manages different subjects, the interviews focused on the value proposition and its facilitation prerequisites from their organizational points of view.

5.2.1 Interview Findings

The following clauses paraphrase the interview logs and quote specific statements of the interviewees.

Market Research and Customer Feedback

Market research is project-specific at segment level for large programs where voices of customer surveys are carried out. Research road maps are not commonly utilized, because there are no global processes that would require implementing research road maps, but a case company project outlines usage of research road maps. The case company specific marketing tool covers calibrate, explore, create, organize and realize (CECOR) framework. Information gaps can be analyzed for research needs in the tool (Group B).

There are eNPS Surveys (Group A, Group B, Group D and Group F) and complaints (Group A) and spontaneous feedback from customers to the onsite personnel performing marketing, sales or installation activities (Group B,

Group D), but this spontaneous information does not come to upstream marketing based on any formal process. Information flow of customer feedback upwards is based on discretion of sales and service organizations in different countries. Regular customer feedback is collected at exhibitions and fairs by utilizing surveys and questionnaires. Customers are approached actively for inputs during new product introduction (NPI) programs. The global customer complaint system also usually provides information that can be considered being more customer feedback type than complaint type. The separate customer advisor board conducts occasional surveys, which they analyze (Group B).

There are no specific key performance indicators (KPI) in use other than the overall NPS to evaluate the success of a product or service (Group B). Service poles conduct customer satisfaction opportunity (CSO) cases based on questionnaires. Customer loyalty leaders review the CSO cases and lead the communication towards the make center (Group A). CSO has a list of hot issues and they find resources to achieve resolution and to keep customer satisfied (Group F).

Sales Organization and Its Challenges

The case company internal rules complicate sales of the demanded extended warranties when customers are looking for the total cost of ownership with their P&L's products, as mentioned in one of the interviews:

> The contribution of this organization is currently measured through sales figures, but it should be measured through the success of overall marketing strategy that focuses on the holistic customer needs and experience (Group C).

Some percentage of the net price is to be taken off to the service warranty and transferred to the service organization. Currently this price is invisible to the customer, who does not see the price structure of the average selling price (ASP). If the price structure were visible to the customer, sales would become more difficult, because the extended service price is much more expensive than that of the competitors. In order to win a deal ASP should be lowered and this would decrease the sales organization's revenue figures. In Europe, Middle East and Africa (EMEA), Western European market is a replacement market in majority. In Middle East and Africa, new hospitals are built and there is an expansion of the number of monitors. The situation is

similar in Eastern Europe but the volume is lower. There is no direct relationship between the price of the extended warranty and the market saturation, as group C point out.

> In Western Europe, our offering for extended warranty is simply out of range vs. competition. Device sales are replacing sales for hospitals and demanded growth from service organization is not possible without increasing price of spare parts (Group C).

NPI are challenging to the sales organization to manage, because of the poor level of predictability of release schedules.

> Product release is enough to be something small, but something new that expresses progress in product portfolio to the customers (Group C).

The frequency of new product releases is not so critical an attribute compared to the predictability of new product releases schedule wise (Group C).

Performance Measurement Systems

Direct regions sales persons are measured for all their outcomes, orders, sales and margins (Group C). Sales targets form measurement reference (Group F). Their bonuses are related to modalities and products. Zone sales managers sell to distributors and they must cover all P&L and modality offerings of devices, therefore the zone sales persons are differently measured (Group C).

There exists a reward policy (Group C). The case company wide rewarding is challenging, because of local country regulations, such as tax regulations. Other performance metrics exist including rewards that can be for example training courses. Reward attractiveness is very subjective and some persons may not find rewards attractive. Recognition programs exist, too. The case company's reward program contains both monetary and non-monetary elements and it is referral-based system. Awards contain recognitions that may contain also a monetary element, or they are just public recognitions without any kinds of actual rewards. Award programs are very culture dependent with respect to their public recognition practices. Employees in one country hesitate public recognitions while in some other countries public recognitions are desired (Group I).

Service Offerings

There exists a range of service contracts based on customer needs. Service contracts are different in every country, based on the product. Distributors are authorized service providers and in some countries they can distribute case company services, too (Group F). Publicly funded customers may find it difficult to purchase leasing services from capital budget. They need to own the devices. For others the leasing model could be suitable (Group H). In order to control service prices, variable cost productivity programs are executed on products and service processes (Group F). Currently ~40 % of field engineers' work time is consumed to field modification instructions (FMI). This percentage does not apply to the whole case company and all poles or regions (Group G). Prospects are biomeds in large hospitals, and hospital managers or finance managers as well as departments directly (Groups F), such as IT people and nurses (Group A) in cases of small hospitals (Group F).

Challenges in Proposing Added Value

There should be a clear understanding how this kind of value proposition can be offered to the customers in total customer experience oriented ways and would at the same time satisfy each organization's performance needs (Group C). As group A states this same consideration.

> Connectivity in USA is more popular, but in EMEA customers seek for more added value before they are willing to pay for remote device access service. Connectivity in turn is essential to minimize recall costs and cost savings can be significant mainly through electrical field modification instructions (eFMI) (Group A).

Therefore measurement systems of related functions and organizations should be aligned to support this "one voice and face to the customer" approach. Also customer device configuration should be managed so that unexpected surprises with device inter-compatibilities requiring expensive unplanned device upgrades would not appear. Therefore offering this kind of value proposition to one device type only is not feasible due to this inherent business risk, if the whole system configuration at customer's installed base was not known and managed (Group C).

P&L is in a hard situation to provide service contracts, because devices are more like commodity devices, of which the availability can be ensured through redundant device units compared to the neighboring P&L's devices,

of which the device unit level availability is critical to the customer, as group F points out.

> P&L should be able to promote value in service contracts, something biomeds cannot do themselves, e.g. biomeds cannot access SW upgrades (Group F).

Not all competitors have remote serviceability capability. Though, European customers look for clinical value from the case company's remote service technology platform (Group F).

> Regarding [case company's remote service technology platform], we could have done better job in communication the customer value. Customer's still see [case company's remote service technology platform] often as a cost saving tool for [case company], instead of the additional value it gives to them, such as better up-time, proactive maintenance, better quality technical and clinical support, faster and better complaint handling, higher first-time fix etc (interviewee P. T.).

> The other challenges in getting higher connectivity rate (besides of value proposition) include, but are not limited to the following issues. You need two network drops for patient monitors, biomed community is concerned of "losing their jobs", "general security concerns", and in EMEA there is some EU legislation that patient data should not "cross the borders". No clear strategy how we offer [case company's remote service technology platform] for the customers. For my understanding, currently we provide it free of charge during warranty period for any customer that accepts it. After warranty period it is provided for customers who has a service contract with [case company]. The problem is currently that our service contract capture is very low (Group G, Initials P. T.).

Based on the responses from the interviewees there is not a clear way to evidence to the customer the added value from the remote service capability. Customers look for value that they consider important.

Integrated and Open Service Innovation

Points about the feedback systems are given in the interviews:

> This [customer feedback for innovation] is a challenge. Does not work well, because upstream service engineering does not hear what customers advocate to downstream service (Group A).

> Normal customer feedback does not typically provide real innovative ideas (Group B).

The customer advisor board conducts research for gaining customer origin innovations together with leaders of customers that can provide out-of-box thinking and can provide insight about customer needs at a larger context (Group B). eNPS scores interaction with the case company. There are direct questions how they consider case company products. A review of the comments follows. Interesting feedback becomes included in service requirements for products. The marketing organization should primarily drive customer feedback (Group F).

Service engineering maintains service technology road maps that plan technical service features wrapped into various independent service packages. In general the service engineering function is focused on service technologies rather than developing overall holistic customer experience services (Group A). The current service innovation culture within P&L is more reactive and focusing on cost savings than proactive and focusing on real value propositions to customers (Group G).

> Service organization is a business unit of its own right. It could be the instance that manages required technology, manufacturing and business model innovations for service innovations (Group B).
>
> There is no kind of body that would facilitate service innovations that would require product, process and business model innovations that would bring up convergence to offer the service innovation (Group C).
>
> Strategic service leaders' role is to capture service innovations. Their job is to capture opportunities on product features and drive them into NPIs (Group F).

It can be interpreted from the responses that a holistic service innovation is not clearly organized in the case company. Also inputs to the innovation process come mainly from polling types of methods, and spontaneous feedback from the ends users of products and services is not well processed.

Cross-Selling Culture

The sales organization sets the pricing of products for Europe, Middle East and Africa (EMEA) (Group C). Hardware, software and all options are priced separately (Group B). Service price varies country by country. Service price is a percentage of sales prices, typically 5-10 % of ASP. Labor based pricing is used for small contracts (Group F).

> Sales organization [should own the value proposition], because it provides user training as part of sales of new devices. It facilitates also some other user support. Though, installation and helpdesk type of services are provided by the service delivery organization (Group C).

No cross-selling of services exists (Group C, Group F). In general there are no established cross-selling culture, processes nor management that would align different organizations and their offerings for the customer's benefit. There exists a strong concern that when something is cross-sold binding human resources, it is away from the organization's own revenue contribution with respect to its own performance seen in the measurement metrics. For example customer relationship management systems (CRM), which would facilitate cross-selling processes, are not in use within P&L, and not even outside the P&L (Group C).

Separate representatives from the sales organization and service organization represent their own organizations in the sales meetings. These two sales organizations are driven by different performance metrics. Region managers coordinate total case company corporate offerings to customers and they utilize representatives from relevant organizations (Group F). A service sales leader (SSL) in each country is responsible for selling services. He has his own sales organization in the country. Integration is progressing and attempts to break out from silos exist (Group F). The service sales organization was split from the service delivery organization a year ago. Service sales sells services from multiple P&Ls. Single face to customers approach is under development. Sales organizations and their processes and practices vary based on poles, regions and zones (Group I). Customer information is maintained in countries and no global visibility is available. Information is available, but requires effort. Electrical device history record (eDHR) brings device specific information available to the upstream marketing, but does not hold information about any service agreements made with individual customers (Group B).

Software Development Process

The software (SW) development organization consists of a program manager (PM), who creates and supervises programs, lead program integrator (LPI), who is responsible for the program schedule and organization, lead system designer (LSD), who is responsible for contents and quality of SW,

and lead SW architect (LSA), who outlines the architecture of SW. One PM can have multiple programs simultaneously under control, but PMs do LPI types of tasks (Group D).

New product introductions (NPI) are major releases that impact the design of user manuals. User manual creation processes and other later stage processes such as verification can slow down NPI releases to such an extent that they can only occur twice per year at the most, but in practice only one release per year for NPIs is the current goal. Maintenance releases typically fix customer problems and lead to field modification instructions (FMI). Service packs can contain small feature enhancements based on customer feedback. Verification and program management consume a significant amount of resources compared to the product enhancement achieved (Group D).

> The upgrade service should manage the latent features that can be activated for customers by license codes (Group D).

