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Maximizing Customer Value: Better Software and Web Solutions through Iteration of Use Cases

Kaukonen, Sonia Maria

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Sonia Maria Kaukonen
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Laurea University of Applied Sciences **Abstract**
Laurea Kerava
Degree Programme in Entrepreneurship and Business, User-Centered Design
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Sonia Maria Kaukonen

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The concept of use cases appears ambiguous in the academic literature. Strongly rooted in software development and Unified Modeling Language (UML), use cases evolved to a User-Centered Design method in the course of the time. But what factors of use case creation process contribute to maximizing customer value? What is the relation to customer value in this context? Which stakeholders contribute to the use case creation process? This research focused on collecting empirical data in an authentic software development work environment to design a use cases process card for the case company, Tekla Corporation. The deployment of a tabular format of use cases was inspected within a web solution development project for a district heating outage map service.

Methodologically, this research was conducted using *grounded theory* (Glaser & Strauss 1967; Glaser 1978). Charmaz (2006, 14) compares the grounded theory method to a camera with many lenses: first viewing a broad sweep of the landscape and then changing the lens several times to bring detailed scenes closer. This metaphor addresses the openness, pragmatism and flexible focus of grounded theory in comparison to other qualitative research methods.

This research commenced with a review of the existing User Experience (UX) process in the case company, gradually refocusing on the early process phases and finally on use cases. A series of interviews, observations and an expert walkthrough supported the refining of perspectives and research questions in the course of the research. The emerging phenomena were iteratively coded, analyzed, sorted and categorized into an affinity diagram. Key success factors were defined based on the affinity diagram and arranged in a use cases process card. The process card provides recommendations on best practices, format and goal-orientation. The results were compared to the statements from the academic literature on this topic.

As a result, the use case success factors encompass investing in early research, focusing on goals, optimizing the format, iterating through communication and maintaining a sustainable customer relationship. User research in the early phase is the foundation for a functioning collaboration. The research addresses the importance of recognizing user and business goals to streamline the development activities. It also reveals the significance of a systematic communication of tacit knowledge. The process card uncovers a business-oriented perspective which helps to promote User-Centered Design methods among the stakeholders and decision makers within a software development organization to maximize customer value.

Keywords: customer value, grounded theory, interaction design, iterative method, map service, use case, user-centered design, web solution.

Laurea-ammattikorkeakoulu **Tiivistelmä**
Laurea Kerava
Yrittäjyyden ja liiketoimintaosaamisen koulutusohjelma, käyttäjäkeskeinen suunnittelu
Ylempi ammattikorkeakoulututkinto

Sonia Maria Kaukonen

Asiakaslisäarvon maksimointi: paremmat ohjelmistot ja verkkosovellukset käyttötapausten iteroinnilla

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Käyttötapaus-käsitteen tulkinta on tieteellisessä kirjallisuudessa monivivahteista. Vahvasti ohjelmistokehitykseen ja Unified Model Language (UML) -menetelmään juurtuneet käyttötapaukset ovat ajan myötä kehittyneet käyttäjäkeskeisen suunnittelun menetelmäksi. Mutta minkälaiset käyttötapausten ominaisuudet maksimoivat asiakaslisäarvon? Mikä on käyttötapausten suhde asiakaslisäarvoon? Keitä ovat käyttötapausten luomiseen osallistuvat osapuolet? Tämä tutkimus keskittyi empiiristen tietojen keruuseen aidossa ohjelmistokehityksen työympäristössä. Samalla kehitettiin case yritykselle, Tekla Oy:lle, käyttötapausmenetelmän prosessikortti. Tutkimuksessa selvitettiin taulukkomuotoisen käyttötapauspohjan käyttöönottoa kaukolämmön keskeytyshallinnan verkkosovelluksen kehittämisprojektissa.

Tutkimusmetodina käytettiin *grounded theory* -menetelmää (Glaser & Strauss 1967; Glaser 1978). Kuten kamera, jossa on monia linssejä, ensin katsellaan laajaa maisemaa. Sen jälkeen vaihdetaan kameran linssi ja tarkennetaan yksityiskohtiin, toteaa Charmaz (2006,14), joka käyttää tätä metaforaa korostamaan *grounded theory* -tutkimusmenetelmän avoimuutta, käytännönläheisyyttä ja joustavaa fokusta verrattuna muihin laadullisiin tutkimusmenetelmiin.

Tutkimuksen alkuvaiheessa selvitettiin nykyistä käyttäjäkokemusprosessia case yrityksessä lähestymällä asteittain prosessin alkuvaiheen käytäntöjä ja lopuksi varsinaisia käyttötapauksia. Haastattelut, havainnoinnit ja asiantuntijaläpikäynnit tukivat näkökulmien ja tutkimuskysymysten muokkaamista tutkimuksen aikana. Tutkimuksessa esille tulleet ilmiöt koodattiin, analysoitiin ja lajiteltiin iteratiivisesti samankaltaisuuskaavioon. Tämän kaavion pohjalta määriteltiin asiakaslisäarvon kannalta olennaiset käyttötapausten menestystekijät ja järjestettiin ne käyttötapausprosessikortin muotoon. Laadittu prosessikortti korostaa parhaita käytäntöjä, käyttötapauspohjan suosituksia ja tavoitteiden saavuttamista. Näitä esille tulleita tekijöitä verrattiin tutkimukselliseen kirjallisuustietoon.

Tutkimuksen mukaan käyttötapausten menestystekijöitä ovat panostaminen käyttäjätutkimukseen kehitysprosessin alussa, keskittyminen tavoitteisiin, käyttötapauksen formaatin tehostaminen, iterointi viestinnän avulla sekä kestävä asiakassuhteen ylläpito. Alkuvaiheen käyttäjätutkimus on toimivan yhteistoiminnan peruskivi. Tämä tutkimus osoittaa käyttäjän ja liiketoiminnan tavoitteiden tunnistamisen tärkeyden kehitystoiminnan tehostamisessa. Se myös paljastaa systemaattisen hiljaisen tiedon jakamisen tärkeyden. Tutkimuksen pohjalta laaditussa prosessikortissa on asiakashyödyt maksimoiva liiketoimintalähtöinen näkökulma, joka auttaa ohjelmistokehitysorganisaatiossa sidosryhmän jäseniä ja päätöksentekijöitä suosimaan käyttäjäkeskeisiä suunnittelumenetelmiä.

Asiasanat: asiakaslisäarvo, grounded theory, iteratiiviset menetelmät, karttasovellus, käyttäjäkeskeinen suunnittelu, käyttötapaus, verkkosovellus, vuorovaikutuksen suunnittelu.

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Kerava, 19.08.2011 Sonia Kaukonen

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1 Introduction

Interactive solutions, such as software and web products facilitate the interaction between human and computers. Interaction is a key concept of interaction design and can be explained as a transaction between two entities, typically an exchange of information. Interaction takes place between people, machines, systems and a combination of those. (Saffer 2010, 4.) The nature of interactive solutions has increasingly become customized and process-oriented, thus even solutions equipped with sophisticated features may not exactly be what customers really expect.

User-Centered Design (UCD) and user experience (UX) are nowadays playing a greater role in software and web development aimed at understanding user needs, goals and behavior to influence successful implementation, claim Sharp, Rogers & Preece (2007, 520). Nevertheless, UCD and software development seem still quite decoupled. Holtzblatt, Burns Wendell & Wood (2005, 291-300) recommend systematic organizational efforts with involvement of management to grant UCD a solid foundation in the software development process. But why is it worth the effort?

Software and web solutions are often offerings to *business customers* and replace their work processes and routines, which have been so far non-digitalized or covered by other tools and solutions. Striving for improvement is the basis for cooperation between the business customer and the software or web solution provider. The new solution is thus expected to support the *customer's end users* in the most convenient way. The customer's end users may be either representing the customer's organization or the general public. So is the user's advantage the only interest of the customer too?

Software or web product acquisition usually requires a business justification. Productivity and efficiency are important aspects of interactive products in addition to being useful, usable and even pleasurable (Sharp et al. 2007, 520). Usable solutions tend to be more successful – technically and commercially. The economic indicators may comprise of reduced support, training and helpdesk costs. And finally, usable products bring less risks of failure or rejection by their users. (ISO 9241-210 2010, 4.)

The perception of customer value is still difficult to measure and often subject to subjective judgment in the interaction design field. This research aims at looking at common methods to iteratively outline customer processes in the early phase of design and development to avoid faulty understanding: considering how accurate can they be in the very early stage, how they evolve throughout the project, who can contribute to their improvement and finally, what the customer's gain is business-wise out of this effort.

Customer processes need to be explored, understood and documented early in the project, as advised in most of the interaction design academic literature (ISO 9241-210; Sharp et al. 2007; Cooper, Reimann & Cronin 2007; Gould & Lewis 1985). In interaction design with user focus, user research, task analysis and creating user scenarios, user stories and use cases are known as reliable and systematic methods to initially outline and document those processes in the specification phases, but they still did not put roots into software development yet.

Sharp et al. (2007, 509-510) specify user scenarios as a description of user's activities, context of use or simply daily routines as an input for establishing requirements, while use cases emphasize user-system interaction stressing the user's perspective and providing an initial outline for designing the system. User scenarios and user stories usually have narrative character, while use cases consist of action steps in a simple template, flowchart or diagram. In ISO 9241-210 (2010, 11) only one term appears: context-of-use description with the distinction between current context description and context of intended design. The use of terms with regard to these methods varies throughout other academic sources and will be elaborated in detail in chapter 4.3.

This research will refer to *process-oriented use cases* (often described as user scenarios or user stories) in the requirement specifications and to *solution-oriented use cases* in functional specifications (sketching the interaction of the planned software or web solution). In the context of the case organization, requirement specifications mean an outline of user requirements, work environment and customer's and solution provider's benefits, while functional specifications comprise of finding technical solutions and commencing the design. In the software development environment the "narrative" character of the terms "story" or "scenario" does not apply well to the format under development in the case organization to describe user goals, activities, contexts and routines. Cooper et al. (2007, 113) claim that traditional use cases do not sufficiently outline the goals of users' actions and tasks, while this research is an attempt to find a way of presenting wider information than mere functionality workflow and taking advantage of the easy-to-read, schematic and tabular structure of use cases.

1.1 Research motivation and objectives

This research was conducted to explore the relation between implementing and iterating UCD process methods such as use cases and creating customer value in business terms. The researcher performed a committed data collection and evaluation in natural project settings, both within the solution provider organization and with the customer to define the assets of enhancing and institutionalizing the UCD process within the case organization. Grounded

theory was used in this research to define current trends and future improvement potentials. The unique contribution lies in the perspective of anchoring the interaction design discipline and UCD in customer value, which is still underrepresented in the academic literature on interaction design, or even perceived as opposing User-Centered Design.

Based on the grounded theory approach, the research evolved over the time. Grounded theory is aimed at the development of a theory that fits a set of collected empirical data, explain Sharp et al. (2007, 409). The first thought triggering the research was linked to inspecting and reinforcing the role of interaction design in the early phase of software and web development projects since this phase still shows some deficits in the case organization. Later the research focused on verifying the relation of early phase methods, such as use cases to other project activities. In addition, surveying the advantages a cross-functional team can gain from use cases was inspected. During the data collection phase, a new perspective emerged. The academic literature urges the research of customer processes early in the specifications, but is somewhat lacking instructions on how to possibly correct deviations of the process that arise even before prototypes are created. This research discusses how a cross-functional team effort can create customer value through understanding and refining processes, which are the core part of the solution under development.

In interaction design, the concept of iteration usually becomes obvious only from prototyping and usability testing onwards. Iteration allows designs to be refined according to feedback and is necessary, because it is nearly impossible to immediately find the right solution (Sharp et al. 2007, 428; Gould & Lewis 1985; Löwgren & Stolterman 2004, 22). Can anyone expect in practice that first guess of use cases is immediately correct and does not evolve later in the development process? Should use cases remain carved in stone of the specifications documentation as a part of a contract? Or does iteration of use cases rather contribute to better process understanding and adds customer value while producing best possible solution? This thought was crystallized during a series of stakeholder interviews, observations, customer site visits and critical reflection upon the UCD process development, previously only aiming at inspecting use cases as an information source in the software or web development project.

When exercising the grounded theory approach, the results of the data gathering evolved towards this focused phenomenon. As a result, tailor-made practices for the case organization were defined as a part of a so-called *UX methods toolbox*[1] for the early phase. A systematic UX methods toolbox development covering all phases belongs to the future development plans.

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[1] *UX methods toolbox* is developed for training purposes for various target groups in the case organization.

1.2 Research subject and limitations

UCD in software and web development is a challenge and continuously promoted as enriching the end product quality, but also how to convince business customers that this extra effort is worthwhile? This research strives to present evidence that systematically optimized user research methods are in the interest of business customer and end users.

The interaction design field and UCD process are complex and subject to various dependencies on other disciplines. In this research, the dependencies will be limited to software engineering. The evolution of process-oriented and solution-oriented use cases and how they affect the various stakeholders and the quality of the end product is inspected. The gathering of empirical data concentrates on the Tekla Outage Map Service case project and experiences related to the UX process and UX methods toolbox development accompanied by other ethnographic observations in the work environment of the researcher.

1.3 Research questions

Since the research was conducted using the grounded theory approach, no initial research questions were specified (Glaser & Strauss 1967; Glaser 1978; Charmaz 2006). In the course of the research, questions were raised and continuously modified until the final research questions were formulated. Those are:

Which factors of use case creation process contribute to maximizing customer value?

This question attempts to outline the most important characteristics of the use case creation process. Additionally, a clarification of roles and responsibilities in the use case creation process is considered. The supplementary research question is:

What are the stakeholders' roles in the use case creation process?

These research questions are responded to in chapter 8.2 after creating the main concepts and categories of the grounded theory in this research.

1.4 Structure

The grounded theory research encompasses the case study and a comparison to the current academic literature. First, the reader will become familiar with the case organization and topic of the study in chapter 2. The current level of implementation of the UX process and

activities will also be reviewed. Chapter 3 introduces the selection and definition of the research methods for deriving grounded theory. The framework of the research lies within the discipline of interaction design, hence chapter 4 outlines the definition of key concepts and principles and the relationship to other disciplines, in this case to software engineering. The complex terminology of use cases methodology is systematically presented. Finally, an initial link to the concept of customer value is outlined. Thereafter, chapter 5 provides an overview of the data collection excerpts. Chapter 6 moves on to the coding, sampling and sorting resulting in an affinity diagram. Chapter 7 presents the description of the final categories derived from the empirical data and is compared to academic literature and studies. The "lens" of customer value is applied. Finally, a discussion answering the research questions and presenting recommendations for the use cases process card of the *UX methods toolbox* and an inspection of the ethics, validity and reliability culminates the research followed by final conclusions including further development plans and personal reflections in chapters 8 and 9.

1.5 Key concepts and definitions

The purpose of the overview of key concepts and their definitions is to provide a common understanding of the key notions that are used in this research, because the use of concepts and terms may vary across other academic sources. For this research, the most suitable definitions were cited or adapted. The following concepts are introduced in alphabetical order:

Business customer / Customer

"Customers of a product are stakeholders who make the decision to purchase it" (Cooper et al. 2007, 55). In the case project, the business customer also acted as system user familiar with Tekla Solutions, which brought a slightly different nuance to the project business settings.

End user / User

"User is a person who interacts with the product" (ISO 9241-210 2010, 3). In the case project, end users represented either the customer organization (system users) or general public (users of the IMS web interface for district heating outages).

Grounded Theory

Grounded theory methodology is a systematic qualitative analysis and interpretation while emphasizing the importance of empirical data in the derivation of theory. Research questions

are not specified in the beginning of the research, but they evolve throughout the process. (Glaser & Strauss 1967, renewed 1995, 1; Charmaz 2006, 8-9.)

Interaction design

Interaction design means planning and designing of digital product and system behavior, both the form and the aesthetics to support human behavior (Cooper et al. 2007, 13). "Interaction design is concerned with theory, research, and practice of designing user experience for all manner of technologies, systems, and products" (Sharp et al. 2007, 10).

Use case, process-oriented (user scenarios, user stories, context of use)

Human activities or tasks in a story that allows exploration and discussion of contexts, needs, and requirements. It does not explicitly describe the use of software or other technological support to achieve a task. (Sharp et al. 2007, 505.)

Use case, solution-oriented (use case, context of use)

"Use cases also focus on user goals, but the emphasis here is on a user-system interaction rather than the user's task itself". Their focus lies on the interaction between the user and a software system, but the stress is still very much on the user's perspective, not on the system. (Sharp et al 2007, 510.)

User-Centered Design (UCD) / Human-centered design (HCD)

"Approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors / ergonomics and usability knowledge and techniques" (ISO 9241-210 2010).

User experience (UX)

"Person's perceptions and responses resulting from the use and/or anticipated use of a product, system or service" (ISO 9241-210 2010, 3). User experience means how a product behaves and is used by people in the real world. It includes their overall impression of how good it is to use. (Sharp et al 2007, 15.)

1.6 Acronyms

Hence both the interaction design discipline and the product offering of the case organization include acronyms, an introductory acronyms list is provided.

GIS	Geographic Information System (also Tekla GIS solution)
HCI	Human-Computer Interaction
IMS	Internet Map Service (Tekla)
NIS	Network Information System (also Tekla NIS solution)
OMS	Operation Management System (Tekla)
UCD	User-Centered Design
UML	Unified Modeling Language
UX	User Experience

2 Research background and case organization

The purpose of this chapter is to introduce the case organization and the software and web solution offerings related to the case project. A brief outline of the case project and the key stakeholders of the UX process complement the overview, highlighting the role of the UX professionals and the researcher to better understand the interdependencies between UX and the stakeholders in the software development process. Finally, the level of current implementation of use cases in the case organization and the innovations in the case project are discussed.

2.1 Case organization

Tekla Corporation was established in 1966 as an Automatic Data Processing (ADP) company in Helsinki (Finland) offering consultation, computing services, training courses and software development. Nowadays, Tekla's software solutions, products and services are targeted at customers' core business processes in building and construction (Tekla Structures) and infrastructure management and energy distribution (Tekla Solutions). Tekla's model-based software products are used in nearly 100 countries and the company's head office is located in Espoo (Finland). Tekla became part of Trimble Group in July 2011. (Tekla 2011a.)

Tekla Solutions provide information management and process support tools for infrastructure-related business operations, such as energy distribution, public administration and civil engineering. Public administration applications for storing and managing built-up environment data are based on the Geographic Information System (GIS). In the energy distribution sector

Tekla serves utilities, companies and organizations working with electricity, district heating, gas and fiber optic communication networks covering asset management and planning, construction, operation and maintenance. The solution consists of a Network Information System (NIS) platform and modular industry applications for various processes. (Tekla 2011a.)

The scope of this research focuses on the User-Centered Design practices of the Infra & Energy business unit with regard to the Tekla Solutions software offering for energy distribution, in particular district heating, henceforward referred to as case organization.

2.2 History of Tekla Solutions for energy distribution

In early 2011, Tekla Corporation redefined the set up of its offerings in the Infra & Energy sector. Tekla Solutions for energy distribution are based on the NIS basic, which is used for modeling and managing electricity networks and the related business processes. The network data on the utility's energy network is gathered into a single database and as a multi-user system, it enables different work processes to simultaneously use and maintain the same data. Additionally, configurable modular industry applications supporting various customer-specific processes can be combined with the NIS basic platform according to individual needs. Capabilities to store location information for each network object are supported, for example, in district heating technical planning, maintenance, operation management and network construction with additional Geographic Information System (GIS). To enable publishing data on the internet or intranet, web applications for offering GIS data and services can be integrated into the system, such as Internet Map Service (IMS). Tekla Solutions for energy distribution can be integrated with other systems through various standards, common interfaces, for example, to Supervisory Control and Data Acquisition (SCADA) systems and Customer Information Systems (CIS). (Tekla 2011a.)

2.3 Case project: Tekla Outage Map Service for district heating

Feeding district heating outage data into Tekla NIS is not a new functionality. Both planned and unplanned outages can be documented using the Operation Management System (OMS). This means planned construction or maintenance work, but also sudden district heating outage situations. So far, district heating operators still have not been able to take full advantage of OMS data for communicating relevant outage information to their customers. Publishing a list of outages on the district heating operator’s web pages, answering customer calls, local radio announcements used to be the most typical communication channels, to name a few. The target of faster, more reliable and efficient publishing of outage information on the web and visualizing the affected locations on the Tekla IMS triggered the Outage Map Service web development project. The Tekla Outage Map Service web cannot replace all current pub-

lishing channels, but establish a main source of information and support the laborious outage listing on the web. It is expected that public information about district heating outages is shared in nearly real-time and reduces, for example, the service line workload peaks in outage situations. Ideally, a subscription service for house owners and tenants could ensure the outage information distribution to the relevant parties. The Tekla Outage Map Service for district heating requires efficient promotion and visibility on the district heating operator's main web page to ensure that it will become widely used.

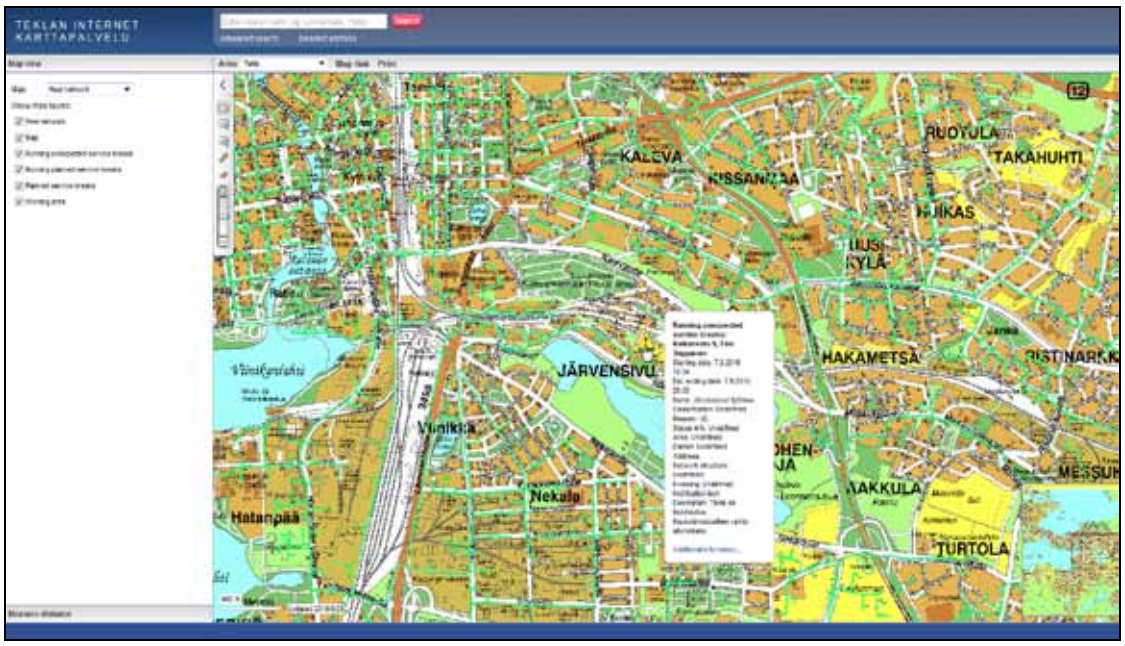

Figure 1: Pilot version of IMS user interface for district heating

Figure 2: Detail view of the outage information displayed on IMS for district heating

In more detail (see Figure 2), the outage information appears as an icon on the map with relevant information for the district heating customers. The tooltip[2] appears while pointing at the icon.

Process-oriented web solution development, such as the Tekla Outage Map Service depends on understanding needs: How is the Tekla NIS solution currently used for feeding in OMS data? What are the typical workflows? Which information should be reserved for internal use and which shared with the public? What does a district heating customer (end user of the Outage Map Service) expect to see on the map? Which types of outages need to be differentiated on the map? It was deemed important that understanding those questions early in the requirement specifications phase and incorporating them into the existing platforms such as Tekla NIS and IMS will serve customer's and user's way of working. The research was carried out by inspecting the implementation level of use cases and their impact on cross-functional project work and quality of the end product in the pilot phase.

2.4 UX process and its stakeholders

The Tekla UX process (former usability engineering process) was redesigned to highlight the ISO 9241-210 (2010) improvements, in particular the early phase UX involvement in the requirement specifications phase and iterative methodology throughout the whole lifecycle. Being a part of the software development process, UX process is affected by numerous dependencies. Internal and external stakeholders can be identified. Stakeholders within the case organization are typically internal stakeholders, while external stakeholders represent mainly the customer organization or end user groups, in this case potential system users of the district heating company or general public.

2.4.1 User Experience (UX) team

The Tekla User Experience (UX) team's common mission is "to uplift the user experience, consistency, efficiency and professionalism of Tekla products through improving their usability. The goal is to make Tekla products easy and pleasant to learn and use, so that they support the effective and efficient completion of users' tasks in a given work context." (Tekla 2011b.)

The Tekla UX team was formed approximately six years ago. The team members are mainly User Experience specialists. The team is lead by the User Experience manager.

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[2] Tooltip is a graphical user interface element appearing in conjunction with a cursor, usually a mouse pointer.

UX team activities cover both the Infra & Energy and Building & Construction business areas and day-to-day operation development, such as creation of common guidelines, style guides, distributing UX know-how to various target groups through internal training, workshops and briefing sessions. Currently the UX process, which is part of software development process, has been further streamlined. In addition, targets for further improvements have been set in the strategic action planning.

2.4.2 Internal stakeholders

In the Tekla Infra & Energy business unit, the software development process is owned by software development managers, thus UX process renewal activities are agreed upon and approved by the process owners. In the user research and requirement specifications phase, close cooperation occurs mainly with product management. The activities are comprised of performing user research, planning UX methods to be involved in the project and providing input on UX requirements to the requirement specifications document. The cooperation with software product development stretches across the design and development phases, focusing on interaction design, prototyping, usability testing and consultation. The target is to further promote the importance of the iterative lifecycle supported by an unambiguous definition of the UX process. A working group formed between the UX specialists and several software developers especially interested in UX matters was established. The purpose of the working group consists of cross-functional information sharing, technology co-operation, enforcing and promoting UX issues across the software development teams.

Other internal stakeholders include, for example, the web team, customer service, documentation and testing and occasionally other support functions.

2.4.3 External stakeholders

The external stakeholders are typically business customers and end users. End users can either represent the customer's organization or belong to general public (customers of the customer's organization).

Typically a business customer represents the negotiation counterpart in all software development issues from the beginning of the project. Customer interface person(s) involved in negotiations are possibly also users[3] of the future software and web solution, usually the system users, also in the case project. It is considered an asset for the negotiations if the busi-

[3] The user, is defined as a person who interacts with the product (ISO 9241-201 2010, 3).

ness customer is experienced in using the product. Nevertheless, it can be also an obstacle to creating a new solution or making innovations to the existing one since the customer may have certain expectations on the product.

Tekla Outage Map Service users can be categorized based on the nature of the potential tasks. The user roles were specified in the requirements specifications and classified in detail in the functional specifications document.

Roles	Description
Administrator	Customer support personnel, system user, operator or some other employee in the network company whose job is the manage account's of public users.
Operator	Operator is a role for a member of network operation personnel with assigned operative responsibilities (and authorities). Operator uses NIS OMS in REAL or PLANNING state.
Planner	Planner is a role for any personnel involved in network operation when recording actions to the valve closing list. Planner uses NIS OMS in PLANNING state.
Public user	Someone that register on a public web page. For example a house manager for apartment building.
Subscriber	Public user
System user	System user maintains and configures the NIS system
User	Planner or operator

Table 1: User roles according to Tekla Outage Map Service functional specifications

The main external stakeholders in this research are system users. Input from potential subscribers (public users) was simulated in the usability testing sessions during the design and development. It is planned to collect further feedback from public users after the solution will be made available for general public.

Involving customers and end users in the development process links interaction design and User-Centered Design disciplines. Saffer (2010) recommends that users are to some extent co-creators of the product and in an ideal situation, involved from the very early phase and in all stages of the design and development in a User-Centered Design process.

2.4.4 Researcher's role

The researcher completed a one-year study programme in User-Centered Design at the Laurea University of Applied Science in 2007. After joining Tekla Corporation (Infra & Energy business unit) as usability engineer in 2008, the job title was later renamed to UX specialist. The change also had impact on the job responsibilities. Moving away from the misconceptions that usability means merely "ease of use", user experience has a broader view on perceptual and emotional aspects and satisfaction (ISO 9241-210 2010, 7). In 2009, the researcher commenced the Master's Degree Programme in Entrepreneurship and Business specializing in User-Centered Design. This thesis culminates the Master's Degree Programme.

As a member of Tekla's UX team, the researcher was responsible for the UX issues in the Tekla Outage Map Service case project from the early requirement specification phase. In the Tekla Outage Map Service development project, empirical steps were taken at clearer definition of the role of use cases and their impact on the entire design and development process and its stakeholders and the measures how to enhance them in the course of a project. The researcher was the primary contact in UX matters for internal and external stakeholders. At the same time, the Tekla UX process was undergoing a redesign. The researcher was assigned to facilitate the review and prepare the new process chart and documentation. The key factors were to intensify the participation of UX starting from the early phase of requirement specifications including user research and focusing on making the entire process iterative.

2.5 Current level of use cases implementation in the UX process

The practice of documenting use cases varies across different software and web development projects in the case organization. There are two potential reasons: many development projects are based on long customer relationships and the case organization representatives are familiar with the industry practices and customer work environment. The information is documented as separate requirements and the interdependencies rather discussed face-to-face. This may appear quite abstract to, for example, new project team members since dependencies can hardly be derived. On the other hand, specification documents are extensive and there may be lack of willingness (and often time) to document issues which appear obvious to the authors. First, within the UX process development project, optimizing these practices was considered and collection of stakeholder opinions evaluated. Along a renewal of the requirement specifications template, a simple structure was proposed for documenting use cases leaning on various academic publications (for example, Schneider & Winters 2000; Cockburn 2001; Cockburn 2002).

In the case project, the description of the customer process was documented in a narrative way as a part of the requirement specifications and its executive summary. As key motivation, factors of efficiency and quality improvement were mentioned. The documentation included a description of the current work environment illustrating the outage publishing process and its visual representation. Accordingly, a list of district heating outages can currently be found on the company web of the district heating organization, as illustrated below.

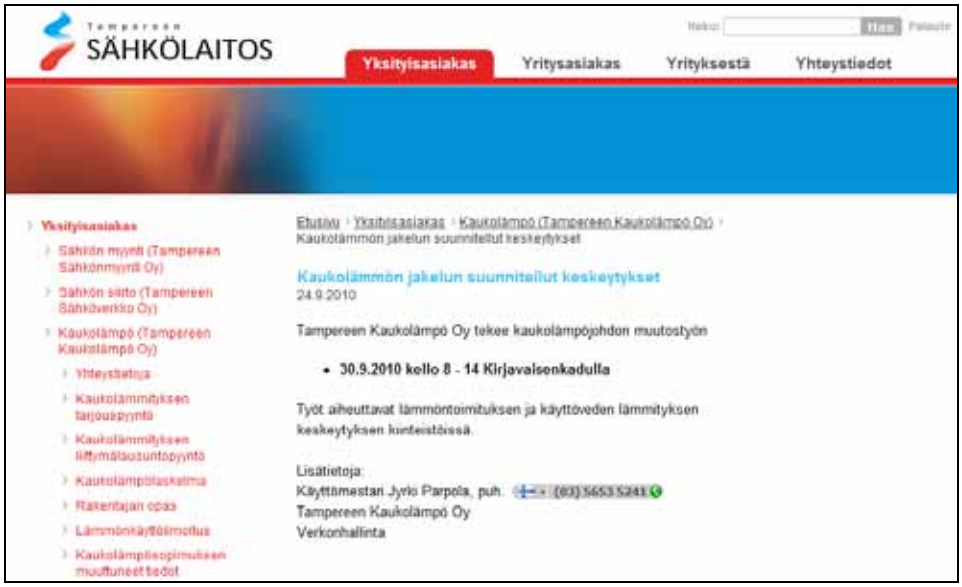


Figure 3: Previous user interface for communicating outages (Tampereen Sähkölaitos 2010)

In addition, information about the current level of NIS solutions usage for outage management was communicated, but not elaborated upon in the requirement specifications document.

Typically, program management interacted directly with the customer. The UX specialist was involved in site visits and other customer meetings, for example on the occasion of the Tekla Outage Map Service round table during the Tekla User Days 2011.

The map-based solution was defined such that it should become a part of the company web of the district heating company. This is in line with other Tekla IMS-based solutions, for example, for municipalities, thus comparable cases could be found.

Users of the solution under development and a brief description of their roles were listed in Table 1 in chapter 2.4.3 both in requirement and functional specifications. The definition was derived from the experiences through previous cooperation; thus no actual user profiles with in-depth information such as personas by Cooper et al. (2007) were researched in the case project.

Other contexts of deploying simplified process-oriented use cases for different purposes were encountered in the work environment, where, for example, during a business unit training session on software version content, the Tekla Outage Map Service was presented. The presentation consisted of a briefing and a demo. The briefing commenced with use cases for understanding of the purpose and the workflow including an example of publishing practices for planned outages. The presentation took place in April 2011.

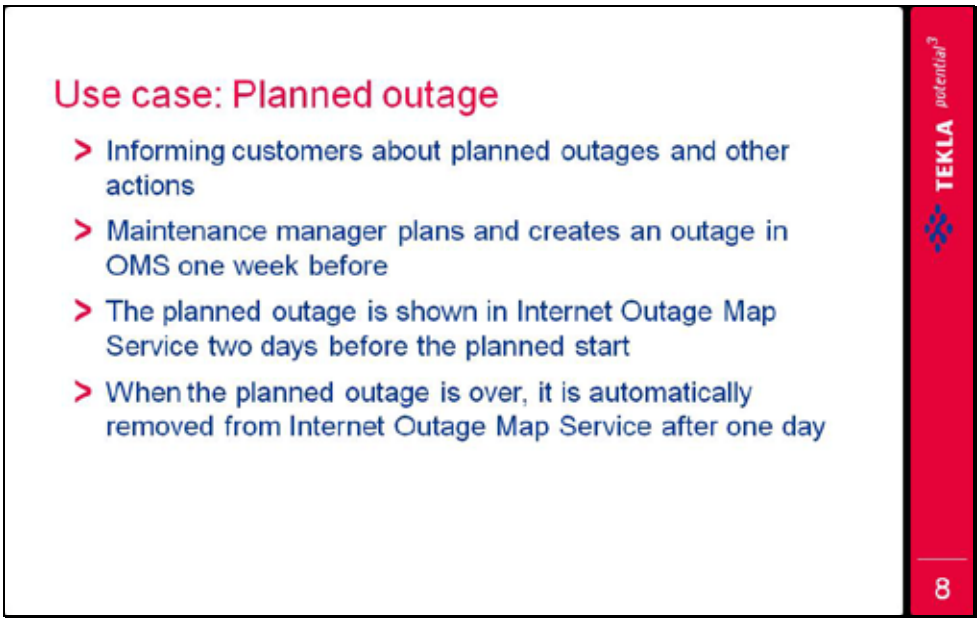


Figure 4: Example of brief use case (I&E Academy on the Tekla Outage Map Service)

In the functional specifications, solution-oriented use cases were developed based on the currently available template. Before, there was no harmonized practice to use the template for specifications. In the interviews and observations, feedback was given by many stakeholders on how they worked with the format and what may be a potential subject for further development.