For example a monitor has both Intensive Care Unit (ICU) and anesthesia features installed, but either one is activated based on which care area the monitor is intended to. A SW can have up to 20 individual features that are packed to 5 feature packages. These packages contain certain features while some features are not possible in certain packages (Group D).

Software Release

Bulletins go downstream (Group A). SW release bulletin is distributed to poles, which forward them to the countries in their pole. Then release information is communicated to the customers under discretion of each sales channel. USA demands release notes even about FMI. EMEA in turn does not require them, because release notes should be translated to each language in EMEA (Group B). New clinical parameters are not to be activated before users are trained, as this is the rule (Group A).

> Current [release] frequency too long! Cannot continue like this (Group A).

Spare parts are consumed by manufacturing, because time schedules of NPI releases prolong. Predictable time schedules are needed and it does not matter whether the schedule is short-term or long-term, it should be predictable (Group A). Focusing on improving certain features at a time would

shorten the lead time. Localization processes should be trimmed, because they remain as the last process. Platforming requires successive verification for various products, which makes "one NPI date per year" difficult to implement. Agile methods are used in certain SW development phases. Scrum methods are used between [milestones] M1 and M2, for example sprints and burn down charts are used and max 5 days long tasks are managed within teams (Group D).

> Challenges are the changing requirements during design execution (Group D).

This is due to a too detailed requirements specification that must be changed, because of lack of understanding of realism of the original detailed requirements. Providing better status communication and visibility with respect to burn down charts, bug charts and verification charts in order to promote mental institutionalization of current release contents and in order to ensure execution peace could enhance current agile methods (Group D).

System Compatibility

SW upgrades may at a certain point lead to serious unplanned network compatibility issues if compatibility issues are not planned in product design (Group H). The case company's remote service technology platform does not work with certain legacy network technology and those customers need to update their network infrastructure (Group A). Currently a separate network drop is always needed. Devices cannot be remotely accessed via mission critical network (Group G).

> In the future we will have single-wire solution, then both [case company product name] and [case company product name] will be transferred via the same network drop (Group G).

Even if hardware (HW) changes, Linux based systems can run on older HW. SW runs at the limit of the central processing unit (CPU) in a certain product of the case company. The case company's network is peer-to-peer architecture utilizing transfer control protocol/internet protocol where all devices must conform to the protocols in order to be compatible. A server-based SW should know what kind of HW is attached to the network. In general HW lifetime expectance versus SW compatibility backwards lifetime requirement should be decided for enabling total service solution. This would involve schedule for periodical HW renewal of installed base. Original equipment

manufacturer (OEM) CPU boards will be in use in future products and this will make HW lifetime management easier (Group D).

Software Installations

Biomed activates SW through device in-built service user interface. New SW upgrades will introduce more robust activation methods that can be administrated by a remote service desk without any intervention by Biomeds (Group A). Roll back is available in device memories for recovering from possible installation failures. This hidden readiness could be utilized for the roll back feature (Group D).

> Roll back of a SW is possible through service interface by biomed credentials. At least with monitors [case company product name] and [case company product name], but I am not sure about server products. Software storage may become available at back-office. Yes, hopefully in the future (Group G).

Company Wide Customer Portal Program

There is a customer portal program that addresses all products (Group F). The customer portal is the address www.[case company].com that is a generic interface. New features will be introduced and facilitate various kinds of services, for example spare parts store, problems solving databases, frequently asked questions (FAQ), etc. Some requirements origin from a legacy data source system that is dedicated to field engineers and distributors. The basic feature of the customer portal is to allow customers to browse relevant information about products. Registered users can customize the pages for themselves. Product documentation is in scope for the upcoming release. The customer portal provides country based features and profiles (Group H).

> Case company delivers currently less than expected. There is no consensus on how to attach a price tag to customer portal. A possible strategy would be to embed it in the price of service contract for premium customers/services. Profiles for premium customers have been established. There is an idea to provide enrollment to training and education. SW delivery is going to be out of scope for now (Group H).

Customer Education and Other Support

Service-training certification becomes important and requires certified trainers, who are professional trainers with subject matter expertise (Group A).

> Professional training developers are needed for development of self-study packages, too (Group A).

> Currently trainers are pedagogically and clinically trained and pedagogically and clinically competent persons prepare the training modules (Group G).

The remote device access platform enables to see the device's service data for P&L products at back-office. Back-office can provide technical support to use devices, but not real clinical support. For example simple configuration problems are typically reasons for wrong functionality of a product (Group G).

> Back-office should be interpreted broadly. It does not only refer to the remote online center, but to any [case company] employee, who connects to a customer unit remote through Internet via the back-office server, including field engineers, technical support, engineering etc. (Group G).

An auto-update feature or manual update may become possible (Group G). The remote device access platform will enable remote activation of SW (Group F). Also demo use with temporary licenses may become possible through remote device access. Interviewees are not sure what all implies (Group G):

> If this means that a user may activate temporary licenses just by browsing the device menus, the device then connects to back office and fetches the needed activation codes, etc., then this could be possible, but nobody knows for sure (Group G).

Remote device access shows whether a device is on-line or off-line. Biomeds fear loosing their jobs due to automated SW download and activation. They fear remote service in general, not just the remote SW management (Group G).

Manuals, configuration notes and self-study packages can be delivered through the remote device access. Today specific files can be transferred, so it means the technology exists, but it does not mean that all mentioned above will become reality automatically (Group G).

> Software can be pushed on the device, but there might not be space for documentation and training material, and the device might not necessarily contain proper user interface to access the extra material (Group G).

Other value propositions to the customers could be to enhance the usability of web portal types of services, which a prolonged customer portal program addresses (Group G).

Asset Management

> If [case company] maintained asset management (AM) for installed hospital device base, possible registry regulations should be concerned (Group D).

There are approximately 17 different service management systems in EMEA. A road map exists for the case company database to be taken into use in EMEA. Each country has its own installed base (IB) tracking system in use (Group F). Hospitals can have on-site AM systems in their enterprise network. The case company can also have in-site AM system, which remote device access can facilitate to some extent by keeping track of hospitals and their connected devices. Tracking knows the system configuration and parameter modules and other options. The interviewees are not aware of how the current asset tracking systems work, or what they display and report (Group G).

The electrical device history records (eDHR) know device configurations as manufactured and as factory serviced. There exists aside the electrical tool a new system that automatically manages activations of SW versions and their option configurations based on customer orders. These two systems know what the device configuration is as manufactured, but they do not know where the final locations of uses of devices are. Enterprise resource planning system knows who was the first consignee of a device. This is not necessarily the hospital using the device; it could be, for example, a distributor. There should be a specific IB track record system in use. This system should maintain post-manufacturing configuration information for device history (Group E).

> Probably this system maintains device specific information, but does not maintain hospital level AM information (Group E).

5.2.2 Conclusions from Internal Stakeholder Interviews

The case company does not implement research road maps under any processes and they do not measure any specific product or service successes in addition what the generic net promoter score (NPS) addresses.

Market research is in general case specific even though some process and competence framework exists. Customer feedback channels are more polling types of channels and customers cannot provide spontaneous feedback on products and services. There exist also filtering towards upstream organizations.

Sales organization is in a difficult situation, because it says it is suffering from unpredictable product releases and expensive service contracts that impact their average selling price (ASP). Sales and service delivery organizations are measured for performance and incentives include both monetary and non-monetary rewards and awards. Non-monetary incentives are challenging to implement due to cultural diversity.

Services are sold to various professionals depending on the customer case. There is a range of service contracts, which also distributors can offer in addition to their on services. The customer's financing base may determine how leasing services are purchased. The service delivery organization conducts cost reduction programs even though a distinctive part of their workload is in bug fixes called field modification instructions (FMI).

Several interviewees address challenges in proposing value to the customers through value adding services. An organization that would drive integrated service innovations is not quite clear as a concept to the interviewees. Strategic service leader (SSL) role or service engineering is seen as such an organization. Customers' innovative feedback is not well heard, or it comes through generic NPS process, or it is only focus group based.

Sales organization considers them to own the value proposition of continuous software upgrade services. Clearly the case company does not have a strong cross-selling culture, even though some cross-selling activities exist. Customers can see multiple representatives from the case company in meetings, even though attempts to single face to customers approach exist. Cross-functional visibility of customer data does not exist, because of lack of customer relationship management (CRM) system.

Current software development process has challenges to meet release schedules and some considerations to improve the situation have already emerged. System compatibility issues due to hardware limitations resulting from evolution of software releases are a concern and some considerations,

such as periodic hardware upgrades and default software backwards compatibility lifetime requirements, are given to overcome these challenges.

Customers receive two types of software releases that implement specific option policy. However, release notifications seem be challenging to implement. The demand for roll back capability emerging from the external customer questionnaire was a new idea to the internal stakeholders, who considered it to be possible to implement. When software is upgraded in the device remotely, a competent person should verify its correct installation.

A case company wide customer portal program for facilitating overall customer access to the case company's resources exists and is being developed. The capabilities to provide other types of customer support including remote technical support and customer education are addressed. The current understanding of the quality level of delivery of customer training is not well established, because two interviewee groups indicated slightly different viewpoints on this subject.

Asset management (AM) for customers' devices seems to be a challenge to the case company. The manufacturing site of the case company cannot see the customer's installed base current status through electrical device history records (eDHR), because they are not connected to the various AM systems.

6 PROPOSAL FOR SERVICE CONCEPT

The OECD report indicates that the global consumption trend to health care services increases (OECD 2009). Global market research indicates that patient monitoring is becoming ubiquitous technical competence to hospitals, which means that patient monitoring devices expand from surgery and intensive care processes to other hospital departments and even to homes of patients. In other words, user base increases, too. This calls for user-friendly value adding services that should address total cost of ownership principles in order to minimize and predict associated costs seen by the customer organizations.

6.1 Value Proposition of Service

The basic idea behind the value proposition is to address certain service attributes that customers have indicated being important to them, thus bringing them value. The value proposition is built on the remote software delivery infrastructure system that is emerging within the product sector of the case company. The value proposition also addresses some regulatory issues that limit some practicalities with medical devices and quality issues with the devices, software and with the service itself. The value proposition intents to deliver this service and value to the customers in a way that the total cost of ownership experienced by the customers would be minimized in both monetary and non-monetary means. Due to the two different financing models at the customer end, the service offering would be available in two alternative forms. The customer selects the form when the service contract is made.

	Service Offering Forms	
	Form 1	***Form 2***
Type of Target Customer Organization	Public Entities	Private Entities
Contents of Service	Specified Accuratelly in the Service Contract	All Available Technical Competences Included to the Extent Specified by the Customer
Ownership of Devices After Contract is Ended	Customer Owns	Case Company Owns
Capacity Changes Affecting Monthly Fee	Annually	As Needed

Table 1. The two service offering forms

Table 1 shows how the service concept could be offered to customers. Form 1 is primarily addressed to the publicly funded hospitals that typically need to follow rigorous procurement rules for public procurement. The rules can limit more open scope type or leasing type service purchases implemented from

capital budged. The objects of the contracts need to be objectively substantiated in such organizations. Therefore the customer defines the device configuration and owns the devices purchased from capital budget. The customer can depreciate the goods in their accounting. Due to stringent budgeting in public entities the service contracts would freeze service contents for one year period, thus keeping monthly fees constant over one year. If the customer wants to make contracts on a yearly basis, the first year fees would contain initial device costs. Renewals of the service contract for the following years would be less expensive covering only continuous service fees, as the customer has already paid for the initial devices.

Form 2 of the service offering would represent the premium solution offer. The customer has a need to monitor patients and the case company provides the means to do that. In this model the case company leases availability of patient monitoring to the extent that are within the competence limits of the case company or within the limits set by the customer. This is a leasing model that includes all product features available. The breadth and width of the service is agreed initially in the contract defining the starting monthly fee. Any changes to the contents of service can be made during the contract period and the service fee changes accordingly immediately. This model is more suitable to the private sector hospitals, which would like to acquire state of the art patient monitoring solutions, but need not implement purchases with the rigor typical to publicly funded hospitals.

The service fee would be fixed until service content change is made. However, developing medical device software further and introducing billing systems at the case company, action based leasing fees could be implemented. A patient monitor knows already today when there is a patient attached to the monitor and this duration of attachment could be used as base for fees. The billing system would tell the case company the utilization level of each monitor, and thus enable the case company to analyze the utilization levels of monitors and initiate planned maintenance actions proactively. Billing could also take into account what kinds of patient parameters are monitored and the service fee may change accordingly if parameters are divided for example into commodity parameters and premium parameters.

In order to ensure overall system functionality at customer installations when software is upgraded, the service fee would cover essential hardware up-

grades mainly for the central processing units of devices and networking hardware parts and devices. The case company would conduct four years backwards compatibility requirement in its software design and therefore the service fee would cover hardware upgrades every fourth years on average.

Since the customer base can be quality oriented through accreditations by state or through quality system standards, the information technology type of external service should be delivered within the framework of IT service related quality system standard. ISO 20000 reference is an advantage and it could be achieved by implementing and documenting the value proposition to the customers by using IT Infrastructure Library V3 framework.

Due to the pending European Union regulation on restriction of certain hazardous substances in electrical and electronics equipment, the device base for this service should be known to be compliant with the regulation. Otherwise future declaration of conformities issued for new software releases would cover also hardware platform and would claim hardware conformity at the date of issuance. The regulation is dynamic in its nature. Therefore it is essential conformity wise to separate hardware platform from software executed on it in order to be able to show that the hardware was placed on the EU market on date 1, when a certain regulation exemption set applied, while software installed on it were placed on the market later on dates 2, 3, 4 etc. Figure 20 illustrates this system approach.

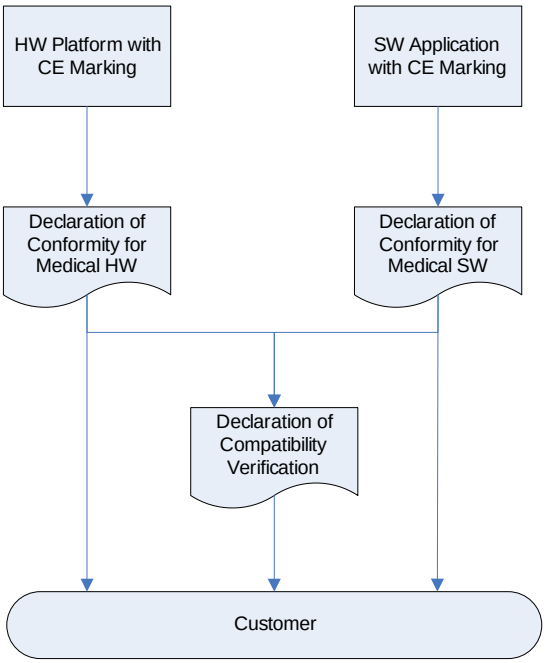

Figure 20. System approach for medical devices

Customers may need to make special one time trade-in contracts first in order to bring their device base into conformity with the regulation and having its enabled for the remote SW delivery capability that is going to be the platform to deliver software upgrades, to facilitate remote technical helpdesk support and basic asset management.

The issues introduced above form the core of the value proposition for the service. The value proposition would also contain value-adding services that the users can use through Internet web pages by using their credentials that they get when service the contract is done. The web service will be implemented as part of the case company wide web service platform that is currently developed.

Service Attribute	Classification of the Attribute
Upgrade Processes for both Automatic and Authorized Upgrades	Desired
Availability of Roll Back Process	Desired
Self-Notification of Hardware Changes	Latent
Availability of Release Data	Basic
Self-Booking of Field Engineer for Hardware Changes	Latent
Self-Booking of an Instructor	Latent
Selection of Spontaneous Customer Feedback Channels	Desired
Availability of User Forums	Desired
Availability of Marketing Materials	Basic
Availability of Self-Study Materials	Basic

Table 2. Service attributes and their classifications

The entire service concept is illustrated in Figure 21 on the following page.

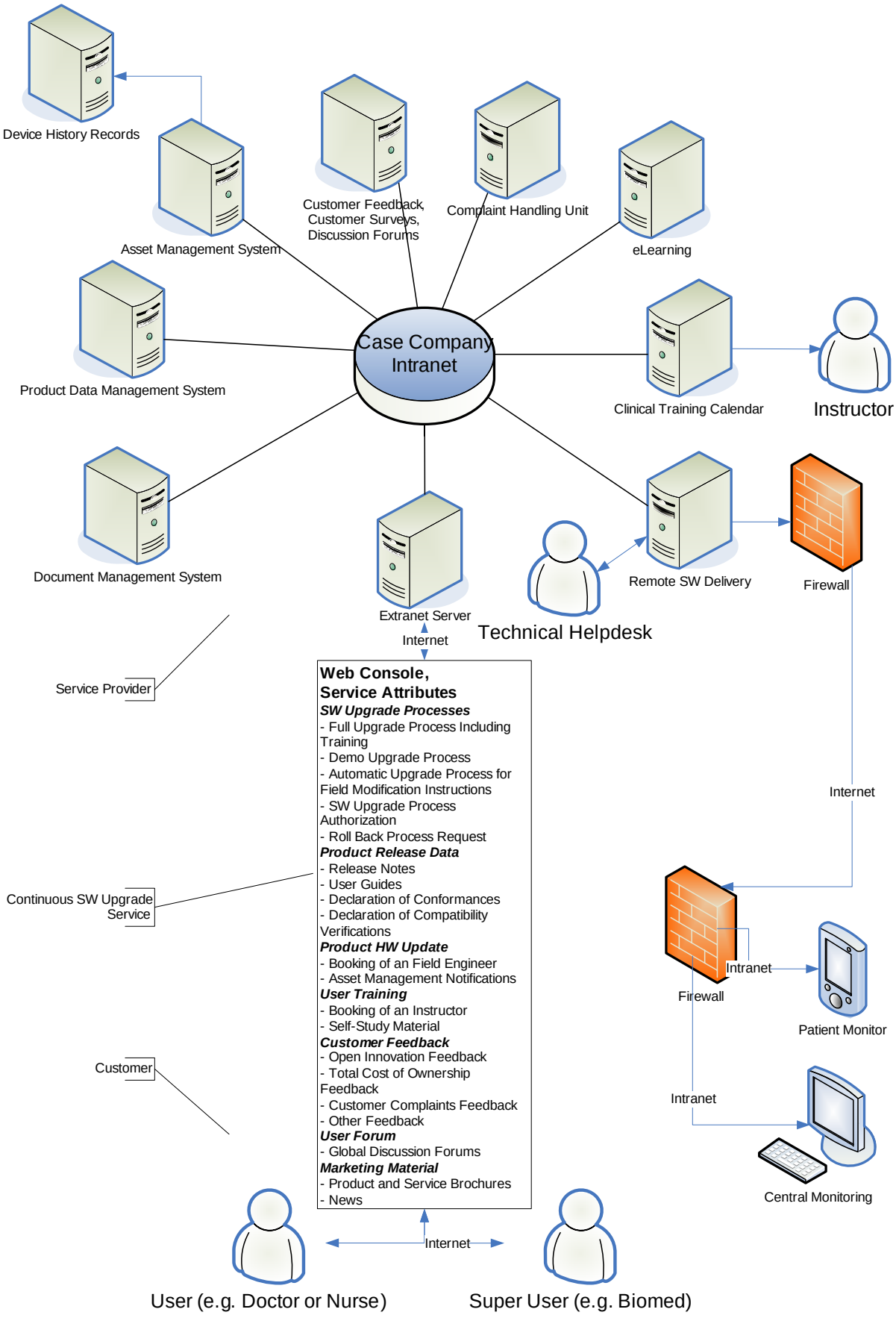

Figure 21. Service Concept for Value Proposition

6.2 Focus Group Pilot

This value proposition was introduced in a pdf file that was e-mailed around the world to the 14 health care professionals that provided their acceptance to participate in a focus group in their initial customer questionnaire responses. There were a total of eight responses. Two came from the United States of America, and responses from Australia, Belgium, Denmark, Finland, Germany and The Netherlands were received one from each. After having read the pdf file the customers were asked to provide their pilot feedback through a separate questionnaire that was facilitated in the same survey tool as the initial external customer and internal stakeholder questionnaires. This time there were only three questions. Two open ended and one position type of question.

Customers were given an opportunity to comment freely how they perceive the value proposition draft. Responses were quite lengthy and the main quotes are displayed in the following mind map.

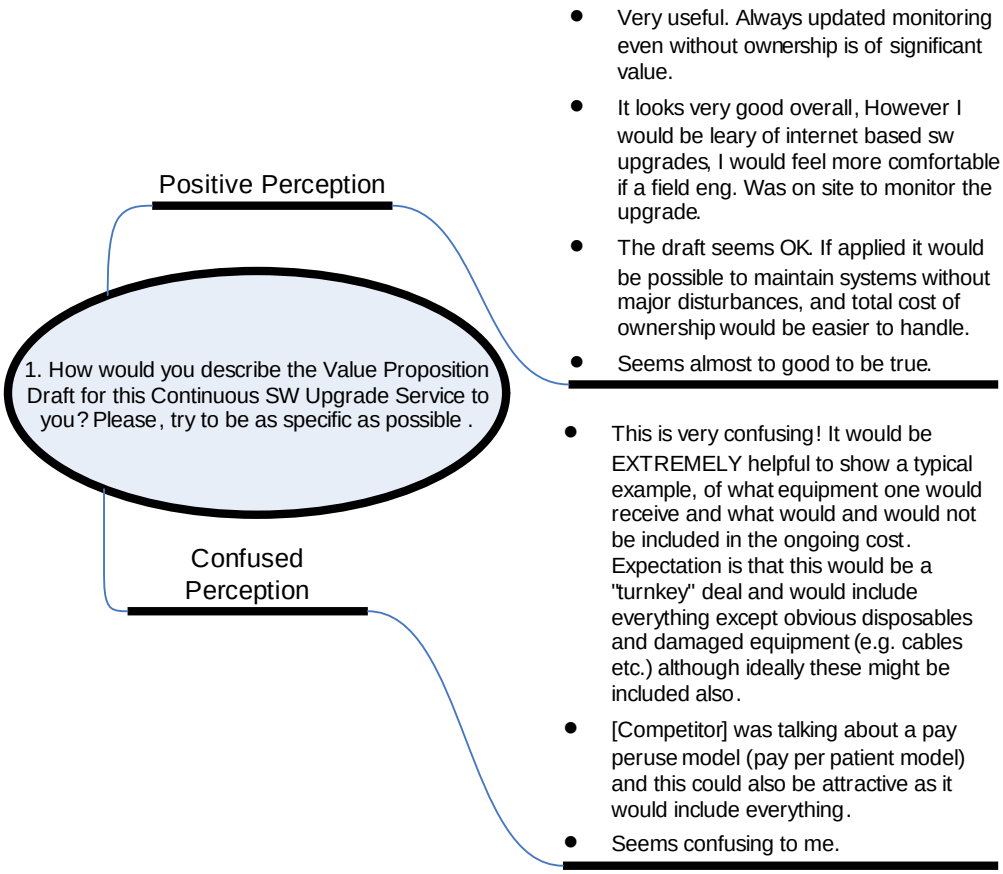

Figure 22. Customer perceptions from value proposition pilot

The service attributes were specified in the pdf file to the customers. Their satisfaction levels with the service attributes were asked for by utilizing position type of question. Customers selected a position from 1 to 5 to each service attribute. 1 means full dissatisfaction and 5 means full satisfaction. Table 3 introduces the service attributes and customers perception on each of them.