One of the use cases in the case project is illustrated below. More examples based on the case project are demonstrated in Appendix 1.

Use Case Summary:	**Display running unexpected service breaks in IMS**
Actors:	Operator
Preconditions	· Unexpected service break occurred
Basic sequence	· Create the unexpected service break and enter all the wanted attributes for it (explanation etc.) · Set the service break to active · Close the valve (some objects get unsupplied) · The objects of the service break appear to the IMS after next polling
Post-conditions	· Open the valve (or change the status of the service break to be Over) · The objects disappear on the IMS after next polling
Open Issues	

Table 2: Use case example on running unplanned service breaks

The use case summary was brief and indicated the different options of outage publishing on the IMS web. Actors were derived from the user roles table described in the specifications documents. The basic sequence consisted of a task flow while post-conditions illustrated the final result. The event causing the action need was described in the pre-conditions section. No open issues were documented at this point.

Using the format was the first step towards presenting use cases in a tabular, easy-to-browse format. But was the content sufficient and understandable? Was the language understandable and concise? Did the user aspect prevail over technical functionality description? These questions were part of the clarification during the data collection phase in order to strive for future improvements.

Further ethnographical observations were made while planning the next release of NIS solutions. Use cases in the tabular format seem to be present in more detail in various projects, often as a separate working document for internal purposes. This may have its roots in the contractual format of requirement and functional specifications. A separate document apparently allows for more freedom to outline use cases in more detail and update them more frequently.

3 Applying grounded theory research method

Grounded theory methodology is a systematic qualitative analysis and interpretation while emphasizing the importance of empirical data in the derivation of theory (Glaser & Strauss 1967, renewed 1995, 1; Charmaz 2006, 8-9). The method has evolved throughout the years. While Glaser remained consistent with comparative inductive methods, Strauss moved towards a new inductive-deductive methodology allowing for the forcing of data and analysis from preconceived categories. Charmaz (2006, 9) responded to Glaser's and Strauss' invitation to use grounded theory flexibly compiling a practical and contemporary set of guidelines, which provided a process framework for this research.

The interpretation of grounded theory by Charmaz (2006, 10–12) comprises of collecting data, initial and focused coding, memo-writing, theoretical sampling, saturation and sorting followed by reconstructing and writing the theory. This process model was used for this research to derive best practices and improvement potentials within the case organization based on authentic empirical data. Applying grounded theory was expected to better outline how to create and maximize customer value through selected interaction design methods in software and web development on an example of use cases since academic literature seldom profoundly discusses these aspects.

3.1 Research approach

Charmaz (2006, 14) uses a metaphor to point out the clearer focus of grounded theory in comparison to other qualitative methods: "Like a camera with many lenses, first you view a broad sweep of the landscape. Subsequently, you change your lens several times to bring scenes closer and closer into the view."

The "camera lens" in this research was first directed towards the broader view on the UX process maturity in the case organization, later bringing early phase interaction design activities and finally use cases into the scene based on a concrete case project, the Tekla Outage Map Service. Refining the understanding of the role of use cases brought about a new direction resulting in an iterative redefinition of the research questions. Repeatedly, use cases were named by the interviewees as one of the most important tools for communicating customer processes and outlining the solution under development. Blumer (1969) describes it as a notion of sensitizing concepts, when initial ideas and the emerging data are constantly re-evaluated and sensitize the researcher to ask particular questions (Charmaz 2006, 17).

3.2 Research process and techniques

Charmaz (2006, 11) draws attention to the non-linear nature of the research process and illustrates the grounded theory process in the following chart:

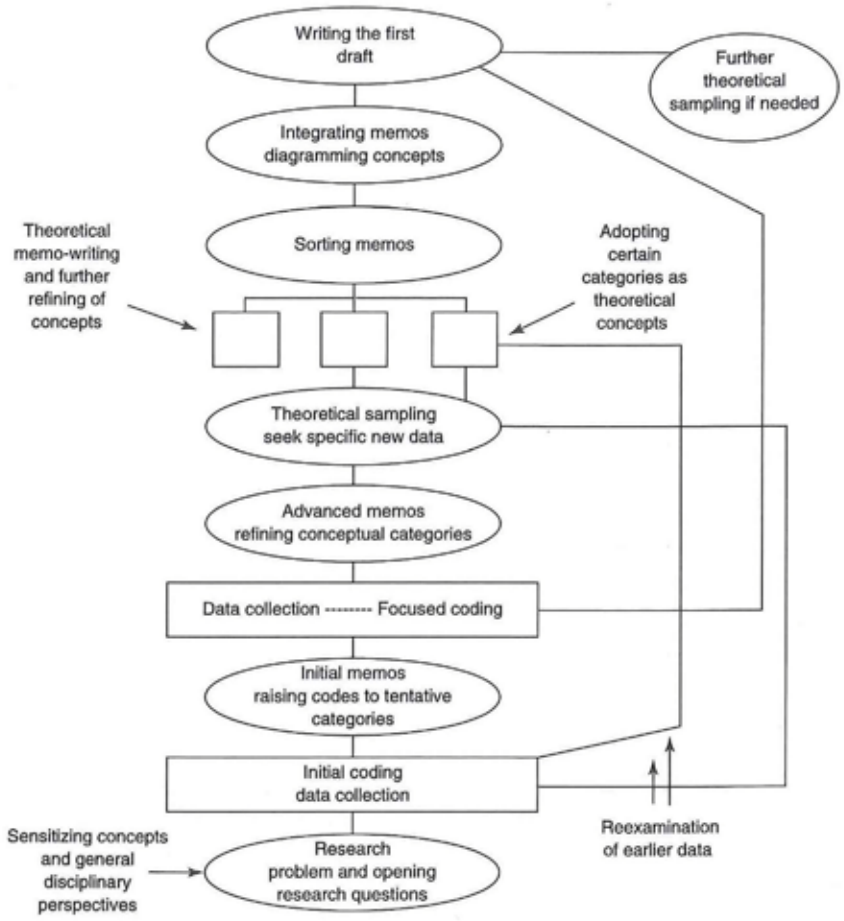


Figure 5: The grounded theory process (Charmaz 2006, 11)

The main phases of the grounded theory model are carried out iteratively. This means that during the analysis the researcher can continue collecting data and asking more detailed or refocused questions. Writing and reviewing memos helps the researcher to reflect upon the emerging theoretical concepts before a final theory is written for the audience.

The following sections outline the selected techniques for data collection, analysis and constructing the theory and how they were adapted in this research.

3.2.1 Data collection

Three different data collection techniques were applied in this research. Interviews and ethnographic observations were selected following Charmaz's (2006, 13–14) recommendations. This research refrained from textual analysis since observations in combination with interviews allowed direct, synchronous dialogue adding the possibility to observe moods and body language of the interviewees and test users. Minor obstacles such as geographical dispersion of stakeholders were overcome by planning and scheduling of the research well in advance. In addition, expert walkthrough reflecting the researcher's own experience using use cases in planning, performing and evaluating the usability testing sessions underpinned the data collection. For this purpose, Nielsen's (1993, 155) cognitive walkthrough methodology was adopted. All applied techniques focused on collecting rich qualitative data.

The diagram below illustrates a summary of the data collection activities related to the case project. The sessions stretched from late 2009 until mid 2011 accompanied by the iterative analysis, memo writing and focusing on further data collection. An overview of the amount of participants, schedules and stakeholders' background followed by several excerpts of the field notes is provided in chapter 5.

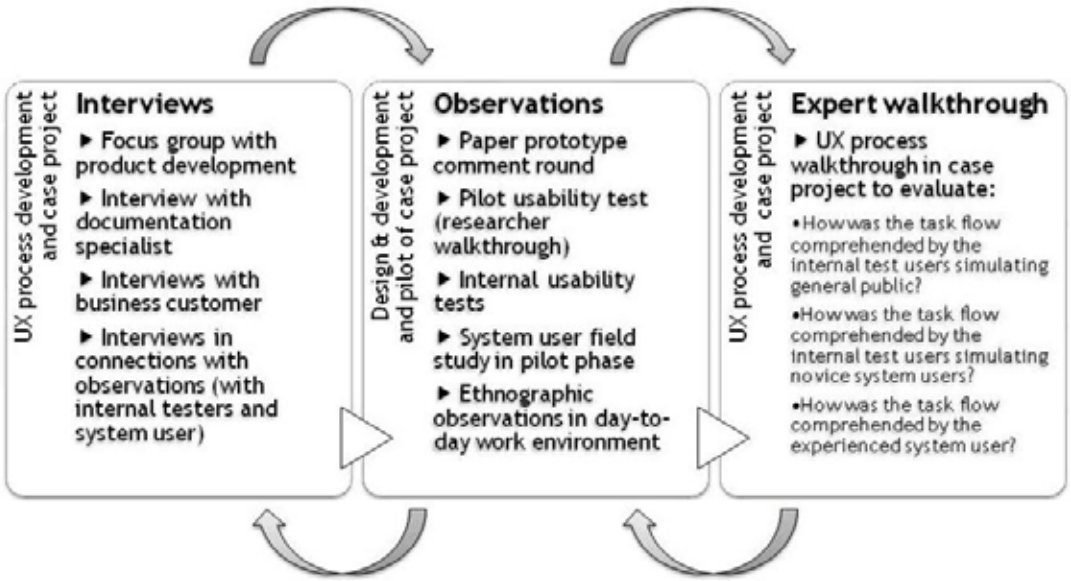


Figure 6: Outline of data collection sessions in the case project

Interviews are typically defined as conversation with a purpose (Kahn and Cannell, 1957). Interviews can be held with a group of people simultaneously, as a focus group (Sharp et al. 2007, 302). A focus group with product developers was selected, because it allowed for collecting multiple viewpoints, highlighting areas of consensus and conflict. Nevertheless, it poses a risk of dominant characters. (Sharp et al. 2007, 343.) Due to the participant selection, familiar atmosphere in the product development team and a skillful moderation by the researcher and the UX manager, a solid foundation for further refining of the research was set by the focus group session.

Charmaz (2006, 25) uses the concept *intensive interviewing*, meaning an in-depth exploration of topics and experiences. In this case, only a few basic questions are prepared allowing the interview to become conversational. In order to collect the interviewee's impressions and subjective data, the researcher paid attention to professional recommendations on successful interviews such as presenting open-ended, concise, non-compound questions formulated in a clear language and switching to a listener rather than a speaker role (Robson 2002; Sharp et al. 2007, 358). In this research, the amount, nature and frequency of questions were evaluated case by case, matching the interviewee's context, expertise and involvement in the case project. Questionnaires were prepared for interviews with the documentation specialist and the business customer. Other interviews were held in a conversational manner.

Sharp et al. (2007, 303) point out the dilemma that "What users say is not always what they do" and offers ethnographic observations as a technique for better understanding of user context, tasks and goals. Ethnographic observations in the form of usability tests were applied in this research to verify the task flow and goals as defined in the solution-oriented use cases. Due to the project settings, the usability tests took place in usability laboratory (with internal test users during the design and development) and on customer site (with the system user during the pilot use). The system user's test environment did not yet fully represent the user's natural settings, which would allow gaining even a deeper insight, as pinpointed by Sharp et al. (2007, 323). Instead, advantage was taken of learning about user's procedures, regulations and standards, focusing on details without interruptions in a controlled environment as well as increasing trustworthiness and credibility and developing relationships with the stakeholders. Considering the limitation of the applicability of results in the user's natural settings due to artificial conditions need to be considered. (Sharp et al. 2007, 323; Shneiderman & Plaisant 2010, 129–132).

So-called thinking-aloud enhances feedback collection during ethnographic observations, but may be challenging depending on the participants' ability to express their thoughts and assumptions. It also can make the duration of tasks longer and change a user's behavior. (Dumas & Redish 1999, 279.) Nevertheless, asking questions is not found as intrusive in the usa-

bility laboratory as in the field observations (Erickson & Simon 1985). In the case project, interviews during the ethnographic observations (usability tests) kept the research focused on examining the role of use cases. Both the internal test users and the system user communicated openly during the observations. While the internal sessions followed the planned task flow more strictly, the system user (experienced with the system) performed the tasks without prescribed task flow.

The researcher reflected upon her own work routines from the expert perspective, especially considering the interdependencies between use cases and the planning, performing and evaluating of the usability tests. For that purpose, a checklist was developed to analyze different aspects in an expert walkthrough derived from Nielsen's (1993, 155) cognitive walkthrough. The result of a cognitive walkthrough relies on the expertise of the evaluator and may be highly subjective, thus it is recommended to involve several evaluators in the long run. The purpose of the expert walkthrough was to draw conclusions for further UX process development on a practical level, however, less formally than in a process inspection or validation.

Since in most cases recording and transcribing interview and observation data was not possible due to non-disclosure, field notes formed the basis for analysis. This influenced the coding of concepts and categories so that it was possibly not as deep as coding from transcripts, but it provided a wider view for deriving the grounded theory as claimed by Charmaz (2006, 70). Shneiderman & Plaisant (2010, 129–132) also confirm that in most cases, written report summaries are more useful than complete transcripts, which include voluminous data.

3.2.2 Data analysis

In grounded theory, the empirical data is constantly compared and categorized. The categories are modified into more abstract, theoretical concepts, which are finally logically arranged. Modifications are possible along the continuous empirical data collection. (Jupp 2006, 131-132.)

The categories are created based on coding. Coding data means labeling segments of data for further distillation, sorting and comparison supported by writing memos to compare data, explore ideas about the codes and direct further data gathering. The collected data is separated, sorted and synthesized through qualitative coding. This enables further categorizing and comparisons. (Charmaz 2006, 3.)

Grounded theory distinguishes at least two levels of coding: initial and focused coding. While initial coding early data is inspected for further analytic ideas in further data collection, focused coding helps to pinpoint refined categories. (Charmaz 2006, 46.)

In this research, first step coding occurred through line-by-line coding, meaning naming each line of written data (Glaser 1978; Charmaz 2006, 50-51). This laborious process was selected, because it contributes to crystallizing data, identifying gaps and discovering nuances and in-depth information. Using gerunds for codes was applied to identify action-oriented components, implicit concerns and explicit statements for further refocusing of data collection. (Charmaz, 2006, 49-51.)

Focused coding occurs after analytic directions have been established, but returning to initial coding is iteratively possible and often necessary to make the initial data explicit (Charmaz 2006, 57-58). In this research, most significant or frequent codes were chosen and refined for further categorizing.

Throughout the research, codes and categories were explored and analyzed by writing memos for personal use. Memo-writing forms an intermediate step between data collection and writing the theory draft. It prompted the researcher to compare and analyze data early in the process and explore implicit and unstated meanings, as recommended by Charmaz (2006, 72).

Theoretical sampling means seeking more accurate data when an emerging idea appears incomplete and needs to be refined, for example, by involving new participants and seeking for statements, events or cases. If no further data emerges, the categories are saturated. Thereafter, they can be sorted for integration into the emerging theory. Charmaz (2006, 96–115.)

Visual representations such as diagramming are recommended for sorting, because they provide the framework for a logical structure of the analysis and aid theory creation (Charmaz 2006, 115-117). The affinity diagram was selected to classify the themes and general patterns while researching the research topic and establish the interdependencies of use cases in the software development process more systematically. This method was seen as applicable to distill a large number of ideas into a refined set of related groupings followed by the analysis as recommended by Project Management Hut (2008).

3.2.3 Constructing theoretical concepts

Referring to social sciences in relation to grounded theory, positivist and interpretative inquiry can be distinguished. While a positivist approach seeks explanations, understanding phenomena prevails in the interpretative approach. Charmaz (2006, 126 - 127.)

Interpretative inquiry was selected for this research, because it served the purpose of the research to conceptualize, understand and articulate the studied phenomenon in abstract

terms for identifying process strengths and weaknesses in the case organization, showing the direction for further development.

The evolution of grounded theory brought about further classification into constructivist and objectivist grounded theory. In line with interpretative inquiry, constructivist approach was considered applicable for this research, meaning that data and analysis are created from shared experiences and relationships with participants and other data sources. (Charmaz 2006, 129–130.)

Grounding the link between maximizing customer value and well-defined, iteratively refined use cases was expected to uncover a new, business-oriented perspective which helps to promote interaction design methods among the stakeholders and decision makers of software and web development projects. The theoretical categories form a UX toolbox methodology description in relation to the common academic literature. The description is targeted at different stakeholders groups and will be proposed for pilot use and further development in the case organization.

4 Research discipline framework

Typically, grounded theory offers freedom to generate new concepts explaining human behavior and no pre-research literature review is conducted so that the researcher does not create preconceptions. This sounds quite challenging, since the researcher's professional experience and UCD education track record and the knowledge of the disciplinary literature in some way influence the creation of the grounded theory ideas. In this research paper, the theoretical framework described in this chapter should serve the reader to get acquainted with the main concepts of the research discipline. A more detailed critique, comparisons and analysis based on academic sources are presented in the empirical part in chapters 7 and 8.

The framework of the research lies within interaction design discipline. Interaction design discipline – among other approaches - systematically involves User-Centered Design methodology to ensure proper understanding of users. The earlier user needs and behavior are explored, the better, claim Sharp et al. (2007), among others. How to gather all this information to produce a high-quality solution? Pondering these issues required clarifications with the involvement of internal and external stakeholders to collect as many aspects as possible and derive the grounded theory.

This chapter introduces the key concepts and principles followed by pondering the challenges in the relationship between interaction design and software engineering. Then different definitions of use cases as a method are presented. The terminology of use cases appears ambi-

guous, thus it is important to get a grasp of how it evolved over time. In addition, seeking an appropriate concept definition of customer value was carried out to streamline the research towards the business orientation.

4.1 Interaction design concepts

In the academic literature, interaction design is considered as a novice field and often as a melting pot of numerous related disciplines. It is mainly attributed to digital or computer-based products, but it is not solely limited to this field.