	Range of Satisfaction: 1 = Fully Dissatisfied 5 = Fully Satisfied					
Service Attribute	**1**	**2**	**3**	**4**	**5**	**Summary**
Availability of Service in Two Forms (refer to page 10 of pdf file)	12,50 % 1	12,50 % 1	0 % 0	50 % 4	25 % 2	Avg: 3,625
Selection of Fee Options (refer to page 11 of pdf file)	12,50 % 1	12,50 % 1	12,50 % 1	37,50 % 3	25 % 2	Avg: 3,5
Reference to the ITIL V3 Framework for IT Types of Services (refer to page 14 of pdf file)	12,50 % 1	0 % 0	50 % 4	25 % 2	12,50 % 1	Avg: 3,25
Essential Hardware Upgrades Included in the Service Fee (refer to page 15 of pdf file)	12,50 % 1	0 % 0	25 % 2	25 % 2	37,50 % 3	Avg: 3,75
Contents Strategy of Software Releases to Promote Frequent Software Releases (refer to page 16 pdf file)	12,50 % 1	0 % 0	12,50 % 1	75 % 6	0 % 0	Avg: 3,5
Upgrade Processes for both Automatic and Authorized Upgrades	12,50 % 1	0 % 0	12,50 % 1	37,50 % 3	37,50 % 3	Avg: 3,875
Availability of Roll Back Process	12,50 % 1	0 % 0	12,50 % 1	25 % 2	50 % 4	Avg: 4
SelfNotification of Hardware Changes	12,50 % 1	0 % 0	12,50 % 1	50 % 4	25 % 2	Avg: 3,75
Availability of Release Data	0 % 0	0 % 0	0 % 0	75 % 6	25 % 2	Avg: 4,25
Self-Booking of Field Engineer for Hardware Changes	0 % 0	12,50 % 1	25 % 2	37,50 % 3	25 % 2	Avg: 3,75
Self Bookingof an Instructor	0 % 0	0 % 0	37,50 % 3	37,50 % 3	25 % 2	Avg: 3,875
Selection of Spontaneous Customer Feedback Channels	0 % 0	12,50 % 1	12,50 % 1	50 % 4	25 % 2	Avg: 3,875
Availability of User Forums	0 % 0	0 % 0	37,50 % 3	25 % 2	37,50 % 3	Avg: 4
Availability of Marketing Materials	12,50 % 1	0 % 0	50 % 4	37,50 % 3	0 % 0	Avg: 3,125
Availability of Self-Study Materials	0 % 0	0 % 0	25 % 2	50 % 4	25 % 2	Avg: 4
Total:	7,50 % 9	3,30 % 4	21,70 % 26	42,50 % 51	25 % 30	Avg: 3,742

Table 3. Customer perception on service attributes

Table 3 shows the results of the piloting. Based on the results the service attributes are well perceived, because grades of each attribute are 3 or more and average are almost 4. The number of grades given is shown at the bottom of the table.

The third question looked for any other feedback that a focus group member may have. Again responses were quite lengthy and key quotes are provided in the following mind map.

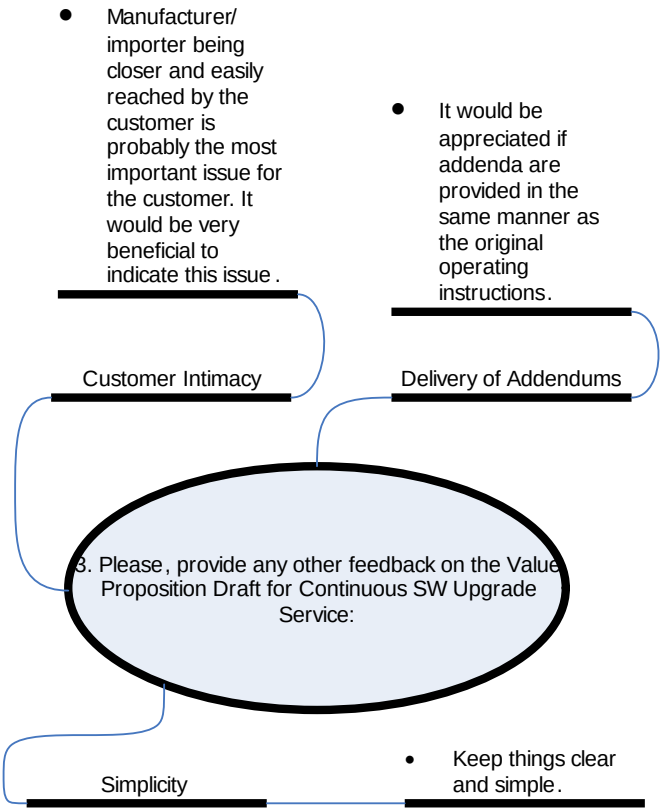

Figure 23. Customers' other feedback on value proposition pilot

Figure 23 shows as conclusion that in general the value proposition was perceived quite positively by the focus group. The average result is almost 4, very good. The availability of the two service forms and related fee strategies were perceived positively. Service mapping to the ITIL V3 framework received neutral perception with emphasis to the positive side. This may indicate that focus group members are not quite sure to comment on quality system related issues, but those who are sure, perceived it as a positive service attribute. Most of the respondents regard the essential hardware upgrades as an important attribute. Also the explained strategy to address predictable and frequent software releases was perceived positively, as the most of the respondents gave 4 to it. Software delivery methods divided into preauthorization and automatic processes were perceived positively. The roll back attribute received positive perceptions. All self-service attributes were perceived from 3 to 4, which is a positive sign. Availability of release data was perceived highly positive; as none of the responses were lower than 4. Availability of spontaneous feedback channels and user forums were per-

ceived worth of 4. Marketing material availability received quite neutral perception, as the average score was close to 3 on the positive side.

Other feedback address need for simple implementation of the service and need for customer intimacy and vendor presence. Delivery of user guide addendums in the same way as were delivery of the user guides for the initial software releases and delivery of software releases by field engineers are issues that should be addressed when the service is outlined more in detail with respect to individual customer profiles and preferences. In order to respond to the customer's concern on roll back availability in the middle of night, from product engineering point of view local roll back of software capability in addition to the remote roll back should be available especially if the case company back office services at technical helpdesk will not be available 24 hours a day. This would mean that field modification instructions should ensure availability of the over-previous release of software, or the latest release that was considered bug free. Since these are details not impacting the overall service concept, and since the overall service concept was perceived quite positively, there is no need to change the service concept for the value proposal, except with respect to the availability of planned maintenance services. This service should be included in the total solution model Form 2 while in the simpler Form 1 this planned maintenance service would continue as optional and additional service contents to the continuous software upgrade service.

Even though there are several service attributes in the service concept, they all can be considered essential to the customers. Still, as one focus group respondent states, the service concept should be kept clear and simple.

6.3 Management Implications to Support the Value Proposition

The following sections introduce suggestions for developments in various organizations in order to make the value proposition successful and sustainable. The key topics are introduced first and then they are elaborated more in detail by reflecting theories and practices introduced in earlier sections.

6.3.1 Development Needs in Market Research

The following development in market research could be adopted in order to make it more efficient:

- Research road maps could be implemented in order to plan a more objectives oriented market research and define better what would be software release contents and their mutual priorities

The case company has several infrastructure types of customer feedback processes in place. They can be roughly divided into two groups. Polling for customer satisfaction and management of dissatisfied customers. No established processes were identified for collecting spontaneous customer feedback and its analysis. The customer questionnaire even indicated that customers do not know how to provide it to the case company. This claim could have been verified by the case company stakeholders indicating that customer complaints usually include feedback that is not complaining by nature, but more like suggestions for further developing of products and services. Customers were also said to provide constructive feedback directly to the field personnel of the case company.

Collection of spontaneous customer feedback and product or service development ideas is important, because spontaneousness indicates that the customer need is real and originates from their daily work tasks. If polls and questionnaires were the only methods to collect this kind of feedback, their timing may be wrong. Customers may not recall their entire work task events taken place in the past when they respond to the questionnaires.

Research roadmaps ensure that all relevant aspects of the patient monitoring market are researched in a predefined manner. This kind of research approach ensures that all relevant information is received for planning product and service road maps that meet market challenges. Researches can address foundational issues in the market, they can test propositions with focus groups, they can measure performance and they can be issue specific research. Specific key performance indicators can be measured in addition to the more generic Net Promoter Scores, NPS. Metrics and tools, such as quality profiles, price profiles, customer value maps, won/lost analysis, key events time lines, head-to-head area charts, and what/who matrixes, for customer value analysis are also helpful methods.

6.3.2 *Becoming Integrated Solutions Provider*

The following development in the mindset of the company could be adopted in order to gain the potential growth:

- Transform from a product centric company to a more integrated services oriented company
- Define core strategy and integrated sub strategies on how the case company wants to position itself as an integrated service company offering total solutions to customers.

Currently it looks like that there are two separate entities, which are product offerings and service offerings. But holistic service innovation aligning and converging product innovation, manufacturing innovation and business model innovation are not identified clearly enough. These are prerequisites to total customer experience services where device products are involved, but not necessarily in the main role. Integrated solutions providers take care of customer life cycles on a “from cradle to the grave” basis. They co-develop services with customers and they deeply understand the customer business. They organize themselves in a way that boundaries between manufacturing, sales and services as well as financing are invisible to the customer, as illustrated in Figure 24.