The term interaction design goes back to 1990 and was first used by Bill Moggridge during the rise of new computer technologies. In an interview with Gillian Crampton Smith, the director of Interaction Design Institute Ivrea, interaction design is defined as "shaping our everyday life with digital artifacts, for work, for play, and for entertainment". Digital artifacts comprise of computers, telecommunications and mobile phones. (Moggridge 2007, xi.)

After the initial definition, the discipline has grown and evolved, but interaction design thinking has already existed in a non-formalized way in prerecorded history. Saffer (2010, 8) considers, for example, tribal smoke signals and landmarks as forms of interaction design thinking.

Cooper et al. (2007, 13) describe interaction design as planning and designing of digital product and system behavior, both the form and the aesthetics to support human behavior. This procedure consists of understanding how people, who are the potential users of the product, live and work, thus both aesthetic and cognitive principles need to be applied and work in harmony. The focus lies on goals as primary drivers of design decisions to ensure that potential users of a product will accomplish their tasks successfully. The model is called Goal-Directed Design (GDD).

Sharp et al. (2007, 38) define interaction design as follows: "interaction design is concerned with designing interactive products to support the way people communicate and interact in their everyday and working lives." A final product or system supporting users' interaction in an effective, useful and usable way are the ultimate goal of interaction design activities (Sharp et al. 2007, 6). The discipline of interaction design is also considered in this publication fundamental for researching and designing computer-based systems for users (Sharp et al. 2007, 9).

The Interaction Design encyclopedia entry specifies interaction design as shaping of interactive products and services with a specific focus on their use making a distinction between its relationship to design disciplines and HCI[4] (Löwgren 2008).

Dix, Finlay, Abowd & Beale (2004, 192) highlight yet another important issue for the research: interaction design covers more than just the artifact of a physical device or computer program, but it is also how it affects the way people work. Manuals, tutorials, online help systems are an important part of the artifact if they are needed to support the users' interaction with the system.

All these definitions reinforce essential perspectives of interaction design, such as understanding users' behavior, needs, goals and way of working. In addition, digital and interactive products are mainly concerned. For this research, the distinction between form and aesthetics by Cooper et al. (2007) proved one of the most important. It raises the awareness that interaction design occurs earlier and more profoundly than merely on the visual level of the user interface. Applying interaction design principles requires that respective practitioners participate in the software development project from the beginning. In addition, Cooper et al. (2007) focus on user goals, which is in line with the nature of the case project. The logic and complexity of the Tekla Outage Map Service required a strong focus on the final result of users' actions.

4.2 Challenges of interaction design in software development projects

Academic literature outlines the multidisciplinary roots and interdependencies, but also addresses the decoupled character of the interaction design discipline and tries to analyze the reasons. Understanding them was considered helpful to solve local challenges faced during the research work.

Saffer (2010, 10) describes interaction design as a "stew of disciplines". Sharp et al. (2007, 10) illustrate the relationship between interaction design and academic disciplines, design practices and interdisciplinary fields to help understanding the key differences arising from the scope, type of problems and concerns.

[4] Human-Computer Interaction

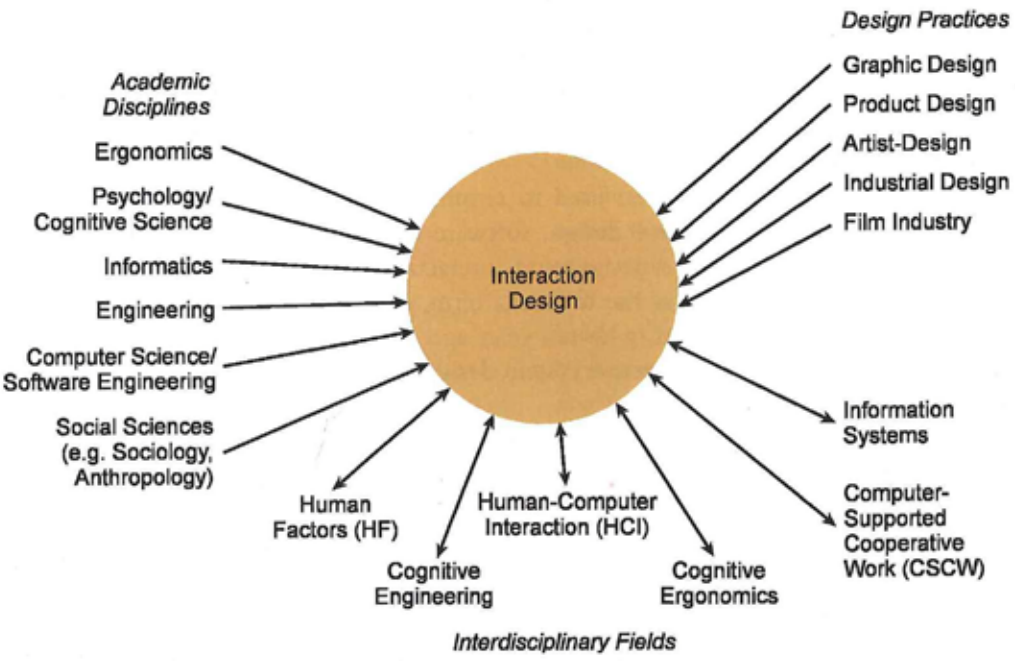


Figure 7: Disciplines and design practices related to interaction design (Sharp et al. 2007, 10)

Saffer (2010, 34) believes that User-Centered Design is the most popular approach in software engineering. Despite the long tradition of the UCD concept it is not yet present in the software development process, as the practice experienced by the researcher shows. There are still miles to go.

Why is it still so difficult to integrate interaction design practices into software development projects in organizations? Can a helpful advice be found? The following table summarizes the most common problems and solution proposals from the academic sources.

Problem	Potential solution
History, methodology, techniques and standards of interaction design and software development are decoupled. Software developers have problems with ambiguous terms and abstract metrics[5] of UCD. (Seffah & Metzker 2004.)	Tip: Briefing software developers on the UCD principles, processes and methods, providing guidance and synchronizing processes (Juristo & Ferre 2006; Seffah & Metzker 2004; Shneiderman & Plaisant 2010, 124).
The practitioners have different interests, communication styles and understanding of roles and responsibilities (Sharp et al. 2007, 10-11).	Tip: Creating interdisciplinary teams to understand each other's views and generate new and creative ideas (Sharp et al. 2007, 10-11).
Number of features and functions is considered by developers and marketing as equal to the product value (Cooper et al. 2007, 25).	Tip: Providing features serving the purpose and the user's goal as a competitive advantage. Aligning system functionality with the business needs and priorities in sales and marketing. (Cooper et al. 2007, 25; Holtzblatt et al. 2005; Shneiderman & Plaisant 2010, 127.)
Usability interests are not represented on the highest management level (Shneiderman & Plaisant 2010, 117).	Tip: Integrating the emphasis on usability in the strategy, promoting usability within the organization. Using the managerial strategy of "four Es"[6] in order to institutionalize usability. (Shneiderman & Plaisant 2010, 117-118.)
Resistance to change (Holtzblatt et al. 2005, 292-295).	Showing empathy and listening to software developers about their concerns instead of "preaching" about UCD. Using "water drop" technique (starting with a project of small scope). (Holtzblatt et al. 2005, 292-295.)

Table 3: The gap between interaction design and software development

When speaking about the decoupled history, Shneiderman & Plaisant (2010, 116) discuss other historical reasons of technically-oriented software design. First programs, editors and applications were developed by programmers for their own use. Their intuition on how to use them used to be sufficient. Nowadays, users may not necessary be technically-oriented.

The most common misunderstanding lies in engineers seeing their role in building the "real" system with its functionalities. Only thereafter they expect usability professionals to make

[5] The meaning of UCD comprises of learnability, efficiency, performance, productivity and satisfaction (Seffah & Metzker 2004).

[6] Education, Enforcement, Exemption and Enhancement (Shneiderman & Plaisant 2010, 118).

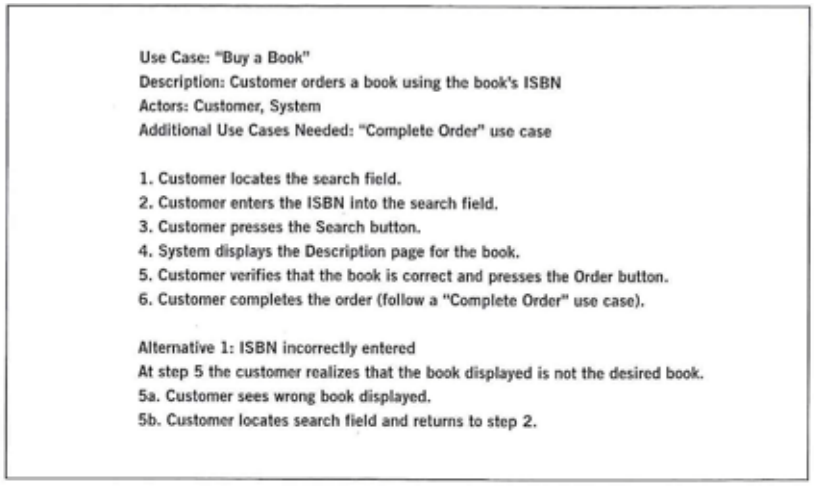
the user interface more user-friendly. On the other hand, usability professionals see their role in first designing and testing the interface with the end users, followed by the implementation of a system that supports the user tasks by the engineers. Consequently, the user interface is considered a thin element on top of the "real" software system, which is skipped in tight schedules or budgets. (Seffah & Metzker 2004.)

Following the analyses of the scientists, several action points for special attention can be defined in order to integrate UCD into software engineering organizations. The concepts of usability and UCD need to be defined more clearer and software developers educated on the role of UCD, its guidelines and methods on a suitable level. Active participation in workshops and focus groups may be more motivating for the developers than listening to the "preaching" about UCD. Formalizing at least the basics of UCD methods raise the awareness among the stakeholders. A documented interaction design process as a part of the software development offers an unambiguous framework for cooperation. The cooperation can be enhanced by assisting software developers on UCD related issues and establishing common communication practices. Eventually, starting product development from a human-driven approach in the early phase and continuing with iterative design has an apparent and monetary impact on the quality of the end product, which needs to be emphasized in the future.

Finally, a certain level of resistance to change exists in every environment. Holtzblatt et al. (2005, 292) recommend the water drop technique, meaning staring off with a single, not necessary large scope project to promote UCD in the organization. The activities comprise of collecting a little data, interpreting it on a small scale and sharing it around. This technique was applied for the systematic UX process development based on the case project in the case organization.

4.3 Use cases methodology in academic literature

Software engineering and the Unified Modeling Language (UML) are considered the origin of use cases, when Jacobson, Christerson, Jonsson & Övergaard (1992, 159) first formulated the textual, structural and visual modeling techniques for specifying use cases: "Use case is a specific way of using the system by performing some part of the functionality. Each use case constitutes a complete course of events initiated by an actor and it specifies the interaction that takes place between an actor and the system." Use cases in UML were used for capturing functional requirements as a method to analyze software development to outline the typical interaction between a user and a system in a text document or a diagram (Brinck, Gergle & Wood 2002, 89–90).



Use Case: "Buy a Book"
Description: Customer orders a book using the book's ISBN
Actors: Customer, System
Additional Use Cases Needed: "Complete Order" use case

1. Customer locates the search field.
2. Customer enters the ISBN into the search field.
3. Customer presses the Search button.
4. System displays the Description page for the book.
5. Customer verifies that the book is correct and presses the Order button.
6. Customer completes the order (follow a "Complete Order" use case).

Alternative 1: ISBN incorrectly entered
At step 5 the customer realizes that the book displayed is not the desired book.
5a. Customer sees wrong book displayed.
5b. Customer locates search field and returns to step 2.

Figure 8: An example of use case specification (Brinck et al. 2002, 100)

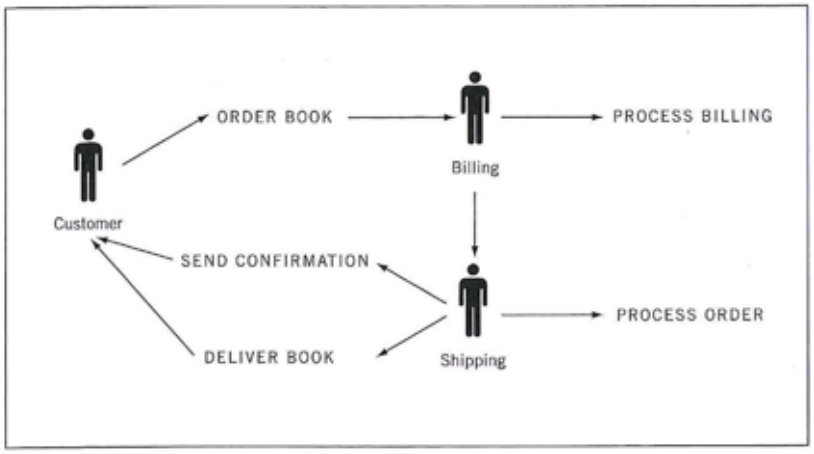


Figure 9: An example of use case diagram (Brinck et al. 2002, 101)

Cockburn (2002) walked through the curvy and knobby paths of the history of use cases in detail pointing out several important issues. Because the original intention of Jacobson et al. (1992) was to keep use cases as informal as possible, uncertainty spread over years on how to handle the method properly and brought about questions and uncertainties: What is the difference between a use case and a scenario or a story? What are the relations of use cases to requirements? How do single use cases relate to each other?

Use cases were seen as equivalent to scenarios and stories due to the recommended informality – writing a short description of a user using the system. Differentiating use cases proceeded further step by step by bringing in the actor-goal relations and the concept of protecting stakeholders' interests. First, linking use cases to an actor's goals was a significant

milestone, because it shifted the attention away from the functional requirement lists and focused on what users attempt to accomplish when using the software. In addition, pursuing stakeholders' interests gave insight into other limitations influenced by stakeholders, who are not necessarily present at the interaction between the actor and the system. Systemizing these topics brought more structure into use cases. (Cockburn 2002.) Cockburn's (2001) other publication also contributed to wider understanding of the methodology and was extensively applied when analyzing the results of this research.

Inconsistent terminology can be found throughout interaction design and UCD literature. Those with the clearest classification between the narrative and tabular formats, or process or solution orientation are summarized in the table below.

Definition	Orientation
"A *use case* captures a contract between the stakeholders of a system about its behavior. The use case describes the system's behavior under various conditions as the system responds to a request from one of the stakeholders, called the primary actor." Cockburn (2001, 1).	Cockburn (2001, 1-2) tends to use a schematic format such as text, flow charts, sequence charts, Petri nets or programming languages written in simple and common language. User goals play an important role in the structure.
Narratives, also called *scenarios*, are "a method of design problem solving by concretization: making use of a specific story to both construct and illustrate design solutions" (Cooper et al. 2007, 110-111).	*Persona-based scenarios* (scenarios complementing personas) are concise narrative descriptions of one or more personas using a product to achieve specific goals (Cooper et al. 2007, 112).
Sharp et al. (2007, 505-512) distinguish between *user scenarios* and *use cases*. *User scenarios* are defined as human activities or tasks in a story that allow exploration and discussion of contexts, needs and requirements, which do not explicitly describe the use of software or other technological support to achieve a task (Sharp et al. 2007, 505). *Use cases* focus on user goals and emphasize a user-system interaction rather than the user's task itself while the stress is still very much on the user's perspective, not on the system (Sharp et al. 2007, 510).	Sharp et al. (2007, 505-512) draw the clearest line between narrative and tabular formats for process or solution description.
Context-of-use comprises of users, tasks, equipment (hardware, software and materials) and the physical and social environment in which a product is used (ISO 9241-210 2010, 2).	*Context-of-use* is distinguished in ISO 9241-210 (2010, 11) as current context description and context of intended design.

Table 4: Definition and orientation of use cases in academic literature

But there are more: Löwgren & Stolterman (2004, 80-81) argue that elaborate narrative format is a natural basis for discussion and refinement. Sometimes, the term *scenario* is used for describing the steps or sequences of a use case, thus as a part of it (Brinck et al. 2002, 99-100; Schneider & Winters 1997, 30-32). Cooper's approach of using narrative format for supplementing personas is advocated by Holtzblatt et al. (2005, 282) and Sinkkonen, Kuoppala, Parkkinen & Vastamäki (2006, 21-22). Holtzblatt et al. (2005, 282) use the term *storyboard* and Sinkkonen et al. (2006, 21-22) distinguish between *action scenarios* and *use scenarios*. Schneider & Winters (1997, 1) recommend taking advantage of use cases in test planning and user guidance documentation.

Apart from Jacobson's (1992) UML-oriented approach, the other academic sources tend either to be in narrative or tabular format, sometimes using both for different purposes. Some interaction design practitioners (Cooper et al. 2007, 113; Brinck et al. 2002, 100) see the weakness of tabular use cases because of their roots in software engineering and not involving human psychology factors, while others (Saffer 2010, 148-149) claim that software developers may be more receptive to using this method, because it has been known to them for a while. Cooper et al. (2007, 113) view the use cases format as inappropriate for describing interaction, because its original purpose was to describe functional specifications without recognizing how likely or important each of them is. Again interaction design and software engineering seem rather distant to each other.

Flexibility should be considered as the highest priority in order not to overload a project with overly formal procedures. Cockburn (2001, 17-19) offers usage narratives as a situated example of the use case in operation, that is the actor using the system. The usage narrative is a more informal text to envision the system in use, for example, in preparation for writing a more detailed use case. Other choices include: brief use cases consisting of few sentences, casual use cases consisting of a few paragraphs covering certain topics and finally the fully-dressed use case template including fields according to the needs. The use of Cockburn's (2001, 121) most exhaustive model, the fully-dressed two column table, should be considered on a case by case basis if the project data need to be documented at such a deep level.

USE CASE #	<the name is the goal as a short active verb phrase>	
Context of use	<a longer statement of the context of use if needed>	
Scope	<what system is being considered black box under design>	
Level	<one of summary, primary task, subfunction>	
Primary actor[7]	<a role name for the primary actor, or a description>	
Stakeholder[8] and interests	Stakeholder	Interest
Preconditions	<what we expect is already the state of the world>	
Minimal guarantees	<the interests as protected on any exit>	
Success Guarantees	<the interest as satisfied on a successful ending>	
Trigger	<the action upon the system that starts the use case>	
Description	Step	Action
	1	<put here the steps of the scenario from trigger to goal delivery and any cleanup after>
Extensions	Step	Branching action
	1	<condition causing branching>: <action or name of sub use case>
Technology and Data Variations		
	1	<list of variations>

Table 5: Two-column table model of use cases (adapted from Cockburn 2001, 121)

Cockburn (2001, 7) confirmed the possibility of using tabular format comprising of the action steps, actors, stakeholders and goals; both for business use cases describing operations of customer's business and for system use cases describing the functional requirements for the upcoming system. After collecting the empirical data, the case organization clearly tends to choose the same path in order to standardize the format.

Common UCD and interaction design process models accommodate use cases naturally in the early specifications phases (for example, ISO 9241-210 2010; Sharp et al. 2007; Cooper at al. 2007).

In ISO 9241-210 (2010, 2), the concept context of use (which was compared with the meaning of use cases in this research) appears in the first iterative phase and is a part of the activity *Understand and specify the context of use*. In more detail, context of use covers users and other stakeholder groups, their characteristics, goals and tasks and the environment(s) of the system. Even early activities and iteration are strongly highlighted in the renewed standard,

[7] "The primary actor of a use case is a stakeholder that calls on the system to deliver on of its services. It has a goal with respect to the system – one that can be satisfied by its operation. The primary actor is often, but not always, the actor who triggers the use case." (Cockburn 2001, 53-54)

[8] "Stakeholder is someone or something that has a vested interest in the behavior of the use case" (Cockburn 2001, 53-54).

there is not enough intonation put on goals, which appear only in the later breakdown of the context-of-use description (ISO 9241-210 2010, 11-12; Jokela 2011b, 88). The context of use is processed further during the *Specifying the user requirements* phase and used later as a basis for validation in *Producing the design solutions* and *Evaluating the design*.

Sharp et al. (2007, 6) draw attention to several important aspects of interaction design, such as taking into account what users are good and bad at, considering what might help users with the way they currently do things, thinking through what might provide quality user experiences, listening to what users want and getting them involved in the design and using "tried and tested" user-based techniques during the design process. These considerations may be helpful when performing field studies and task analysis as data gathering methods when formulating user scenarios and use cases during the iterative *Identifying needs and establishing requirements* phase of the process model.

Cooper et al. (2007, 112-113) distinguish between context scenarios (day-in-the-life), key path scenarios (user interaction with the product) and validation scenarios (what-if conditions for testing the design solutions in different situations). Those are iteratively used throughout the process from *Research* till *Refinement* according to the process model (Cooper et al. 2007, 20).

To wrap up, the terminology and perspectives vary throughout the scientific publications. Collecting data in the research was expected to bring new and specific demands on applying the method successfully in the case organization's specific environment. Perspectives from existing scientific sources are compared to the emerging phenomena in the empirical part of the research in chapters 7 and 8. As introduced earlier, this research refers to *process-oriented use cases* in the requirement specifications phase and *solution-oriented use cases* in the functional specifications phase, trying to apply a standardized tabular format for both.

4.4 Seeking a link to customer value

Seeking the concept of customer value and business motivation and goals in interaction design literature did not bring the desired results.

ISO 9241-210 (2010) takes a stronger focus than other academic theses on the economic and social benefits for users, employers and suppliers in a committed section *Rationale for adopting human centred design* bringing in key words such as productivity, efficiency, accessibility, competitive advantage and improved brand image as well as reducing costs, training, discomfort and stress. As a result, risk of failure or rejection by the end users is diminished or eliminated altogether. (ISO 9241-210 2010, 4.)

Sinkkonen, Nuutila & Törmä (2009, 51-52) distinguish that the most common business need of a new software or web solution lies in maximizing profit or saving costs, thus they are purely monetary. Cooper et al. (2007, 95) include more specific categories of business goals, such as increasing profit, increasing market share, retaining customers, defeating the competition, using resources more efficiently and offering more products and services. According to Cooper et al. (2007, 14) personal user goals need to be addressed in the first place, so that users are able to complete tasks successfully. This alone helps to achieve business goals effectively. The researcher critically pondered if this was that simple. Would any indicators help to approach business goals on a more concrete level without leaving software developers in uncertainty about why customers actually buy the product?

A further review of the literature on customer value went deeper towards marketing terms, but finally an adaptation of a set of down-to-earth criteria provided a framework, which could be adapted to creating customer-specific process-oriented software and web solutions.

Consequently, the customer value creation methodology based on the Lean Solutions by Womack & Jones (2005) was adapted for this research. Customer value is covered in this approach with the following attributes:

- "Solve our problem completely": customers require solutions that precisely solve their problems.
- "Don't waste our time": customers should not be burdened with time wasted due to inefficiency.
- "Provide exactly *what* we want": a flexible packaging can ensure that customers obtain exactly what they need. What customers want to buy overrules what the provider wants to sell.
- "Provide value *where* we want": value-added benefits of the product in the customers' context and those benefits for their business should be clear.
- "Provide value *when* we want": the time frame of product offering should match customer needs.
- "Provide the value we really desire, not just the existing options": the number of decisions customers need to make to solve their problems should be minimized. Offering too many choices makes things complicated.
- "Solve our *complete* problem *permanently*": precise and sustainable solution strengthens the relationship between the customer and the solution provider.

Lean solutions connect to a simple principle of providing the value customers actually desire instead of trying to convince customers that they need what the provider finds easiest to

supply (Womack & Jones 2005, 2). This can be aligned with the attempt to use use cases as a tool for understanding customer-specific way of working and motivation and translate it to a useful and efficient software or web solution. In the empirical part, the conditions set by the above stated attributes are inspected in terms of how well they fit into the emerging categories.

5 Excerpts of data collection field notes

The empirical data was collected through interviews and ethnographical observations and an expert walkthrough or a combination of those techniques. The field notes excerpts are presented in this chapter in chronological order to illustrate the main issues brought up by the interviewees and usability test participants. Finally in the expert walkthrough, the researcher reflects upon the role of process-oriented and solution-oriented use cases in planning, performing and evaluating usability testing.

The interviews were set up to collect information and examine how the internal stakeholders see the role of early phase use cases from their own work perspective. Product developers participated in a focus group interview in conjunction with the UX process development project. The interview with internal test users accompanied the usability tests. A one-on-one interview was held with a documentation specialist involved in the Tekla Outage Map Service project. Interviews with external stakeholders were performed in connection with a use study at the customer site while examining the pilot use of the released product. In addition, feedback was gathered at customer events, such as Tekla User Days 2011 and internally in the regular work environment on a day-to-day basis.

The role and level of involvement of the stakeholders in the data collection process are illustrated in table 6.

Stakeholder's role (number of participants): schedule	Role and involvement
Internal stakeholders	
Product development (6): end of 2009 (responsible Tekla OMS product developer: throughout the project in 2010-2011	Focus group at the beginning of the UX process development project, to outline product developers' needs on user research input in the early phase of the software development project. Most of the interviewees look back at several years of a track record at Tekla and are also involved in the product development workgroup cooperating with the UX team.
Internal test users (2): October 2010	Internal test users participated in usability testing simulating both general public (browsing the IMS web interface) and system user (creating and publishing outages in NIS basic and IMS web). The test users do not belong to the Infra & Energy business unit, bring some level of knowledge on the Tekla Solutions products for Infra & Energy, but have strong background in UCD, thus were active in expressing critical comments.
Documentation specialist (1): April 2011	One-on-one interview after the Tekla Outage Map Service case project and in the course of the UX process development project, to review the impact of early phase interaction design activities on documentation work. The documentation specialist has held the current role at Tekla for the past three years and brings more than 15 years of ICT industry experience in producing and managing product documentation.
External stakeholders	
Business customer of the case project (2): January and May 2011	Interviews during customer events and in the use pilot phase of the end product.
System user / customer organization (2): June 2011	Observation and interview on the customer site to verify the planned task flow against the end product in the pilot use.
Other consulted stakeholders	
Product management (3): during 2010 and 2011	Day-to-day interaction observations were part of the general ethnographic observations. A more thorough focus group session is planned for further development.
Peer debriefers (5): 2009 - 2011	· Mentor support throughout the research. · Process maturity evaluation by two UX specialists (study mates). · Commenting on research paper draft by a study mate and the UX manager.

Table 6: Internal and external stakeholders involved in data collection process

5.1 Excerpt 1: Focus group with product development

The focus group interview with product development was held in conjunction with the UX process development project at the end of 2009. A group interview and discussion with five product developers was held to explore their opinions on the current use of requirement specifications in their work. The problem with how to link requirement specification and functional specification phases was discussed. The session was facilitated by the researcher and the UX manager.

The following findings were detected in the focus group session:

It varies among projects how product management involves product developers in the early project phases and how profoundly the level of requirement specifications documentation is supporting product development work. Product developers are not always assigned to the project in the requirement specification phase. That is why product developers need to collect all relevant and important information from the requirement specification document while starting the functional specification planning work.

The requirement specification document is a good basis for face-to-face discussion, but profound documentation sends a concise message and saves the clarification needs and efforts for all involved stakeholders. On the other hand, reading longer documents may require more time, but the interviewees shared the opinion that "well planned is half done". The length of the document is not necessarily an indicator of the document quality. It may be short, but concise. Common and understandable terms and concepts are recommended for writing the requirement specifications to avoid misconceptions in a cross-functional team.

Understanding customers' reasons and motivation behind requirements helps product developers to take the user-centered approach. Awareness of user goals is crucial when planning the technical solutions based on the requirements specification.

Product developers welcome early involvement of UX specialists in requirement specification. UX specialists could contribute to documenting users' work practices, work environment, goals and expectations before product design commences. Putting single requirements in a framework, how they relate to each other turns a requirement specification document into a working tool for further design and development steps. As a result, documenting process-oriented use cases would ensure the same level of communication across the project team and add the basis for further discussion and clarification.

Customer site visits usually merge observations and interviews. UX specialists could collect the data and communicate it further to spread the knowledge about the users' daily work environment. Observations are considered more efficient than interviews or surveys, because not every user is willing to disclose common problems or is not even aware of them. Visiting customer sites also proved useful for product developers to observe how Tekla solutions are used in practice by end users.

The functional specification planning phase should comprise of close cooperation between product development and product management to ensure that requirements are adopted correctly into solution-oriented use cases, followed by prototyping of the solution.

Typically, the requirement specifications document is a part of an agreement with the customer and supports the communication of common understanding among the stakeholders, in particular between product management and the business customer. Once the requirement specifications document has been approved, infrequent regular iterative updates take place in later stages of the process. Nevertheless, it is impossible to get everything right in the first run. Product developers are missing the possibility to record improvements, innovations and refinement of ideas without adding bureaucracy and maintaining yet another document. Allowing modifications to the process-oriented use cases in a later phase may have a positive impact on the quality of the end product.

To wrap up, process-oriented use cases were perceived as essential part of requirement specifications for planning functional specifications and development work. In practice, they state how a feature will be used, what the goal is, how the users currently perform their tasks and what their preferences are about the future performance without going too deep into technical feasibility issues. A task flow of a process-oriented use case can be illustrated, for example, in a diagram or flow chart. In addition, concrete targets would be helpful to streamline the development process.

Those are:

- frequency of use, for example, how often used, by how many users, which roles involved
- importance of the functionality, for example, critical functionality, functionality providing input for another functionality
- measurable targets, for example, maximum duration of data transfer, system performance, response times or size of files
- UX targets, for example, ease of learning, ease of use and memorability.

Pre- and post-conditions build a framework of users' level of knowledge, way of working and goals. The process-oriented use cases are not expected to be lengthy, in-depth or narrative at this stage, but rather an overview to gain a general understanding of the development purpose.

5.2 Excerpt 2: Interviews and observations with internal test users

Usability testing stretched over the design and development phase. The first comments were gathered based on a paper prototype regarding the visual appearance of an outage presentation on the map. Later during autumn 2010, the functional prototype was tested against the draft of the guidance documentation. First, a pilot usability test was run to walk through the planned task flows. A product developer, researcher and documentation specialist attended the session. As a result, the task flow was optimized, the interactive prototype prepared and usability test material compiled.

The usability testing sessions were held twice with internal test users. The test users had little or no knowledge about the NIS basic and IMS web interface. First, a short briefing on the purpose of the test and its practical arrangements were presented by the researcher. A screen and voice recording permit was obtained. Thereafter, a briefing about the current process and the principles of the Tekla Outage Map Service were presented. The test user was prompted to browse and comment freely on different aspects of the IMS web interface. This is how any public user could use the web interface. Later, a task to create a working area was assigned to the test user. It required using NIS basic as well as controlling the output on the IMS web interface.

The task flow was based on the solution-oriented use cases (functional specifications) and rewritten together with the documentation specialist while creating the first draft of the guidance documentation.

The following issues were detected in connection with the task flow:

Both test users paid attention to the terms of outages and working areas, with initial problems in understanding the differences between them and assigning them to the visual appearance of the map symbols. Thereafter, it was considered whether a public user needs such a deep level of knowledge about the outage. The same issue garnered comments with regard to the content of the information bubble (tooltip) appearing next to the symbols on the map. It was perceived that only necessary information should be seen in order not to overload the small surface. Location, starting and ending date and possibly the reason of the outage were seen as sufficient. Text fields, which have no input do not need to be presented to the public

user according to the test users. Users also pondered whether the given dates show the actual status of the work meaning if the public user can assume that the indicated work actually commenced on-site.

Moving on to the creation task, both test users could follow the task flow, but due to the complex tasks handling in NIS basic, they did not perceive the task flow as intuitive and had problems with using some of the drawing tools. When checking if the added working area appeared on the IMS interface, initial uncertainty about the real time delay was expressed. The symbol and information appeared after a couple of minutes and the participants were assured about the successful working area creation. To reverse the process, removing the working area from the IMS map proceeded smoothly. For both actions, an icon is available on the NIS basic toolbar and the IMS update was prompt.

Other technical findings for development are outside of the scope of this research and subject to non-disclosure.

5.3 Excerpt 3: Interview with documentation specialist

Documentation issues were discussed in an April 2011 interview with a documentation specialist involved in the Tekla Outage Map Service project. A question catalogue was used for this purpose inspecting the use of requirement specifications, other documentation input collection methods, experience with participating usability testing and feedback on the tabular format of use cases. Additional points came up during the interview and provided further valuable information. First, the interviewee described the general settings of the documentation work within Tekla Infra & Energy software development projects.

One of the briefing topics addressed the DITA model[9] (Darwin Information Typing Architecture), which is in use in the case organization.

Then, the experiences from the case project were discussed. The documentation specialist raised following issues:

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[9] DITA derives multiple information types from a common, generic topic, such as concept, reference and task. Task topics describe the steps of a particular task including sections for describing the context, prerequisites, expected results, and other aspects of a task for task-oriented user assistance. A task topic answers the question of "how to?" by instructing the user precisely what to do and in which order to do it. (Day, Priestley, Anderson & Hackos 2007, 7.)

The functional specifications document is one of the main written sources for starting off the documentation work. Normally, documentation specialists are allocated to the project and involved during the functional specifications comment round or review. The requirement specifications document is also available for the documentation work and used for reference, but usually documentation specialists do not participate in the requirement specifications comment rounds or review. As a development idea, the interviewee considered participating at least on a general level in the requirement specifications phase as an asset for the overall understanding of the project.

In the case project, simple solution-oriented use cases with four different task flows were included in the functional specifications document. It was easier to gain an understanding of the user tasks and goals than attempting to figure it out from the technical content of the functional specifications material or by consulting product developers. The availability of written use cases resulted in eliminating faulty understanding of the functionality and enhancing the writing process especially under time pressure since less face-to-face inquiries were needed.

On the other hand, direct communication with product management and product development were deemed useful but doubtlessly more laborious and challenging to fit in people's schedules. Documented use cases form an unambiguous source of information, for example, in reallocation situations of the documentation tasks. Documented reference material is also an advantage for new employees on the documentation team allowing them to get a grasp of the product functions rather than the technical elements as usually described in functional specifications.

The best understanding of the overall project is gained when the reason and purpose of the new functionality is explained in the functional specifications, giving an answer to the question "why?". This helps to highlight the goal of the actual user activity, in other words, tasks leading to a desired outcome are presented. According to the interviewee, executive summaries and description of customer benefits in addition to the use cases are sources of information for the documentation work. Written information is especially useful for documentation of new functionalities if a new section of a manual needs to be written.

Use cases of the case project proved useful to the work routines of the interviewee, since the Tekla Outage Map Service was done simultaneously with other urgent documentation projects.

The interviewee pointed out that the use cases consisted mainly of the technical workflow, but had not left out the role and the point of view of the actor (the user of the Tekla Outage

Map Service). The interviewee pondered that formulating use cases this way enabled the reader to understand the user goal. Further technical details like user interface layout and elements were handled after clarifying the use cases.

In the interviewee's opinion, identifying the use cases as task topics according to the DITA model was possible immediately after inspecting the content of the functional specifications.

Availability of user interface prototypes during the functional specifications phase was among the interviewee's greatest concerns. Visual examples of the user interface are often not available or not accessible for the documentation specialists while writing the first draft. Even a simple draft of what the end product will look like would be helpful. Sometimes the first documentation draft has to be based on best guess. This often results in corrections and amendments and adds to the work effort.