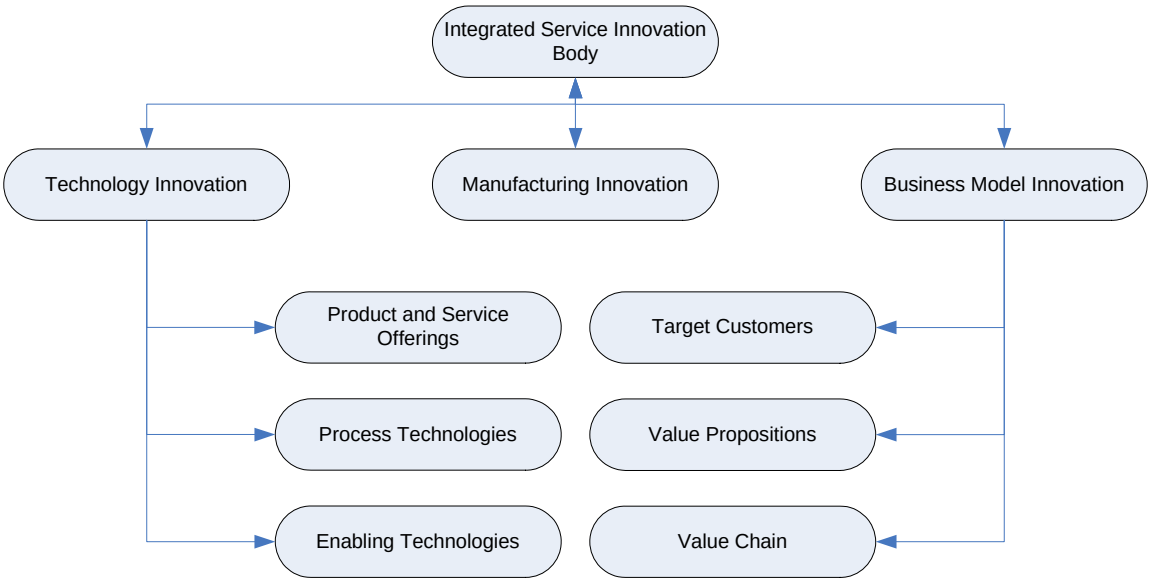

Figure 24. Integrated Service Innovation scheme

In this model external partners can be most useful. The case company could behave more like innovation marketers that analyze their market needs for new innovations and they will find out sources of innovations that could meet the demand with successful business. The solutions provider composes together a customer specific solution by using ingredients from the pieces of components, bundles and glued systems. When the case company acts like an innovation architect and specifies core system with open and standardized interfaces, other partners can provide open innovation solutions compatible with the core system. When total solutions are sold, not all need be self-produced.

6.3.3 Improvements in Software Development Process

To improve frequency and predictability of software releases in incremental software design, the following fundamentals could be adopted.

- Release management of software could cover the entire development life cycle
- A special release manager role could be established for larger software programs in order to provide a single point of contact for communicating holistically about the software release and its progress
- Management and leadership could commit to the agreed release content and timeline

The software development process could be made more predictable in order to deliver frequent high quality software releases on time. This could be achieved by implementing program internal practices that increase rigor throughout software development life cycle.

When a software platform is in the state of incremental design, the feature set could be incremented in relatively small and focused steps. This would enable shorter time to market that should bring competitive benefit. The size and scope of new functionality of software release should be agreed on first and then this agreement should hold throughout the release. The size and scope of software changes in next release should be aligned to the development time available to the planned release date. This release date should hold. Therefore emphasis should be put on the kick-off workout held prior

the first formal design review (FDR) in order to have the program properly measured.

Incremental changes should focus only on certain parts of the software architecture. This would enable clear limited changes, which impact the entire software architecture is easier to understand, manage and which verification should be easier to perform. The level of detail of requirements should be carefully aligned with the customer needs and regulatory and product standard requirements in order to optimize verification process lead-time.

The software development release content and progress of it throughout the development life cycle should be visible to the stakeholder organizations in order to keep them informed about the progress and in order to keep them holding any wishes for late changes in requirements or release dates. When the other stakeholders see the daily or weekly progress, they would understand better what impacts their requests would have on the release.

In addition to the regular mandatory program organization of the case company, software development organization could consider appointing for larger software release programs a specific release manager, who would be in touch with the technical contents and quality of the release from the start to the release as well contacts to all stakeholders of the software release. Currently the roles and responsibilities of people in the software development programs look too fragmented in order to let anyone to have a holistic knowledge of the contents, quality, progress and stakeholder impacts of a release.

The article introducing practices to rhythm scrum development processes introduced one set of milestones that could be considered to improve software release program internal operations in the form of program workout events. These workouts would precede case company instructed formal design reviews and milestones. The release kickoff would be the most important to conduct well while feasibility of implementation of the other additional milestones should be examined program-by-program bases, or piloted in one program first. These later program internal workouts should focus on methods, work practices, operating mechanisms and logistics for ensuring the next case company formal design review and milestone taking place on scheduled time.

Figure 25 illustrates a project timeline and shows how these FDR, milestone (M1, M2, MV and M3) and the new program internal workout events would map to the project timeline.

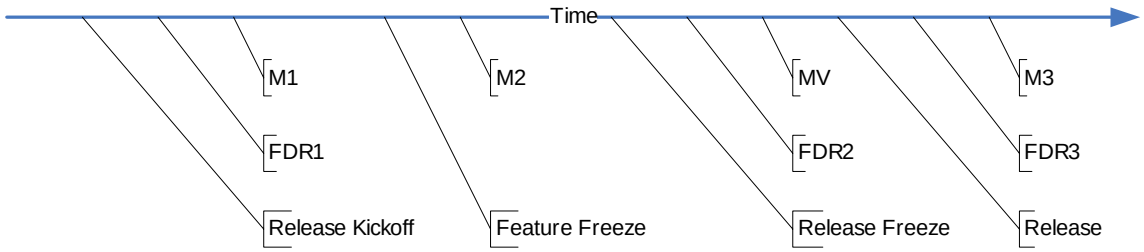

Figure 25. Software program internal workout milestones preceding formal case company design reviews and business milestones (Case Company 2010)

Program internal workout events are shown at the bottom in Figure 25. They precede formal design reviews, which focus on accomplishments of product design process to meet product intended use and user needs. A medical advisor participates in this review. These reviews precede business oriented milestone reviews, which form tollgates to either cancel the program or to pass it into next execution stage. M1 indicates that design inputs are agreed upon, M2 denotes that all design outputs are ready. The milestone MV states that these design outputs are verified to meet the design inputs. Verification is objective activity. Finally M3 denotes that the design is validated to meet user needs and intended use. The validation is more subjective activity. The milestone M3 also indicates that the design is transferred to manufacturing, installation and service processes and limited pilot production to selected markets and customers can begin.

6.3.4 Strategy to Address Regulatory Requirements

The following regulatory affairs strategy could be adopted in order to ensure regulatory compliance with software upgrades during RoHS era with respect to the placing on the market concept.

- Medical devices incorporating software should be regarded as a system consisting of two CE marked and conformity declared medical devices, one being hardware platform and the other being software. This system is provided with declaration of verification document.

The RoHS directive mainly addresses other devices than medical devices. These other types of devices do not have specific regulatory requirements for their software. Their CE marking is applicable to hardware platform only. This makes it possible to update and upgrade software freely without impacting conformance to regulatory requirements.

Medical devices differ in a way that their software is regarded as medical device on its own right when software is used in clinical processes. Therefore the software is also CE marked and a declaration of conformity document is issued for it. Typically this CE marking and the declaration of conformity document cover both hardware and software of a medical device. In other words, software is regarded as embedded software.

The declaration of conformance is a dated document. This date claims that the declared device conforms to all regulatory requirements applicable to the device type on that date. This means that when software of an installed device is upgraded to the most recent version after the original placing on the market date of the hardware part of the device, and if that new declaration of conformity document claims also conformity of hardware, the device hardware is claimed to conform to the RoHS directive on that specific date. The dynamic property of the RoHS directive having expiring substance restriction exemptions may cause unplanned surprises with respect to the conformance to the RoHS directive. The outcome from this is that hardware parts of an installed device may need to be replaced by hardware parts that conform to RoHS directive at the date of the new declaration of conformance.

In order to avoid this kind of situation, medical devices incorporating medical software should be considered as a medical device system consisting of two CE marked and conformity declared medical devices. One is the hardware platform and the other is the software. Each of them has its own conformity labeling, which enables the case company to evidence that each piece of system is placed on the market on certain dates. Software upgrades after the initial date of placing on the market of the entire system will make dates differ. The original date for placing on the market of the hardware part remains valid and no risk for replacing the hardware parts into conformity with the RoHS directive should exist.

This system approach means that each medical device in the system should have its own intended use described. For hardware device it should describe hardware platforming for defined clinical applications. For software device it should describe software for clinical setting when used on compliant hardware platform. The accompanied documents of each device should describe compatibility requirements for other devices in the system. System should be declared for verification of inter-compatibility of devices. Declaration of conformity documents of each device system should be amended by a declaration of verification document. All these documents should be available to the customers.

6.3.5 Cross-Selling of Value Proposition

The following actions could be taken to support the offering of the value proposition:

- Establish a cross-selling culture with a cross-selling responsible manager, who maintains reliable and fair performance metrics related to the cross-selling objectives taking into account customer's total cost of ownership interest
- Invest in customer relationship management system in order to facilitate more efficient cross-functional customer management
- Establish a dedicated and centralized customer training organization that coordinates quality of training delivery to accredited customers
- Prepare a device sales organization with efficient sales materials in order to let them efficiently cross-sell the value proposition to the customers

Interview responses indicate that new device sales and service sales are usually distinct businesses having their own performance metrics behind incentives. One respondent even indicated that customer meetings could involve representatives from both organizations. One sells the devices and the other sells service contracts. Another respondent indicated that the way the service organization tries to increase revenue in western saturated markets is to increase prices of spare parts and service contracts to the level of loosing competitive advantage. In contrary to the customers' preference, cus-

tomers do not see the price structure of the purchase contracts between device sales and service contract sales. In order to meet sales targets the average selling price of devices need to be lowered, which impacts the device sales metrics and related incentives. This all imply that real team selling does not exist between the device sales organization and the service organization and as a consequence customer focus can be lost.

When medical device software (SW) is upgraded, hospitals require user training prior to taking the new software version into use. Being accredited organizations they also expect training to be provided by a person, who has pedagogical skills to train adults and subject matter expertise on clinical applications. When software use is trained by implementing self-study materials, persons having these kinds of skills should develop the material.

Interviews indicate crosswind between the device sales organization and the service organization with respect to responsibility to deliver user training of a new software version. The sales organization indicated delivering user training as part of new device sales contracts while the service organization indicated them to deliver user trainings when new software versions are introduced to the installed devices. Also the competence of trainers was not crystal clear to all working for service related matters. Uncertainty remained as to defining where the organization that supervises is and who is responsible for the quality of training delivered to the customers. Therefore it would be worth considering whether user training could be a separate function operating under medical advisors that ensures clinical and pedagogical quality of training for the customers. The device sales organization and the service organization would purchase the services for their needs while customers could also purchase training service directly from that organization. In fact, customer training could be one type of high quality service offering for the case company if organized well. The Figure 26 illustrates this service.

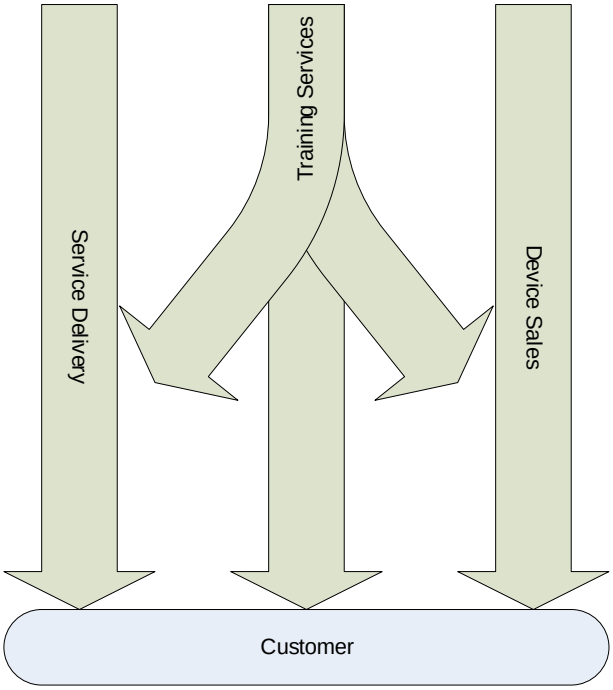

Figure 26. Cross-selling customer training services

Figure 26 shows how customers could acquire training services. They can purchase service directly from the training organization, or they could acquire training services as additional service when they purchase devices or other services.

The value proposition for the continuous software upgrade service should be specified being its own distinct service offering. Since the platform technology of SW delivery would be dependent on the service organization owned internet based remote SW delivery and activation platform that provides also technical back-office helpdesk service infrastructure, the value proposition offering should be owned by the service organization. Since this value proposition would involve periodic hardware replacements in order to maintain system level compatibility during software upgrades, but not all customers would like to purchase this service, the device sales organization will continue to sell devices traditionally. In order to make the device sales organization motivated to offer this value proposition to customers as an alternative way to acquire patient monitoring technical competence without the presence of service sales representatives, which in turn would simplify selling processes especially for smaller deals, cross-selling culture and related methods and processes could be established.

Customer relationship management system (CRM) and processes could be implemented in order to allow cross-functional visibility of customers and their product and service offerings acquired. This would facilitate better co-ordination of customer approaches between device sales and service organization in terms of cross-selling and up-selling matrixes. The service organization could prepare customer brochures about the value proposition, simple questionnaire templates for salesmen to identify prospects to this value proposition during initial approaches, and a more detailed questionnaire template to verify the prospect status during the first sales meetings with the customer. These methods could also make customers more comfortable to identify the value proposition offering that may suit to them. This is according to the total cost of ownership principle addressing the cost of acquiring an offering.

The device sales organization would sell devices either directly without this value proposition or through this value proposition that will decrease their future replacement sales, because the value proposition includes device replacement service. Therefore it is important that the performance measurement system is redesigned to promote cross-selling objectives and one face to the customer approach with reliable performance metrics. A specific cross-selling manager responsible for the success of cross-selling and CRM program need to be identified above these two organizations. This manager should maintain a performance measurement system that aligns both the device sales and service sales organization to the benefit of customers. Having the measurement system elevated to the above organization level decreases mutual competition of the two organizations, makes the measurement objective and fair to meet sales organizations interest. Figure 27 introduces this performance measurement concept.

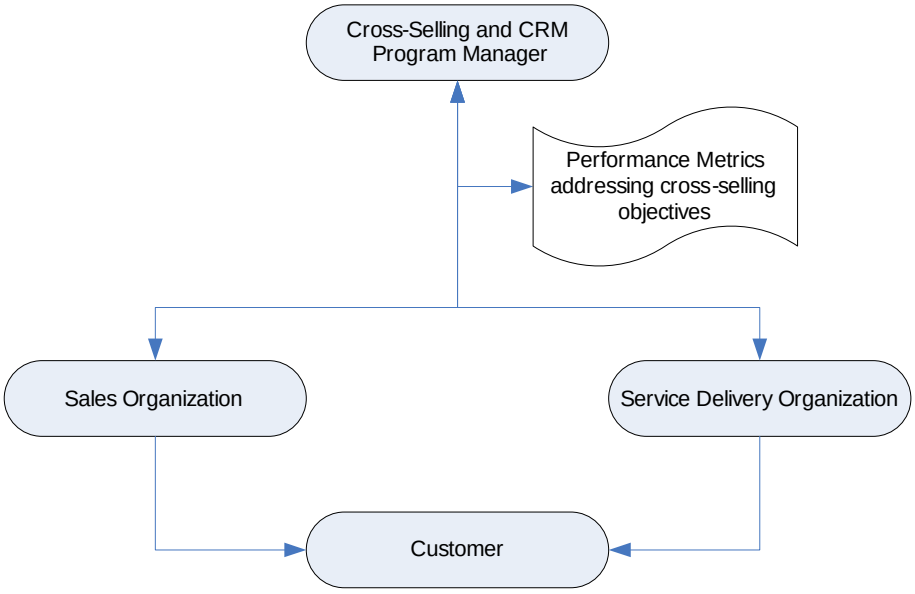

Figure 27. Management of cross-selling

Incentives referred to in Figure 27 concern both monetary and non-monetary incentives according to local cultural preferences. Finder's fees and discounts in the transfer prices of the service offer could be the monetary incentives. An interesting idea would be to incorporate a points based incentive system where rewards could be so valuable and compelling that they would really motivate salesmen to sell this premium value proposition and to collect points eligible to the reward. As to what kinds of rewards would interest salesmen, a simple questionnaire on this subject would bring the answer.

6.3.6 Pricing Strategy for the Value Proposition

The following development in the service delivery organization could be adopted in order to make the pricing of the value proposition competitive:

- Cost trees identified and monitored with trigger for unusual cost components or events

It is positive that costs saving programs have begun. Sales organizations' responses to the interviews indicate that the pricing model of services is too high. Possibly due to current device models requiring costly field services, but may be also due to inherent costs in the service delivery organization. In order to keep the price of the value proposition at a correct level, the internal cost structure should be known as well as the customer's business profile and the real value of service to them in terms of alternative costs should also

be known and understood. This kind of premium value proposition should also be addressed to the correct professional levels at the customer organizations. These are for example senior management and procurement professionals, not necessarily biomeds or the IT department.

7 DISCUSSIONS AND CONCLUSIONS

The following sections summarize how the research question is answered and how this study is evaluated.

7.1 Contribution to the Research Question

The contributions of this study in relation to the research question are now summarized and discussed.

- What would be the value proposition for continuous software upgrade service for hospitals in profitable and value creating way?

The value proposition proposed in this study aims to reduce the total cost of ownership as seen by the customers by introducing and promoting the emerging remote and automated software download technology for their convenience, and by introducing a patient monitoring discipline specific integrated web services, of which the service attributes would address the non-monetary aspect of the total cost of ownership concept by providing all essential contact points to the device vendor, device data and services in one place. The services honor customers' needs to control software delivery processes in order to ensure patient safety. All these should increase the total value to the customers as the focus group has indicated in their initial perceptions.

From the case company's point of view the profitability of the service would be gained from the remote and automated software deliveries via Internet and by promoting as far as possible self-services to the customers. Allowing customers to provide spontaneous feedback under various well known themes would create value to the case company in terms to facilitate better market research, which in turn would realize later in more value creating future offerings to the customers.

- How should roles and responsibilities between sales and service delivery organizations be divided?

The sales and service organizations are different organizations that have different objectives and processes. The main difference is that the sales organization contacts customers briefly during initial sales while the service

organization retains long-term after-sales partnerships with customers through various service contracts. Their processes will also contribute strongly to the return of customers through long-term customer satisfaction. These differences are important to keep in mind and therefore these two organizations will stay as they are.

Offering the value proposition would mean that customers may acquire technical patient monitoring competence as a total solution service owned by the service organization, not as traditional device purchases sold by the sale organization. This new alternative way would impact the sales organization. In order to keep this organization motivated to offer the service as an alternative method to acquire patient monitoring, robust cross-selling culture is suggested. This would incorporate an introduction of a customer relationship management system and its related roles, responsibilities and processes as well as a fair, robust and effective incentive system with a responsible manager that promotes team selling and one face to the customer approach especially for simpler sales cases. Cross-selling culture should simplify utilization of human resources at the customer surface and should enable the case company to better identify potential sales opportunities not only with new prospects but also with existing customers. These later issues should contribute to the profitability of the service to the case company. Cross-selling culture should also enable high quality training and education offerings when a dedicated organization focusing on the subject area would produce such services to customers.

- How should roles and responsibilities between service engineering and service delivery organizations be divided?

These two organizations are traditional organizations with their own objectives and processes. The former engineers services while the service delivery delivers them to the customers. However, neither of them may innovate total integrated service solutions that would require alignment from product engineering, manufacturing and value chain processes, not mentioning the entire business models that may need be brought into the alignment, too. When a device company would like to offer total solution value adding services to the customers, the model of integrated service innovation is a better way to approach the challenge. The value proposition of this study is approaching on this kind of total service offering level and therefore an inte-

grated service innovation model is suggested for adoption. In this model the top leadership runs an integrated service innovation body or organization that aligns all other functional organizations including service engineering and service delivery organizations for delivering the total customer experience and value. Value, which may need also innovations in business models of the company.

- How to manage conformity with medical device related regulations when a CE marked product is upgraded in the field?

Software incorporated medical devices are different from the all other types of software incorporated devices, such as personal computers and cell phones, that software is a CE marked conformity declared device of its own right. In order to evidence different placing on the market times for hardware and software, in order to meet emerging regulatory requirements, both hardware and software are suggested to be treated as distinct medical devices that compose a medical device system. A patient monitor should not anymore be seen as a single device containing embedded software. European Medical Device Directive provides means to label such a system properly.

7.2 Evaluation

This study was an interesting project to conduct in a very challenging schedule. The schedule was additionally demanding to include all the four stages of action research of observation or diagnosing, planning, acting or implementing and reflecting upon the outcome. It also forced the author to deviate from good design practices where the design plan is first completed prior to the execution of the plan. In research the research design is the design plan to address methods to answer to the specific research question that justifies the research. Implementation of the research design is the execution stage that should follow the plan. Now these two stages overlapped, which may jeopardize the quality of research in case the execution outcome puts pressure on the initial research question. Luckily this study needed not change the research question during the course of execution of the research and the commissioner of the study can receive an answer to the initial research question.