The interviewee pointed out that generating the input with NIS basic in the Tekla Outage Map Service was more complicated than IMS output on the web, which can be browsed and understood by any public user. Documentation on how to create outages in the NIS basic exists. It was difficult to decide if it should only be referred to or integrated into the new IMS output functionality. Taking novices and advanced users into consideration, the interviewee pondered if the guidance should be optional for each level and how to find a compromise. Experienced OMS users are familiar with the outage creation routines and no changes were made to these functionalities.

The documentation specialist considered use cases as a basis for cross-functional cooperation and discussion about the end user workflows – could they be further enhanced, are the user needs properly understood? In the Tekla Outage Map Service project, creating the first draft of the guidance documentation was done simultaneously with planning the usability testing by the researcher. Closer cooperation in this phase could have served both purposes: getting the first documentation draft written in the user's language and drafting the task flows for the usability testing. The interviewee would see it as an asset to be able to observe the usability testing session in order to get feedback on whether the task flow draft is logical and smooth for the user. Based on the findings, either user interface task flow or the guidance documentation could be refined, depending upon where the roots of the problems are located.

From a terminology point of view, the interviewee pointed out the importance of clarifying key terms early in the process since working terms and abbreviations easily root in the user interfaces and are difficult and laborious to change afterwards - also in the product documentation.

5.4 Excerpt 4: Interviews with business customer (system user)

An interview and ethnographical observation for gathering feedback on the implemented solution with a special focus on process enhancement and development issues was held by the researcher on two occasions.

First impressions were shared at a round table of an interest group among district heating companies and Tekla representatives at the annual customer event, Tekla User Days, in Tampere in January 2011. The round table was held as an open, interactive and practice-oriented discussion and chaired by the business customer (system user) of the Tekla Outage Map Service project.

Additional background information such as the reason behind the development need of a map-based web service, challenges with defining information targeted at the public users due to certain restrictions and maintaining data input and output with the NIS basic were discussed in the forum. In addition, the timetable for the internal piloting and public use was discussed. The visual aspect of the map presentation received a positive feedback among the participants. Users can seek for information in the area of interest or use address search or possibly subscribe to updates in the future. An internet site was considered as an up-to-date source for this type of information, but placing the map service visibly and promoting its use was considered important.

From the researcher's point of view, the round table discussion with the participation of other district heating companies provided an insight into various practices, workflows and situations, which are subject to non-disclosure and are outside of the scope of this research.

During the pilot use in May 2011, an interview with the business customer (system user) from the district heating company was held. A set of questions was prepared for the interview and comprised of a reflection upon the specifications process, the accuracy and understanding of use cases in functional specifications and the first experiences with the user interface in the pilot use.

When reviewing cooperation with the solution provider in the early planning process, the interviewee highlighted following issues:

From the interviewee's point of view, the requirement specifications document serves the purpose. Later, the use cases in the functional specifications transcribed the actual functionality of the system well. The task flows of the use cases 1 – 3 (see Appendix 1) turned out to be more laborious than expected. The workflow of the fourth use case (displaying working

areas) was considered much easier to perform. This workflow was new, developed and documented in connection with the case project.

According to the interviewee, managing and selecting information being published on the Tekla Outage Map Service web needs to be more selective and transparent. Information which should not be visible to public users should be eliminated from the web view.

During the development phase it was not always clear what the final user interface would look like and how it would work. The product was deployed as a pilot in April 2011 and is supposed to be released for public users in August 2011.

The interviewee considered task-based guidance documentation important. Illustrations and use case examples would provide a useful reference.

Wrapping up the interview, the interviewee perceived the Tekla Outage Map Service as handy and easy to use. Some technical, documentation and graphical issues were communicated for further discussion in the planned site visit. These are outside the scope of this research and subject to non-disclosure.

5.5 Excerpt 5: Interview and observation with system user

Typically, field studies involving interviews and observations on-site are part of the early user research in software and web development projects. This is also practiced by the case organization. Close cooperation and site visits provide input for understanding the real settings and way of working. Continuing the cooperation with the business customer and system users after the end product release is seen as an additional asset. Post-release use studies are expected to provide a real insight on how the functional product is performing in real settings and possibly collect improvement proposals for further development. Furthermore, setting up visits may strengthen the relationship between the solution provider and the customer. The site visit was held in Tampere in June 2011 with the participation of the Tekla Outage Map Service system user and partly accompanied and commented upon by the business customer (system user).

The set of questions prepared for the use study was based on the internal usability testing, but it was only used as a basis for the discussion. The interviewed system users took the initiative in talking aloud with any thoughts regarding the solution and the workflows, which revealed deep insight into the practical use.

The interviewee commenced the discussion with presenting the perceived advantages and disadvantages of the current pilot product of the Tekla Outage Map Service. Various comments were linked to controlling the information presented to end users also in this case, as previously mentioned by the business customer. This helped to better identify the desired content and layout to be presented in the information bubble (tooltip) appearing upon pointing at the map symbols with the mouse. Furthermore, the typical outage situations, their geographical dispersion on the map and the timing were taken into consideration for further development and their impact on the visual image discussed.

The interviewee presented the typical workflows leant on the original use cases, meaning creating planned outages and working areas in the NIS OMS. Following them contributed to better understanding which attributes of the outage information need to be flexible to be modified after being created. Various findings with regard to the search and advanced search functions of the web interface were also revealed. This allowed reviewing the actual needs of different target groups, such as system users and public users.

Handling of outages in NIS basic was performed smoothly and indicated the system user's high familiarity with the system. Improvement proposals were presented in a concise way and walked through with the help of the user interface simultaneously during the interview. Eventually, key issues were documented by taking screen shots for further internal analysis within the case organization. In addition, the current status of guidance documentation was discussed, both in the NIS basic for system users and the IMS web interface for public users. Finally, the development of the IMS user interface does not physically belong to the case project as such, but both the walkthrough with the system user and the initial internal usability testing provided valuable input for improvements.

The results from the site visits were analysed, presented and agreed upon for further steps in a group discussion. This took place with internal stakeholders (product management and product developer) and the customer kept in the loop on the status of immediate corrections and further plans. The details of the technical findings are not mentioned in this research due to non-disclosure.

5.6 Excerpt 6: UX specialist process walkthrough

Finally, the researcher reflected upon her own role in creating, using and verifying use cases during different work tasks with focus on planning, performing and evaluating usability testing and use study. For that purpose, several criteria were set.

In the case project, process-oriented use cases were written by product management. The visual format illustrating the current status was helpful for understanding how outages are currently published on the internet. In the solution-oriented use cases, the workflow documented by the product developer was transferred to the new tabular template due to the initiative of the researcher and made available for use among internal and external stakeholders.

How the use cases helped to create the task flows for the usability testing manuscript was considered a criterion in the planning of the usability test.

Usually, UX specialists need a ready-made guidance documentation draft for writing the task flow. Interviewing the product developers or viewing a demo can also provide input. In this case, a framework of the task flow was available in the functional specifications document. The UX specialist cooperated with the documentation specialist, thus together they could extract the key issues from the use cases for designing a task flow draft, both for guidance documentation and for the usability test. With the assistance of the product developer, the task flow was simulated in the test environment as a pilot usability test. It helped to discover initial flaws for immediate correction. Tight schedules and other project responsibilities prevented the stakeholders from concentrating on the cooperation which could have brought even more observations.

The impact of the documented use cases while performing the usability tests can be considered in three dimensions:

- How was the task flow comprehended by the internal test users simulating the general public?
- How was the task flow comprehended by the internal test users simulating novice system users?
- How was the task flow comprehended by the experienced system user?

When collecting observations and comments about the web interface for general public use, the test users did not have major problems figuring out what the interface was for, what kind of information was presented and how to browse the interface. No specific tasks were needed for testing this section of the user interface. Information overload was defined as the main deficit from the test users' point of view. The test users did not expect such detailed information about the outages and the format and layout of the tooltip was hard to read. Similarly, input was received from the system user and business customer that the outage information intended for the general public should exclude some details, which are not aimed at users from the general public. This slight confusion shows that better clarification of the pur-

pose (what does the customer intend to provide to the end user?) earlier in the specifications process could have prevented this flaw.

When simulating the system user's task flow, the internal test users followed the task flow instructions. Most of the tasks were carried out successfully, but both test users did not consider the task flow intuitive. A certain level of previous experience using the functions of NIS basic was needed to comprehend the way of working. In comparison, this caused far less problems for the experienced system user. Both the internal test users and the system user occasionally doubted about the results of their actions. This resulted in deeper consideration on how to provide better and more obvious feedback to the users. The system user was not guided through the task flow in a similar manner, but freely browsed the user interface. Finally, it was observed that internal test users, who are not familiar with NIS and IMS interfaces presented questions about the general outage management terminology of the user interface.

The last criterion examined which results of the usability testing evaluation depended on the possible lack of precision of the use cases. In general, the task flow was smooth, either according to the task flow instructions (internal test users) or freely browsing (system user). The detected deficits affected the presented content, the layout, the location of items and indicated that customer's and user's goals require better research in the specifications phase.

5.7 Summary of key findings

To wrap up, the following table illustrates the summary of most discussed topics of the interviews and observations conducted in this research.

Interviewee or test user role	Key findings
Product developers…	· see the advantage of being involved earlier in the specifications. · use requirement specifications as a reference document. · want to better understand customer goals and motivation. · value UX specialists' communication in early phase. · preferably use tabular use cases format. · consider possibility of refining use cases important. · would set clearer, measurable targets.
Internal test users…	· can perform the task flow based on use cases, but does not see it as intuitive. · pay attention to the terms of the user interface. · want to see only the relevant information in the user interface.
Documentation specialist…	· sees the advantage of being involved earlier in the specifications. · works with requirement specification as a reference document. · considers written material time-saving, efficient and unambiguous during additional clarification. · considers the non-technical approach in requirement specification useful. · misses visual prototype when starting documentation work.
Business customers…	· require that solution provider understands what they want to provide or communicate to end users. · presents industry practices for better overall understanding. · value the selection of a suitable channel or media of the product. · miss early visual prototype to better understand the use cases. · require task-based guidance documentation. · require visibility of faulty task flows and how to recover. · would like to stay informed how the use research findings will be implemented.
System user…	· considers task-oriented guidance documentation useful. · considers error recovery guidance important. · gives final feedback on process and visual appearance. · communicates openly results of pilot use.
UX specialist…	· prefers direct input on work practices, user profiles and work environment rather than through requirement specifications. · considers understanding business customer value and motivation important. · considers developing usability testing task flows together with documentation specialist efficient. · sees the importance of action after usability testing findings to optimize the product. · builds relationship with customers on other occasions such as user days.

Table 7: Summary of the most discussed topics

6 Concept analysis and creation of categories

Before moving to the final categories, a brief outline is presented on how the analytical methods of grounded theory were applied in this research.

6.1 Initial and focused coding

Using line-by-line coding in the initial coding phase produced over two hundred different statements. The statements were iteratively added to the entire collection, categories defined and several times refined, renamed and rearranged. First statements were extracted from the line-by-line coding of the focus group field notes. In the course of further interviews and observations and their coding, many statements recurred in other interviews, others did not emerge again and some of them were crystallized in more detail. The most recurring statements addressed early user research, understanding of the main motivation behind a development project, the structure and contents of use cases, their iteration and how they contribute to maintaining customer relationship beyond the product delivery. In addition statements that appeared only once (for example, related to specific roles) brought important insights for further classification and analysis.

Appendix 2 illustrates how the process of a line-by-line coding was carried out. It includes an example of a coded field notes excerpt of the interview with the documentation specialist. The emerging statements were further refined and classified in larger entities during the focused coding. Further saturation and sorting of concepts was performed by creating an affinity diagram while gathering more data through interviews and ethnographical observations.

6.2 Sampling, saturating and sorting concepts

During the coding, saturating and sorting, five main categories were established after several iterative redefinitions. It was observed that interviewees put strong intonation on defining how they see themselves and other stakeholders involved in the early specifications. This category was named *Investing in early research*. Furthermore, clarifying the big picture of customer motivation, goals and expectations was repeatedly mentioned in interviews and the input collected under the umbrella of the *Focusing on goals* category. One of the most discussed topics was the content and structure of use cases. The ideas on how to create a use case template were systematically grouped under the *Optimizing the format* category. It was discussed if a written sequence provides enough information to imagine the solution under development. The understanding of iteration did not cover only the dependencies between use cases and testing of prototypes based on them, but any kind of discussion on innovative

ideas, which may already emerge during the specifications or while creating prototypes. This category was distinguished as *Iterating through communication*. Finally, it was of interest to the stakeholders, how to strengthen cooperation and understanding with the customer beyond the product delivery and why it is worthwhile. The result was outlined in the *Maintaining sustainable customer relationship* category. The first four categories comprise of the practical activities within the development team with user involvement, while the *Maintaining sustainable customer relationship* category focuses on the customer viewpoint and the business implications of the development activities in a long run.

The final concepts categorized in the affinity diagram are illustrated in Appendix 3.

As an example of how a subcategory of the affinity diagram was derived from the field notes, following statements can be listed as contributors to the subcategory *Work reference & discussion* (see Appendix 3):

- *"(….) product developers need to collect all relevant and important information from the requirement specification document while starting the functional specification planning work."* (chapter 5.1.)
- *" (…) saves the clarification needs and efforts for all involved stakeholders."* (chapter 5.1.)
- *"The availability of written use cases resulted in eliminating faulty understanding of the functionality and enhancing the writing process especially under time pressure."* (chapter 5.3.)
- *"The UX specialist cooperated with the documentation specialist, thus together they could extract the key issues from the use cases for designing a task flow draft, both for guidance documentation and for the usability test."* (chapter 5.6.)

Those statements, among others confirmed that written use cases act as reference material and a basis for discussions within the team. This subcategory was later incorporated into the main category *Iterating through communication* (see Appendix 3).

7 Creating final theoretical categories

In this chapter, the implications of the data that emerged on use cases and interaction design practice in the case company are considered. A link to the existing academic literature is eventually established and critically analyzed. The data collection observations resulted in creation of five major categories. They also form a foundation for the response to the research questions.

7.1 Investing in early research

The first category intentionally refers to *Investing in early research* to highlight a business aspect, which is seldom addressed in the academic literature on interaction design and not always obvious in the work environment either. It needs to be considered that solution providers and often business customers in software and web development projects usually represent either a technical- or business-oriented mindset and are not necessarily aware of what impact early user research has on the business practice.

When grounding the category in the collected empirical data, three main factors emerged:

- Getting commitment and resourcing stakeholders (internal and external)
- Researching and communicating findings
- Coaching and involving stakeholders in the research.

During the data collection, interviewees, in particular product developers showed a remarkable awareness on how to improve early user research to better understand customer needs and motivation. Concepts such as user research, user profiles and use cases are familiar, for example from the frequent internal briefings provided by the UX team and based on academic sources (for example, ISO 9241-210 2010; Cooper et al. 2007; Sharp et al. 2007, Gould & Lewis 1985).

Internal stakeholders announced their interest to participate earlier in the project, for example, in customer site visits. But what does it mean in commercial terms seen through the "lens" of customer value?

Involving development team stakeholders and gathering input from the customer generates resource allocation needs and work efforts. This also requires the customer's participation, for example, giving interviews, organizing access for field studies or establishing contact with potential end users, and so forth. The question is how to convince customers that this investment of time and effort is worthwhile and why requirements articulated in commercial negotiations do not suffice to ensure the end product's top quality. Yet another obstacle: in the early research phase, the customer will not immediately see the concrete, productive results of these efforts.

This research argues that it is necessary to first identify stakeholders' roles and responsibilities in the early research phase. It is important that the commitment is part of each involved team member's assignment to avoid confusion and frustration due to unclear expectations and work overload. This can be considered a reason that the UX process still needs to be better integrated in software development (Juristo & Ferre 2006; Seffah & Metzker 2004; Shnei-

derman & Plaisant 2010; Sharp et al. 2007). Finally, evidence needs to be provided to the customer throughout the cooperation process that the early research was performed efficiently and resulted in measureable customer value of the end product.

Many interviewees expected early involvement of UX specialists in the specifications phase. Customer value can be created when the research results are put to use across the team. Based on the interviewees' opinions, specifications and use cases support, but do not replace a face-to-face discussion, which ensures proper understanding. It bears the hidden potential of generating creative ideas in a cross-functional team (Sharp et al. 2007, 10-11). For example, product developers pointed out the role of cooperation with product management when sketching solution-oriented use cases based on the requirement specifications. Faults arise later in the development process because of a lack of awareness on issues communicated or observed earlier are counterproductive against assuring the customer that early research pays off.

When involving software developers in the user research, the preparations require attention. It can be derived from ethnographic observations that profound preparation of field studies adds trust and strengthens the relationship between the business customer and the solution provider. If product developers receive the possibility to join site visits, the situation is often new to some of them. In this case, UX specialists could take a coaching role to prepare for the site visit together. Thereafter product developers will also be able to better interpret insights and derive assumptions from site visits on their own. A preparation checklist can make the procedure more homogeneous and clarify the goal of the visit. Gathering existing project records increases also the continuity, thus this type of data should be centrally stored and made available for preparations.

Finally, how can the solution provider organization also obtain evidence that the early effort was worthwhile? Usually, success stories are based on qualitative research and hard to promote on the managerial level. Dumas & Redish (1999, 18) outline criteria, which may provide quantitative evidence that building usability into products from the beginning of the design and development process is worthwhile. It prevents the solution provider from spending money later on fixing problems, support calls, training, getting poor reviews, dealing with unhappy and unproductive customers or employees or even losing customers or employees. Thus focusing on usability may cost money, but not doing it is likely to cost even more.

To summarize, early research efforts should also be seen from the perspective of commitment, resourcing, maintaining dialogue within the team, with the customer and the end users, as well as coaching and preparing potential participants for joining the research activi-

ties. The goal is to utilize the research data effectively, communicating iteratively and handling customer time and effort with respect.

7.2 Focusing on goals

Interviewees, especially those representing software development and documentation had a vested interest in comprehending customer motivation and user goals in the specifications. Yet they often perceived them as insufficiently documented. The above mentioned group of interviewees showed keen interest in improving the goal definition, understanding and documentation. That is why an entire category was committed to *Focusing on goals*. But what actually are the goals and how do they reflect in customer value? The discussions allowed following distinction:

- Focusing on user goals
- Focusing on business goal

The interviewees reported that they expected to get an answer to the question "why?" from the use cases and other specifications. This is exactly how Cockburn (2001, 69) recommends bringing the user's intentions closer.

How to distinguish different type of goals? Cooper et al. (2007, 88) consider goals as "a lens through which designers must consider the functions of a product" while Cockburn (2001, 62) promotes goals as the greatest interest for the user to get the work done and Fournier (2009, 15) even expects that achieving the goal proves the actor a measurable value.

Are user goals the only interest of the customer? When talking about maximizing customer value, business goals come onto the scene. But why do business goals garner so little attention in the interactive design literature? Some effort to distinguish these goals was done by Cooper et al. (2007) and Sinkkonen et al. (2009, 51-52) as was elaborated in chapter 4.4.

In this research, an undiscovered potential of utilizing business goals was considered. Efficient use of resources is one of the most frequent reasons for investing in software and web solutions development, especially when the end users represent the customer organization. On this example, business goal could generate more concrete metrics for product evaluation. Some categories were already proposed during the focus group (see chapter 5.1). First, various types of measurable efforts spent with the task at hand could be scrutinized to compare them later to the process workflow when the end users start using the new product or a prototype of it. This could be a valuable addition to gathering quantitative feedback, while most other usability test results usually provide qualitative data.

In the case organization, executive summaries and customer's benefits are part of the requirement specifications. Considering the commercial nature of this information, it can be assumed that technical personnel do not necessarily grasp the link between business goals and the later breakdown into user goals. Processing this information and anchoring it to the functional specifications with the help of product management and UX specialists could be beneficial to the software developers showing the direction on how to set measurable targets for usability testing task flows.

This research tries to highlight the importance of understanding and differentiating goals by granting user goals a committed and prominent section in the use case template. While Cooper et al. (2007, 113) would rather elaborate goals in a narrative format, Cockburn (2001, 62-66) systematically groups goals, but they still do not stitch out of the tabular use case template. Usually, the goals are accommodated in the use case title (Cockburn 2001). In practice, the goals sometime slip down to the last step of the task flow or into the post-conditions. Assigning goals their own heading in the title line and marking it accordingly would avoid that initially clarified goals again become blurry during development work.

User goals still remain somewhat vague and hard to define, but it is still worth keeping the gathered information in mind and focusing on what the user actually wants to accomplish (Saffer 2010, 34-35). It needs to be considered that user needs and routines often cannot be articulated by users. That is why a contextual inquiry[10] supports task analysis and understanding of goals.

In the case project, one of the greatest challenges was to understand what kind of content the business customer actually wants to provide to the end user belonging to the general public. Internal test users acting in the role of a general public user were surprisingly overloaded with the amount of information, while the customer and system user also urged to exclude data not intended or not important for the end users. Better understanding of this interdependency earlier during the design and development would have allowed the development team to be more focused, thus the research of such interdependencies should be considered carefully in order to provide the desired solution to the business customer.

Finally, if a satisfactory level of considering business goals in planning of the new solution was reached, task flows related to business goals can be used for educating users within the cus-

[10] Contextual inquiry is a combination of interviews and observations (Beyer & Holtzblatt 1997).

tomer organization on how their contribution and the new, more efficient process reflects in setting the company's strategic business goals.

To sum up, defining and differentiating goals hide some risk for ambiguity, but the effort allows streamlining the activities and getting one step closer to what actually may provide customer value.

7.3 Optimizing the format

The first step was already taken in the case project to use a tabular format for the use cases (see Appendix 1). The resonance was positive that is why the category tackles its further improvements under the heading *Optimizing the format*. The results from the data collection included following topics:

- Using a tabular format
- Using the template flexibly
- Writing in understandable language
- Using use cases as a reference for discussion.

As elaborated in chapter 4.3, the main distinction between use cases in terms of the format varies between the narrative and the tabular format including certain data categories. Interviewees and test users responded in consent: use cases should be short, schematic and tabular. Their key assets: quicker to write, quicker to read or browse, easier to refer to, easier to highlight certain aspects (for example, the goals) and closely related to guidance documentation work. The narrative format was accepted in requirement specifications for documenting the information about the process and work environment, for example, as a brief outline supported by illustrations or process flowcharts.

The experiences with the optimized format of the use cases as illustrated in Appendix 1 were mainly positive in the case project. Most of the interviewees shared the perception that they were not too technical to comprehend the task flow and goals. Using understandable language was high on the priority list. This means avoiding technical or business jargon and acronyms. In addition, a standardized format describing the functionality focused on the goal and the user's aspect is an asset of use cases according to Brinck et al. (2002, 100). A standardized format influences better synchronization of software development and interaction design processes, but it should not burden them with excessive bureaucracy.

Cockburn (2001, 224) allows much freedom to select the format suitable for the project scope and need: the author prefers to write as little text as possible in a short, readable format,

because it increases the probability that people will read the use cases, ask questions and discuss based on them. The missing parts can be easily discovered through discussion. In addition, short narratives can be used for sketching use case scenarios (Cockburn 2001, 17-19). Cockburn's (2001) approach shows obvious similarity with the interviewees' opinions.

Approaching the local concerns critically, writing use cases is sometimes perceived as an additional effort during specifications work. But it does not have to be this way. Cockburn (2001, 13-14) says that use cases can illustrate requirements, so requirements affected by use cases do not need to be rewritten, but rather linked as requirements. On the other hand, they leave out other stand-alone requirements such as interfaces, data formats, among others, but help to combine task- and goal-oriented requirement information.

What was missing in the case project's tabular use cases to better address customer value? The format included the most common categories recommended by academic sources (Cockburn 2001; Fournier 2009; Schneider & Winters 1997; Brinck et al. 2002; Sharp et al. 2007). The goal was easily recognized in the use case title.

In the course of the ethnical observations, the level of the required user expertise for performing the tasks remained unclear. Brinck et al. (2002, 100) consider it a risk that the use case content itself does not imply how much training is required for different users in order to complete the scenario. Designing intuitive task flows or redesigning and optimizing existing task flows in the system can effectively curb the risk. In addition, understandable language and visual prototypes from the early phase of design would ensure that the information can freely circulate as a basis for discussion, enhancement and innovation. The availability of simple prototypes as a visual supplement before a functional prototype is released was considered of utmost importance by internal and external stakeholders in the case project.

Modifying the format can yet solve another problem. In the previous chapter, a misunderstanding of the customer's intention on how to define the information intended for the (general public) end user was not comprehended correctly. Adding a section for stakeholders would allow documenting the interests of the end users towards the new solution in the specifications phase more precisely.

As a result, the current format can be supplemented by the category *stakeholders* and visualized with the help of a prototype in the early design phase. Otherwise, flexible modifications and using a language easy to comprehend can make the use cases a good reference for project team communication and innovation in order to develop a high-quality end product.

7.4 Iterating through communication

Making the entire UX process more iterative was one of the goals of the UX process redesign in line with the ISO 9241-210 standard. The greatest concerns of the interviewees, which formed the category *Iteration through communication* were:

- Updating use cases more flexibly to reflect new insights
- Visualizing their contents by iterative prototypes.

The problem basically lies in the stagnant format when use cases are part of customer documentation (requirement and functional specifications). Some interviewees saw great potential in improving the task flows of the technical solution after gaining more input information.

Cockburn (2000, 224) puts emphasis on the importance of initial communication between the usage experts and developers. The better the communication, the lower the costs and consequences of omitting parts of the use case template. As a result, the documentation can remain incomplete if the message circulates through other communication channels. People will talk to each other and clarify issues. On the other hand, the author claims that spending energy on correcting use cases is not worth the effort and does not improve communication. Cockburn (2000, 217.)

Cockburn (2000, 1-2) defines the conversational spirit of a development team saying that use cases can stimulate discussion within a team about the upcoming system. Use cases can document both the planned design and the final stage of the design ideas and the extent of detail can vary among different types of projects.

After satisfactorily setting up the use case format, the research considers how to uplift the discussion based on use cases in a more systematic manner to ensure continuity. Pondering how to classify the knowledge of customer specific information brought innovative communication styles to the research. The knowledge is based on experience, observations, perceptions and relationships, which can be classified as tacit knowledge according to Nonaka & Takeuchi (1995). Tacit knowledge is highly personal, difficult to express and formalize. This proves the applicability of the SECI-model as a knowledge creation process supporting the iteration process. More detailed description of the SECI-model is presented in the recommendations in chapter 8.1. Alternatively, concerns can be discussed in a highly cooperative discussion framework for team cooperation, the so-called *Six Thinking Hats* developed by De Bono (De Bono 2011; Löwgren & Stolterman 2004, 97-98). The purpose of this method is to identify perspectives needed in a successful design process or problem solving promoting collaboration (Löwgren & Stolterman 2004, 97). The perspectives are: facts, creativity, benefits,

difficulties, feelings and action planning. The model is also explained in detail in the recommendations in chapter 8.1. Cockburn (2000, 223) points out that there may be certain circumstances that written use cases and requirements are not essential if the stakeholders have well established communication.

The second concern contributing to the *Iteration through communication* category is linked to the previous category, addressing the early availability of prototypes and using them actively to collect early feedback for iterative corrections and enhancements.

As a result, effective iteration requires a culture change with regards to tackling with change. It needs to be understood both by the solution provider and by the business customer that changes accommodate potentials for innovation and improvement. Naturally, a software development project is limited by restrictions imposed by external forces, such as budgets, timelines and availability of resources. Still, it is important to remain creative in this restricted situation. (Löwgren & Stolterman 2007, 26.)

7.5 Maintaining sustainable customer relationship

Based on the data gathered, the signals were still weak for the category *Maintain sustainable customer relationship*, but hide some potential for future development. Signals emerged during the business customer interviews, the use study and the expert walkthrough and surrounded the phenomena:

- Use studies and customer dialogue
- Measuring the goals

The on-site use study in the pilot phase enabled the researcher to once again review reaching user goals by using the new pilot product to seek potential flaws for corrections.

For deeper insight, even earlier evidence of the previous process (publishing the outages as a list on the web) would be needed to measure, for example, productivity (the comparison of effort between the new and the old system). Providing evidence that the business goals are met proves to the customer that the purchase decision was worthwhile. Grounding it in data provides a basis for further cooperation.

Finally, a walkthrough on a concrete level should be possible to verify how early phase and iterative input from the customer was reflected and integrated in the final solution. Keeping a record of success stories and development issues can provide a sound reference for future projects.

Holtzblatt et al. (2005) argues that there is a change of culture required to understand the meaning of usability as a sales and marketing attribute. Features need to serve the purpose and contribute to reaching the user's goal. Raising awareness on the management and marketing level can create a competitive advantage for the organization.

To sum up, in the case project, usability testing oriented on the user goals provided qualitative data, but concrete metrics were not used. Setting more solid anchors for collecting use studies would provide more concrete evaluation results for creating and maximizing customer value.

8 Discussion and recommendations

Initially, in chapter 4.4, the attributes of the customer value creation in Lean Solutions were perceived as appropriate to apply to this research (Womack & Jones 2005). Now, looking back at the emerging categories of this research, the attributes can be reflected in some of them.

Don't waste our time can be considered one of the most important aspects in the category *Investing in early research*. It was discussed that efforts and resources provided by the customer during user research phase and throughout the process should reflect the quality of the end product. Any communication breakdown, misunderstanding or inefficiency can break the customer's trust and willingness for future commitments.

The attributes *Solve our problem completely* and *Provide value where we want* can be linked to the *Focusing on Goals* category in this research, respectively to user goals (solving a specific problem) and business goals (providing value for the customer's business).

Provide exactly what we want, Provide the value we really desire, and not just the existing options and *Provide value when we want* can be reflected in the final category *Maintaining sustainable customer relationship*. This means that timely and focused response to customer requests leads to providing flexible packaging and tailor-made solutions to specific problems without burdening the customer with too many choices. The concept of Tekla Solutions as process-oriented offering is widely based on flexible packaging (Tekla 2011a).

The only attribute which appears unrealistic in the context of this research is *Solve our complete problem permanently*. Technology and needs evolve and the potential can be seen in further cooperation. If the customer was content with previous offerings, the possibility of further business relationship increases.

8.1 Recommendations for UX methods toolbox: section use cases

To visualize the interdependencies of the emerging categories, the following process card was developed as a first pilot for the *UX methods toolbox*, concerning the section *use cases*.

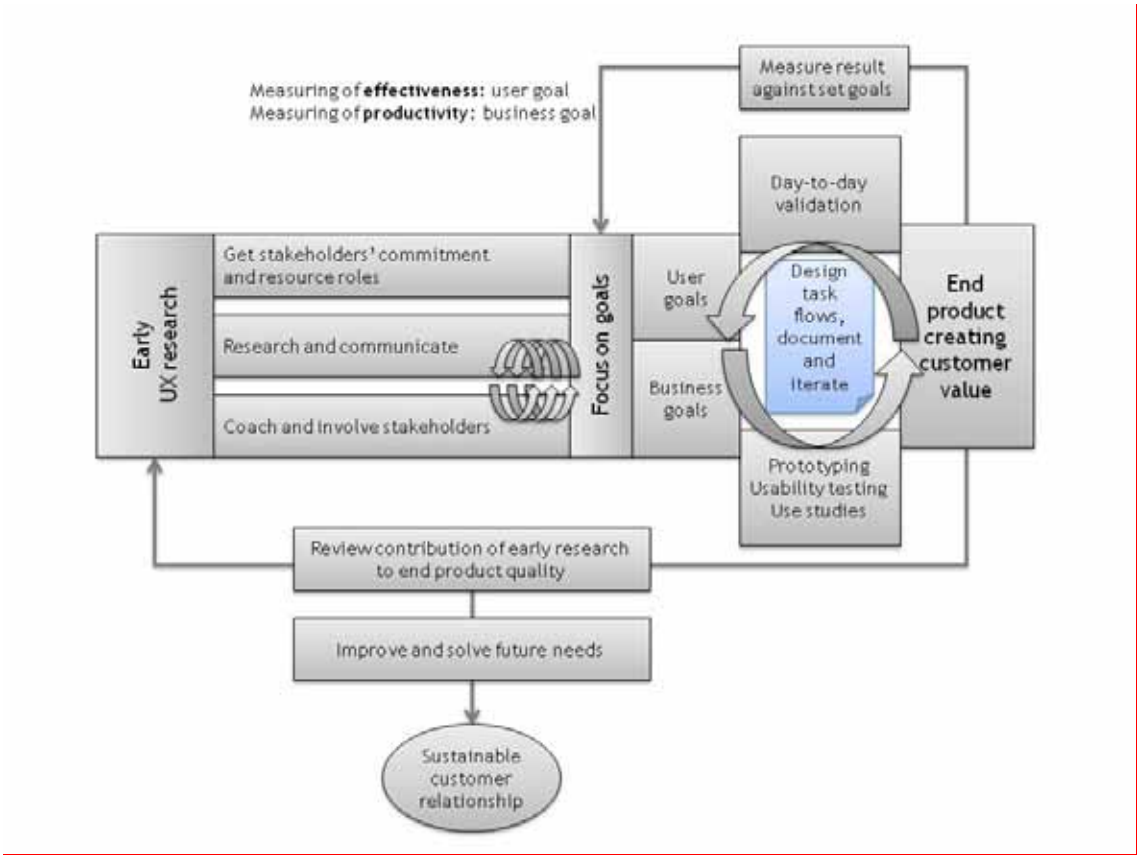

Figure 10: Recommended UX methods toolbox process card for use cases

The early research is initiated through getting commitment among external and internal stakeholders: roles and responsibilities are defined, resources ensured and training about UCD provided on demand. Thereafter, the user research is performed either by UX specialists and diligently communicated and discussed among the internal stakeholders or development personnel is involved, for example, in field studies. The field studies are planned to approach the customer and users purposefully. These activities are iterative. As a result, goals are defined and differentiated. Goals provide a basis for developing metrics for later validation. Based on the goal and process knowledge, the use cases are developed, iteratively refined and supplemented by early prototypes. First prototypes can be simple paper prototypes, wireframes, navigation maps, and so forth. Tacit knowledge gathered during the interaction with the customer or end users is circulated at the same time. For example, the SECI-model can be considered for implementation.

The SECI-model is a knowledge creation process stimulating communication and collaboration. It occurs as a spiraling process of interaction between explicit[11] and tacit[12] knowledge in order to create a new knowledge base through socialization (sharing knowledge and showing empathy), externalization (expressing knowledge to be understood by others), combination (systematic way to share knowledge as plans, reports and product ideas) and internalization (learning by doing and implementing innovation). (Nonaka & Konno 1998.)

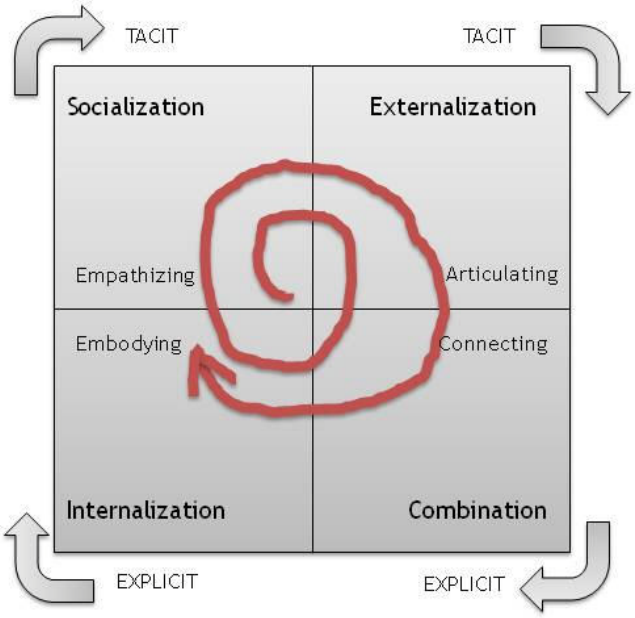

Figure 11: SECI-model (adapted from Nonaka & Takeuchi 1995)

The SECI-model can be well adapted to the early research, because the type of information needed for formulating effective use cases initially consists of tacit knowledge: based on experience, observations, perceptions and relationships. Articulating them in the project community is supposed to originate a continuous learning and improvement process involving all stakeholders on one-on-one basis, in a group or among different stakeholder groups. In this case, it is also important to communicate the purpose and result of the iteration activities to the customer to prove efficiency. Doing so can be aligned with the SECI-activities.