Questionnaire respondents from procurement function of hospitals turned out to be challenging to approach. This may be due to the reason that they have not been the marketing department's primary prospects and approaching them indirectly did not work in large customer organizations. Also direct clinical health care professional contacts turned out to be quite passive to respond to the questionnaires. There are so many questionnaires nowadays that people may not want to respond to all of them. The subject of these questionnaires might have been too difficult and abstract to be answered by the end users of devices. Questionnaires themselves should differentiate in compelling ways from each other. Perhaps a compelling price lottery would have improved response activity. It could also have increased the number of contact information items given.

Some focus group respondents perceived the value proposition draft confusing. Their expectations were to have more finalized value proposition that would materialize in practical terms the service to them. However, in a very initial stage of product and service development this may not be possible if the development organization itself is looking for correct paths to proceed from the crossroads in the development process. In this case clearer communication practice addressing this premature framework should be considered. A customer typically looks for something final while in this kind of research framework they may contribute to something that is very initial.

In general this study accomplished to propose a service concept that could please customers and bring them value in their daily work. This study also proposes new mindsets to facilitate premium services that go beyond product centric planned maintenance and similar services. These premium services open to the case company new ways to gain revenue.

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APPENDIX 1: INTERNAL STAKEHOLDER INTERVIEW DIARY

Interview Group	Initials	Title	Function	Interview Date	Time	Interview Log Reviewed, Corrected and Approved	Questionnaire Response	Subject Areas Covered
A	N. N.	Service Engineer Manager	Service Engineering	15.3.2010	9:30 - 11:00	Yes	Yes	Service Engineering Processes, Remote SW Delivery and Service Technologies
B	V. R.	Global Marketing Manager	Global Marketing	18 .3.2010	8:30 - 9:30	Silent Approval	Yes	Global Marketing Processes
B	S. L.	Global Product Manager	Global Marketing	18 .3.2010	8:30 - 9:30	Yes	Yes	Global Marketing Processes
C	F. P.	EMEA Marketing Director	EMEA Sales	18.3.2010	10:00 - 11:30	Yes	Yes	EMEA Marketing and Sales Processes
D	T. T.	Engineering Director	Product Engineering	22.3.2010	14:00 - 15:00	Silent Approval	Yes	Software Engineering Processes
D	M. S.	Engineering Manager	IB and ES Manager	22.3.2010	14:00 - 15:00	Yes	Yes	Software Engineering Processes
E	J. V.	Manufacturing Program Leader	Operations	23.3.2010	13:00 - 13:15	Yes	No	Device History Records and Asset Management
F	M. D.	Service Segment Leader	Service Delivery	24.3.2010	17:15 - 18:15	Yes	Yes	Service Delivery Processes
G	J. N.	Senior Lead Service System Designer	Service Engineering	25.3.2010	13:00 - 14:00	Yes	No	Remote SW Delivery and Service Technologies
G	P. T.	Senior Lead Service Integrator	Service Engineering	25.3.2010	13:00 - 14:00	Yes	No	Remote SW Delivery and Service Technologies
H	N. M.	Service Delivery Leader	Service Delivery	30.3.2010	16:00 - 17:05	Yes	Yes	Customer Portal Program
I	H. S.	Human Resources Manager	Human Resources	6.4.2010	10:00 - 11:00	Yes	No	Incentives, Rewards and Awards

APPENDIX 2: EXTERNAL CUSTOMER QUESTIONNAIRE QUESTIONS

Question	Answer Options	Literature Reference
Value of Service		
1. What would you like to understand by the concept "Continuous SW Upgrade Service"?	SW upgrades only; SW upgrades and dependent HW upgrades; Keeping the whole device system up to date; I cannot say; Other: *(Free field)*	
2. How would you describe the value of this Continuous SW Upgrade Service to you? Please, try to be as specific as possible.	*(Free field)*	Anderson, B. 2008. Service-Level Agreements: It's Value Proposition. *Computerworld*. December 1. 2008. 34. Anderson, J. C., Narus, J. A. And Van Rossum, W. 2006. Customer Value Propositions in Business Markets. *Harvard Business Review*. March 2006. 90 - 99. Berry, L. L. 1999. *Discovering the Soul of Service. The Nine Drivers of Sustainable Business Success*. Free Press. Donath, B. 2007. Set Price Metrics Parallel to Value Proposition. *Marketing News*. April 1, 2007. 6. Gale, B. T. 1994. *Managing Customer value. Creating Quality & Service That Customers Can See*. Free Press. Harrington, R. J. and Tjan, A. K. 2008. Transforming Strategy One Customer at a Time. *Harvard Business Review*. March 2008. 62 - 72. Peppers, D., Rogers, M. and Dorf, B. 1999. Is Your Company Ready for One-to One Marketing? *Harvard Business Review*. January - February 1999. 151 - 160. Salvador, F., Martin de Holan, P. and Piller, F. 2009. Cracking the Code of Mass Customization. *MIT Sloan Management Review*. April 2009. 1 - 16. Spirek, D. 2001. ASPs: The Real Value Proposition. *Health Management Technology*. July 2001. 24 - 25. Thomke, S. and von Hippel, E. 2002. Customers as Innovators, a New Way to Create Value. *Harvard Business Review*. April 2002. 74 - 81. Zeithaml, V. A., Rust, R. T. and Lemon, K. N. 2001. The Customer Pyramid: Creating and Servicing Profitable Customers. *California Management Review*. Summer 2001. Vol. 43. No. 4. 118 - 142.
3. What would be the most important features of Continuous SW Upgrade Service to you? Select 1 - 3 the most important features.	SW upgrade frequency; Fixed SW upgrade intervals; Delay of SW upgrade delivery after feature release; SW upgrade delivery method; User training included with SW upgrade; Training delivery methods; Helpdesk services from GEHC; Other features: *(Free field)*	Anderson, B. 2008. Service-Level Agreements: It's Value Proposition. *Computerworld*. December 1. 2008. 34. Anderson, J. C., Narus, J. A. And Van Rossum, W. 2006. Customer Value Propositions in Business Markets. *Harvard Business Review*. March 2006. 90 - 99. Berry, L. L. 1999. *Discovering the Soul of Service. The Nine Drivers of Sustainable Business Success*. Free Press. Donath, B. 2007. Set Price Metrics Parallel to Value Proposition. *Marketing News*. April 1, 2007. 6. Gale, B. T. 1994. *Managing Customer value. Creating Quality & Service That Customers Can See*. Free Press. Harrington, R. J. and Tjan, A. K. 2008. Transforming Strategy One Customer at a Time. *Harvard Business Review*. March 2008. 62 - 72. Peppers, D., Rogers, M. and Dorf, B. 1999. Is Your Company Ready for One-to One Marketing? *Harvard Business Review*. January - February 1999. 151 - 160. Salvador, F., Martin de Holan, P. and Piller, F. 2009. Cracking the Code of Mass Customization. *MIT Sloan Management Review*. April 2009. 1 - 16. Spirek, D. 2001. ASPs: The Real Value Proposition. *Health Management Technology*. July 2001. 24 - 25. Thomke, S. and von Hippel, E. 2002. Customers as Innovators, a New Way to Create Value. *Harvard Business Review*. April 2002. 74 - 81. Zeithaml, V. A., Rust, R. T. and Lemon, K. N. 2001. The Customer Pyramid: Creating and Servicing Profitable Customers. *California Management Review*. Summer 2001. Vol. 43. No. 4. 118 - 142.
4. How well would you tolerate situation where any of your patient monitors would not be SW upgraded due to HW limitations while the most of them would?	Not any problem; Minor disturbance; Moderate disturbance; Intolerable situation; I cannot say	
5. Select your country	List of world countries	
6. Name of hospital	*(Free field)*	
7. What is capacity of your hospital?	Value categories for both Patient Beds and Patient Monitoring: 1- 10; 11 - 20; 21 - 50; 51 - 100; 101 - 200; 201 - 500; Over 500	
8. Is your hospital a publicly funded entity or a private entity?	Publicly funded; Private company	
9. What is your primary care or work area?	OR, PACU/preop; ICU; NICU; CCU/Step down; Administration; Sourcing; Information Technology; Other: *(Free field)* ; Not Applicable	
10. What is your occupation?	Senior Management; Medical Doctor; Nursing; Medical Device Maintenance (Biomed); IT Management; IT Maintenance; Procurement; Other: *(Free field)*	

Question	Answer Options	Literature Reference
Senior Management		
11. Is the hospital operated under any quality management system standard or regulation?	No specific Quality Management System reference is used; Quality Management System is based on the following: *(Free field)*	
12. Does your hospital differ distinctly from other hospitals?	No; We differentiate in the following way(s): *(Free field)*	Zeithaml, V. A., Rust, R. T. and Lemon, K. N. 2001. The Customer Pyramid: Creating and Servicing Profitable Customers. *California Management Review*. Summer 2001. Vol. 43. No. 4. 118 - 142.
13. How would you utilize biomeds if GE provided continuous SW upgrade service?	*(Free field)*	Allmendinger. G. & Lombreglia. R. 2005. Four Strategies for the Age of Smart Services. *Harvard Business Review*. October 2005. 131 - 145.
14. Do you have separate personnel that maintains medical device SW from those who maintain IT network and workstations?	We have separate staff; We share IT resources for both equipment base, I cannot say	Materna GmbH 2008. *ITIL Version 3 Pocket Guide*. Materna GmbH. Spirek, D. 2001. ASPs: The Real Value Proposition. *Health Management Technology*. July 2001. 24 - 25.

Question	Answer Options	Literature Reference
Biomeds and Procurement		
15. Do you have multibrand patient monitoring solutions in use?	We have only GEHC and its legacy solutions in use (Marquette and DatexOhmeda); We have patient monitors from other vendors, too; We have only nonGEHC solutions in use; I cannot say	
16. What is the level of system integration?	Only stand alone patient monitors are in use; Central monitoring is supported Patient monitoring solutions are interfaced to hospital information systems; I cannot say	
17. Do you have remote monitoring solutions in use?	Yes; No; I cannot say	
18. What is the average age of your patient monitoring equipment?	Less than 1 year, 1 - 3 years; 4 - 6 years; Over 7 years; I cannot say	
19. Do you utilize patient monitors evenly across care areas?	We use patient monitors evenly across care areas; There are differences in the utilization levels between care areas; I cannot say	
20. Have you upgraded patient monitor SW earlier?	We have not upgraded our patient monitors; We have purchased one time upgrades; We upgrade continuously our patient monitors; I cannot say	
21. Which budget do you use for procuring services?	Capital investement budget; Cost budget; I cannot say	
22. Are there constraints to procure several years long services paid from capital investment budget?	No; Yes, the following: *(Free field)*	
23. Which you prefer?	Separate procurements for equipment and continuous SW upgrade service; Single total procurement for continuous SW upgrade service and hospital owns the equipment after the continuous SW upgrade service contract has ended; Single total procurement for continuous SW upgrade service and GEHC owns the equipment after the continuous SW upgrade service contract has ended; I cannot say	
24. How do you address procurements in general?	One hospital per its specific care areas; One hospital for all its care areas Several hospitals per their specific care areas; Several hospitals for all their care areas; I cannot say	
25. How would you like to address Continuous SW Upgrade Service procurements?	One hospital per its specific care areas; One hospital for all its care areas Several hospitals per their specific care areas; Several hospitals for all their care areas; I cannot say	Anderson, J. C., Narus, J. A. And Van Rossum, W. 2006. Customer Value Propositions in Business Markets. *Harvard Business Review*. March 2006. 90 - 99. Peppers, D., Rogers, M. and Dorf, B. 1999. Is Your Company Ready for One-to One Marketing? *Harvard Business Review*. January - February 1999. 151 - 160.
26. Which care areas would you address when procuring Continuous SW Upgrade Services?	The following: *(Free field)* ; All equipment in hospital; I cannot say	
27. How would you like to select services for Continuous SW Upgrades?	I prefer to select services from a Service Catalog; I prefer to negotiate a customized service with GEHC; I prefer to select services from a Service Catalog and then amend that selection by customized service attributes; I cannot say	Materna GmbH 2008. *ITIL Version 3 Pocket Guide*. Materna GmbH.

Question	Answer Options	Literature Reference
Biomeds and Procurement		
28. Would you consider procuring care area specific service levels for continuous SW upgrades?	Yes; No, all equipment should have same service level; I cannot say	Anderson, J. C., Narus, J. A. And Van Rossum, W. 2006. Customer Value Propositions in Business Markets. *Harvard Business Review*. March 2006. 90 - 99. Peppers, D., Rogers, M. and Dorf, B. 1999. Is Your Company Ready for One-to One Marketing? *Harvard Business Review*. January - February 1999. 151 - 160.
29. Which life span of service do you prefer?	1 year; 2 years; 3 years; 4 years; 5 years; Longer than 5 years; Other fixed period agreed with GEHC; For time being; I cannot say	Materna GmbH 2008. *ITIL Version 3 Pocket Guide*. Materna GmbH.
30. Which granularity of Continuous SW Upgrade Service scope do you prefer for your equipment?	Device specific scope; All GEHC patient monitoring equipment are in scope; All GEHC medical devices are in scope; I cannot say	Materna GmbH 2008. *ITIL Version 3 Pocket Guide*. Materna GmbH.
31. Do you expect GEHC to conduct any service provider's quality standard or reference in relation to its continuous SW upgrade services?	No; Yes, the following: *(Free field)*; I cannot say	Materna GmbH 2008. *ITIL Version 3 Pocket Guide*. Materna GmbH.
32. Which frequency of continuous SW upgrade service fee payments do you prefer?	Yearly fee; Monthly fee; Action Based fee; Does not matter, I cannot say; Other: *(Free field)*	Spirek, D. 2001. ASPs: The Real Value Proposition. *Health Management Technology*. July 2001. 24 - 25.
33. As part of Continuous SW Upgrade Service, would you allow GEHC to establish and maintain a registry about your hospital's patient monitoring equipment with detailed HW, SW and accessory configuration data?	Yes; No; I cannot say	Materna GmbH 2008. *ITIL Version 3 Pocket Guide*. Materna GmbH.
34. Would you be willing to notify GEHC registry through a web tool about any changes you make in your patient monitoring configuration?	Yes; No; I cannot say	Frei, F. X. 2008. The Four Things a Service Business Must Get Right. *Harvard Business Review*. April 2008. 70 - 80. Peppers, D., Rogers, M. and Dorf, B. 1999. Is Your Company Ready for One-to One Marketing? *Harvard Business Review*. January - February 1999. 151 - 160. Salvador, F., Martin de Holan, P. and Piller, F. 2009. Cracking the Code of Mass Customization. *MIT Sloan Management Review*. April 2009. 1 - 16. Spirek, D. 2001. ASPs: The Real Value Proposition. *Health Management Technology*. July 2001. 24 - 25. Thomke, S. and von Hippel, E. 2002. Customers as Innovators, a New Way to Create Value. *Harvard Business Review*. April 2002. 74 - 81.

Question	Answer Options	Literature Reference
Final Questions		
35. How GEHC could differentiate itself with its Continuous SW Upgrade Services compared to other patient monitoring solutions suppliers?	*(Free field)*	Anderson, J. C., Narus, J. A. And Van Rossum, W. 2006. Customer Value Propositions in Business Markets. *Harvard Business Review*. March 2006. 90 - 99. Harrington, R. J. and Tjan, A. K. 2008. Transforming Strategy One Customer at a Time. *Harvard Business Review*. March 2008. 62 - 72. Peppers, D., Rogers, M. and Dorf, B. 1999. Is Your Company Ready for One-to One Marketing? *Harvard Business Review*. January - February 1999. 151 - 160. Zeithaml, V. A., Rust, R. T. and Lemon, K. N. 2001. The Customer Pyramid: Creating and Servicing Profitable Customers. *California Management Review*. Summer 2001. Vol. 43. No. 4. 118 - 142.
36. Please, propose any other ideas and comments about Continuous SW Upgrade Service you would like to share with GEHC?	*(Free field)*	
37. Can GEHC contact you later for more customer specific interview or survey?	You are welcome to contact me to the contact information provided; No, I would not like to be contacted at this time	
38. Would you be willing to participate in a Focus Group that will review and evaluate GEHC's new Continuous SW Upgrade Service offering concept for your initial customer perception (GEHC may limit the number of participants if popularity is too high)?	I would like to evaluate GEHC's new service offering proposal, GEHC can contact me to the contact information provided; I would not like to evaluate at this time	
39. Do you allow GE Healthcare to contact you in possible future product or service demand research programs after this specific research where this survey belongs to	Yes, GE Healthcare can contact me for future product or service demand research programs; No, I do not want GE Healthcare to contact me for future product or service demand research programs	

APPENDIX 3: INTERNAL STAKEHOLDER QUESTIONNAIRE QUESTIONS

Question	Answer Options	Literature Reference
Value of Service		
1. What would you like to understand by the concept "Continuous SW Upgrade Service"?	SW upgrades only; SW upgrades and dependent HW upgrades; Keeping the whole device system up to date; I cannot say; Other: *(Free field)*	
2. How would you describe the value of this Continuous SW Upgrade Service to the customer? Please, try to be as specific as possible.	*(Free field)*	Anderson, B. 2008. Service-Level Agreements: It's Value Proposition. *Computerworld* . December 1. 2008. 34. Anderson, J. C., Narus, J. A. And Van Rossum, W. 2006. Customer Value Propositions in Business Markets. *Harvard Business Review* . March 2006. 90 - 99. Berry, L. L. 1999. *Discovering the Soul of Service. The Nine Drivers of Sustainable Business Success* . Free Press. Donath, B. 2007. Set Price Metrics Parallel to Value Proposition. *Marketing News* . April 1, 2007. 6. Gale, B. T. 1994. *Managing Customer value. Creating Quality & Service That Customers Can See* . Free Press. Harrington, R. J. and Tjan, A. K. 2008. Transforming Strategy One Customer at a Time. *Harvard Business Review* . March 2008. 62 - 72. Peppers, D., Rogers, M. and Dorf, B. 1999. Is Your Company Ready for One-to One Marketing? *Harvard Business Review* . January - February 1999. 151 - 160. Salvador, F., Martin de Holan, P. and Piller, F. 2009. Cracking the Code of Mass Customization. *MIT Sloan Management Review* . April 2009. 1 - 16. Spirek, D. 2001. ASPs: The Real Value Proposition. *Health Management Technology* . July 2001. 24 - 25. Thomke, S. and von Hippel, E. 2002. Customers as Innovators, a New Way to Create Value. *Harvard Business Review* . April 2002. 74 - 81. Zeithaml, V. A., Rust, R. T. and Lemon, K. N. 2001. The Customer Pyramid: Creating and Servicing Profitable Customers. *California Management Review* . Summer 2001. Vol. 43. No. 4. 118 - 142.
3. What would be the most important features of Continuous SW Upgrade Service to the customer? Select 1 - 3 the most important features.	SW upgrade frequency; Fixed SW upgrade intervals; Delay of SW upgrade delivery after feature release; SW upgrade delivery method; User training included with SW upgrade; Training delivery methods; Helpdesk services from GEHC; Other features: *(Free field)*	Anderson, B. 2008. Service-Level Agreements: It's Value Proposition. *Computerworld* . December 1. 2008. 34. Anderson, J. C., Narus, J. A. And Van Rossum, W. 2006. Customer Value Propositions in Business Markets. *Harvard Business Review* . March 2006. 90 - 99. Berry, L. L. 1999. *Discovering the Soul of Service. The Nine Drivers of Sustainable Business Success* . Free Press. Donath, B. 2007. Set Price Metrics Parallel to Value Proposition. *Marketing News* . April 1, 2007. 6. Gale, B. T. 1994. *Managing Customer value. Creating Quality & Service That Customers Can See* . Free Press. Harrington, R. J. and Tjan, A. K. 2008. Transforming Strategy One Customer at a Time. *Harvard Business Review* . March 2008. 62 - 72. Peppers, D., Rogers, M. and Dorf, B. 1999. Is Your Company Ready for One-to One Marketing? *Harvard Business Review* . January - February 1999. 151 - 160. Salvador, F., Martin de Holan, P. and Piller, F. 2009. Cracking the Code of Mass Customization. *MIT Sloan Management Review* . April 2009. 1 - 16. Spirek, D. 2001. ASPs: The Real Value Proposition. *Health Management Techn* Thomke, S. and von Hippel, E. 2002. Customers as Innovators, a New Way to Zeithaml, V. A., Rust, R. T. and Lemon, K. N. 2001. The Customer Pyramid: Cr
4. What do you think, how well customers would tolerate situation where any of their patient monitors would not be SW upgraded due to HW	Not any problem; Minor disturbance; Moderate disturbance; Intolerable situation; I cannot say	
5. How GEHC could differentiate itself with its Continuous SW Upgrade Services compared to other patient monitoring solutions suppliers?	*(Free field)*	
6. Please, propose any other ideas and comments about Continuous SW Upgrade	*(Free field)*	

APPENDIX 4: EXTERNAL CUSTOMER FOCUS GROUP QUESTIONNAIRE QUESTIONS

Question	Answer Options	Literature Reference
Value of Service		
1. How would you describe the Value Proposition Draft for this Continuous SW Upgrade Service to you? Please, try to be as specific as possible.	*(Free field)*	
2. Indicate your level of satisfaction for the proposed implementation of each service attribute (1 = Not Satisfied, 5 = Fully Satisfied)	Availability of Service in Two Forms (refer to page 10 of pdf file) Selection of Fee Options (refer to page 11 of pdf file) Reference to the ITIL V3 Framework for IT Types of Services (refer to page 14 of pdf file) Essential Hardware Upgrades Included in the Service Fee (refer to page 15 of pdf file) Contents Strategy of Software Releases to Promote Frequent Software Releases (refer to page 16 pdf file) Upgrade Processes for both Automatic and Authorized Upgrades Availability of Roll Back Process Self-Notification of Hardware Changes Availability of Release Data Self-Booking of Field Engineer for Hardware Changes Self-Booking of an Instructor	
3. Please, provide any other feedback on the Value Proposition Draft for Continuous SW	*(Free field)*	