[11] Explicit knowledge can be expressed in words and numbers and shared, for example, as data (Nonaka & Conno 1998).

[12] Tacit knowledge is not easily visible or expressible and hard to formalize and share with others, for example, insights and intuitions based on personal experience, ideals, values and emotions. (Nonaka & Conno 1998).

Even more variations are offered by the *Six Thinking Hats* method (De Bono 2011, Löwgren & Stolterman 2004).

The different modes of thinking are illustrated below.

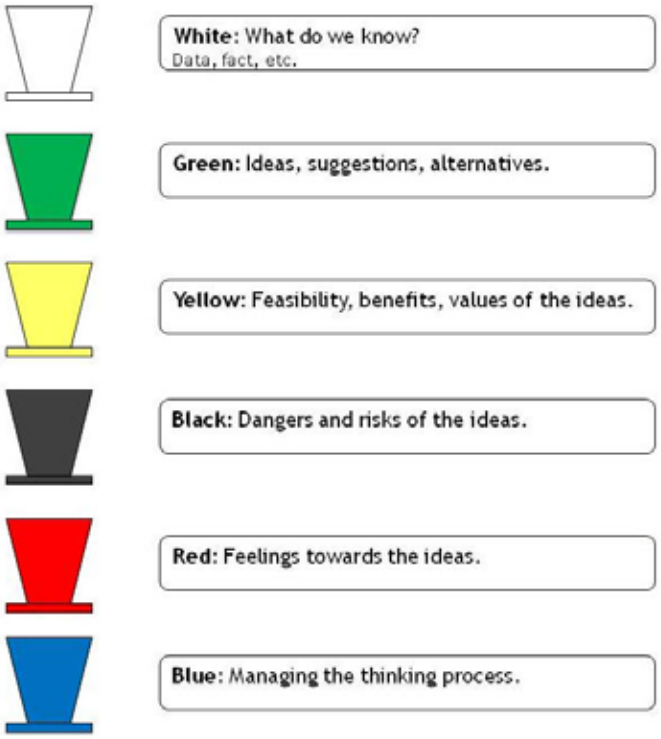

Figure 12: The Six Thinking Hats method (adapted from De Bono (2011) and Löwgren & Stolterman (2004, 98))

The asset of this workshop method is the freedom to select only one or a few of these topics, for example to concentrate on producing ideas and/or pondering risks (Löwgren & Stolterman 2004, 98). The team members learn how to categorize thinking into six distinct categories, which are defined by the metaphorical "thinking hat". The focus and thoughts can easily be redirected (De Bono 2011).

Those two methods can be applied based on the needs: is there any hidden, tacit knowledge to be shared (apply SECI-model) or should a problem be tackled from a distinct perspective (Six Thinking Hats)?

Finally, the concept of maximizing customer value could still be concretized in future. To achieve this, the *quality in use* metrics model appears suitable for this process card (Bevan 1999, 5-7). Quality in use is the user's view of the quality of the implemented software solu-

tion, not the functionalities of the software as such. When performing a quality in use measurement, the actual software quality measurement can be considered background information. In addition, user's individual characteristics, goals and context of use need to be taken into account. This model still refers to the previous ISO 9241-11 standard (the predecessor of ISO 9241-210 standard), but it includes useful factors for measuring quality.

Those are:

- *Measuring effectiveness* indicates the accuracy and completeness of the system measured on achieving the goals and sub-goals by the user.
- *Measuring productivity* relates the level of effectiveness to the resource expenditure including mental and physical effort, time, materials or financial costs. Time is usually the most common measure of productivity when considering products, which are improving processes.
- *Measuring satisfaction* examines the comfort and acceptability of the use.

Quality in use can provide a valuable contribution to the use cases process card. While effectiveness illustrates the re-evaluation of user goals, productivity tends to address the business goals (Bevan 1999, 5-7). This would concretize the outlined link between the *Maintaining sustainable customer relationship* and the *Focusing on goals* categories of the use cases process card in order to re-evaluate the end product quality.

A larger loop connects the final re-evaluation when looking back at the results of the user research efforts in the early stage. This feedback could be gathered by evaluating if the given customer effort is reflected in the end product with a positive outcome. Open interviews or surveys can also provide valuable feedback data to further strengthen the relationship and cooperation.

8.2 Responding to the research questions

The research led to a creation of the main categories followed by positioning them in the UX methods toolbox process card for use cases as described in chapters 7 and 8.1. To sum up, following responses to the research questions can be provided:

Which factors of use case creation process contribute to maximizing customer value?

Creating the main categories allowed defining the main factors contributing to maximizing customer value: *investing in early research, focusing on goals, optimizing the format* and *iterating through communication*. The category *maintaining sustainable customer relation-*

ship can be considered an outcome of the successful implementation of the four above mentioned categories and a continuous effort in a customer-solution provider relationship.

According to the empirical results of the research, investing in early research is a key to establishing a solid foundation for customer process understanding and documenting them in a use case format. Commitment, resourcing and coaching are the key factors to trigger the early research process. This means that both customer and solution provider are aware of their roles and capable of committing efforts and resources to these activities. Internally, interaction design process must be a valid part of the software development project to ensure commitment. Exchanging multidisciplinary views among the involved team members can enhance the definition process.

There are two important channels for collecting and distributing input for use cases: UX specialists perform early field studies, analyze the information and compile a draft. In some cases, developers were interested in participating in site visits. To create a productive contribution out of this effort, continuous training on UCD research methods is recommended. This would better prepare other stakeholders for extracting useful insights from the field studies.

If UX specialists collect customer and user information, customer input needs to be evenly distributed and understood throughout the cross-functional team. The case organization already commits efforts in this direction. (Tekla 2011d.)

In this research, day-to-day communication formed an addition to the typical iteration in the interaction design and software development processes. It was perceived that filling the gap between the first draft of use cases, both in the requirement and functional specifications and the initial prototypes is necessary. Because insights are often of a tacit nature, attention needs to be paid to sharing the information. The idea of applying the SECI-model emerged (Nonaka & Takeuchi 1995). In addition, the cycle between specifications and prototyping could be shortened. When considering the usefulness of the use case format, visual supplements (early, simple prototypes) were deemed important by many interviewees. Even paper prototypes or simple wireframes and navigation maps could be deployed for validation of the goal and the task flow of the use case. When tackling a problem at hand, the innovative collaboration method, so-called The Six Thinking Hats is targeted for dynamic refocusing and problem solving across the project team (De Bono 2011).

Finally, a constant orientation on goals and verifying the end product against the defined goal provide orientation throughout the process. A more concrete re-evaluation of meeting user and business goals need to be considered in the future development, for example, employing the *quality in use* approach (Bevan, 1999). This allows measuring both user goals (effective-

ness) and business goals (productivity). Doing so requires data collection even before the requirement specifications of the development project commences. Goal-orientation is recommended to replace feature-driven development in the long run and is one of the main success factors named in the academic literature on use cases.

What are the stakeholders' roles in the use case creation process?

Creating and maintaining use cases involves multiple roles, as described in the process card recommendation in chapter 8.1. To sum up, in order to explore customer-specific processes, access to customer information is required, including customer participation, for example, facilitating field studies or interviews. The support of program managers, acting at the customer interface is usually needed at this stage. UX specialists can act as researchers and messengers for the entire development team, or as coaches and collaborators when involving developers in the customer process research itself. Other stakeholders such as documentation specialists, training providers and customer service can be involved earlier to gain a clearer view on goals, both in the user and business context. Finally, sharing the tacit knowledge on customer-specific processes and methods requires a unique contribution by all involved stakeholders. Sharing, understanding, documenting and enhancing require active and frequent participation in the collaborative process.

8.3 Ethics of the research

UPA (2011) outlines a useful set of ethical principles in a usability professional code of conduct.

It consists of rules such as:

- Act in the best interest of everyone
- Be honest with everyone
- Do no harm and if possible provide benefits
- Act with integrity
- Avoid conflicts of interest
- Respect privacy, confidentiality, and anonymity
- Provide all resultant data.

This code of conduct can be combined with the Tekla Values including keywords such as professional expert, committed partner, innovative pioneer and successful team (Tekla 2011c).

The researcher possesses the necessary expertise for practising the profession and made a development contribution through versatile data collection and analysis, studying academic literature and gathering additional competences on UCD in higher education and company-specific training. High commitment was shown through close cooperation, honesty and acting in the best interest of the customer and within the case organization. Data gathering was presented anonymously and field notes produced with high attention to facts, while trying to avoid subjectivity. Results were presented in relation to the research questions. Other technical input was processed for further development within the case organization and is not reported in this research paper. The results are supposed to be implemented and verified in future projects with high sensibility to new emerging phenomena and needs.

8.4 Validity and reliability of the research

Performing a validity and reliability inspection is common in qualitative research. First, for better understanding, a brief definition is cited:

"Validity determines whether the research truly measures that which it was intended to measure or how truthful the research results are. In other words, does the research instrument allow you to hit "the bull's eye" of your research object? Researchers generally determine validity by asking a series of questions, and will often look for the answers in the research of others." (Joppe 2000.)

Reliability means "The extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability. In other words, if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable." (Joppe 2000.)

Since this research was conducted using the grounded theory methodology, the original research intention was only crystallized through data collection and analysis of the emerging phenomena. It brought the results towards a closer focus on use cases as a method to understand and enhance customer processes and develop a high-quality product which is supposed to have implications on customer value creation. In grounded theory, validity should be measured on criteria such as fit, relevance, workability and modifiability. Fit addresses how closely concepts are related with the collected data. Relevance focuses on the concern of participants in practice, not only of academic interest. Workability elaborates the solution to the problem and modifiability has to do with the opportunity to modify the theory when new data emerges. Consequently, grounded theory represents more or less fit, relevance, workability and modifiability and cannot be judged as right or wrong. (Glaser & Strauss 1967; Glaser 1978.)

According to the researchers' own judgment, the concepts address the most frequently and intensively discussed phenomena (fit). Process card development is conducted mainly for the practice, but applies comparisons to the academic literature (relevance). The recommended model should support the work community (workability) and further ethnographic observations can result in modifications of the process card model (modifiability).

Additionally, the validity of this research was examined by peer debriefing as promoted by many researchers (Creswell 1998; Ely, Anzul, Friedman, Garner & Steinmetz 1991; Lincoln & Guba 1985; Maxwell 1996; Merriam 1998).

The purpose of the peer debriefing is to obtain critical comments and feedback regarding the accuracy and completeness of the data collection and data analysis procedures from an impartial colleague in order to critically review the implementation and evolution of the research methods. This can be done by handing in any written research notes, reports, drafts and the final report to the peer debriefers. (Spillett 2003.)

In this research, five peer debriefers were involved. The UX manager of the case organization was inspecting the material and provided valuable feedback regarding the classification and naming of the final categories. This feedback was in compliance with the grounded theory validity criteria, because of the practical knowledge of the peer debriefer within the case organization. Additionally, two study colleagues were involved in commenting on the level of the UX methodology implementation in the case organization and highlighted potential research directions. Finally, a study mate provided comments on the final draft with special attention to the logical structure and framework. This procedure belongs to the Laurea thesis process and was considered useful to refine the final report. Last but not least, mentoring during the whole process generated new ideas.

As for reliability, the grounded data represents a specific organization with the involvement of internal and external, cross-functional stakeholders. This allowed deriving final categories and conclusions suitable for the practice. Nevertheless, practices and approaches may vary among other business units due to project modes. Researching the phenomena on a larger scale should be considered in the future, but also take into consideration business unit and customer-specific circumstances. Generalization in a dynamic software development environment is deemed impossible.

9 Conclusions

In conclusion, conducting this research facilitated and strengthened the relationship to various stakeholders while observing phenomena emerging in the project work environment and trying to understand their motivation. These factors allowed deriving the main categories to highlight the importance of certain practices in order to fulfill the purpose: strive for maximizing the customer value.

Methodologically, the selection of interpretative inquiry and constructivist approach served the purpose of conceptualizing, understanding and articulating the emerging phenomena based on authentic experiences and sustainable relationships with participants and other data sources (Charmaz 2006). Collecting rich data, reflecting upon it while writing memos and coding the concepts provided a variety of viewpoints, highlighted existing best practices and addressed deficits for improvement. It also proved the willingness of the stakeholders to influence the process development and share their expertise. A co-created process is supposed to have a higher acceptance for implementation.

The purpose of this research in establishing the link to the business perspective in the interaction design process succeeded through adapting the attributes of the customer value concept.
Grounding the link between maximizing customer value and well-defined, iteratively refined use cases was expected to uncover a new, business-oriented perspective which helps to promote UCD methods among the stakeholders and decision makers of software and web development projects.

Use cases held a prominent position in this research, nevertheless, they can be considered an instrument to systematically track and process complex user research data in a large project team. Their referential format works best when visualizing the content for better understanding, for example by prototyping, and closely collaborating.

The research concluded on that applying use cases in software and web development projects requires setting a few cornerstones such as investing time and effort in early research, focusing on the goals (while distinguishing between user and business goals), optimizing the written format, iterating through communication (intensively, frequently and in a systematical manner) and maintaining a sustainable customer relationship. Managerial understanding and support is a prerequisite to initiate this process as a valid part of the overall software development lifecycle.

These cornerstones allow establishing a proper focus of the development work on how the product shall support the user goals and what business interest is involved from the customer point of view. Focusing on goals contributes to better understanding of the human-computer interaction in order to design an intuitive task flow of the functionality leading to a productive outcome. A central issue was to establish a source of information (written use case format) and make the systematically collected user research knowledge circulate among the cross-functional team for further refinement (SECI-model or Six Thinking Hats). This way every team member can provide a unique contribution. Thereafter, the efforts are expected to result in a quality asset and added customer value for the end product. Fulfilling these criteria adds visibility for the customer that the cooperation on defining the solution and the invested time and efforts were worthwhile. Doing so is a prerequisite for further, sustainable cooperation with mutual trust, openness and respect.

Finally, change is supposed to be understood as a potential, not a threat. Iteration will remain the central concept also in the future. First, it should close the gap between documenting the use cases and releasing the first prototypes or mock-ups. Currently in this phase, use cases seem somewhat stagnant. It is also important that initial visual prototypes are released at a quicker pace. Secondly, the communication and validation practices will still be accelerated and gain more importance if transferring to the agile model in software and web development.

9.1 Further development

The empirical data emerged in the course of a running project. A new project would offer the possibility to track the phenomena from the beginning. The aspect of the stakeholders' commitment and resourcing should especially be emphasized at the managerial level in order to obtain support for implementation of the intensified communication (for example, SECI-model) and more flexible documentation of the iteration.

In the future, the progress of agile software process implementation also needs to be considered and the process card possibly adjusted. Nevertheless, the important role of iteration defined at this stage provides a solid basis for reviewing the model.

Shneiderman & Plaisant (2010, 126) advise not to forget that early involvement of interaction design reduces time and costs within the solution provider organization, for example, due to smoother development, lower maintenance costs and needs of correction. It is recommended to develop a technique to collect the data within the organization to finally grant UX process the status it deserves as a real contributor to the development of competitive advantage.

9.2 Personal reflection

Eventually, to reflect the personal learning experience and professional development, the researcher considers a two-fold viewpoint: the evaluation criteria provided by the Laurea University of Applied Sciences and their implications on the role as UX specialists at Tekla Corporation.

The Laurea Learning by Developing (LbD) model's evaluation criteria consist of authenticity, research orientation, innovation and usability (Laurea 2008, 7-8).

The authenticity of this research can be derived from the intention to develop and systematize the early phase UX process methodology in the case company, yet to keep it flexible and informal to stimulate the cross-functional collaboration and communication. The research paper attempts to present the whole process of applying the grounded theory "lens" to navigate from a wider field of interaction design through data collection and analysis to the core of the development issue: how enhanced use cases create and even maximize customer value?

The scope of the academic literature on interaction design and its specific concepts are broad and provided a framework for finding a specific problem for research. The research tried to provide the missing link: taking a business-oriented glance at the relation between intensifying the early research efforts and their implications on customer value. Grounded theory was selected as a qualitative method to generate new knowledge, which is tailor-made for the case organization, thus based on authentic opinions from a variety of stakeholders.

The research orientation was versatile as rich data collection crystallized the view step-by-step towards the research subject and the research question. The business perspective is still underrepresented in the academic literature on UCD and interaction design, thus a new and innovative perspective was taken. In fact, academic literature was not supposed to be analyzed deeper before collecting the empirical data according to the traditional grounded theory approach, but due to the researcher's professional experience and the track record of UCD studies, it naturally influenced the research proceedings. Using grounded theory was a challenging enterprise as a first research experience in this mode, especially taking confidence in designing theoretical assumptions. Secondly, it was difficult to dismiss the previous experience within the research discipline and the professional practice and neutrally analyze the empirical data.

Adapting grounded theory, the researcher presented a methodology walkthrough followed by systematically presenting excerpts of the empirical data and final sorting and creation of the categories resulting in deriving the practices for the planned *UX methods toolbox.* This should help to sketch new directions for further development and continuous improvement in the case organization.

In the work environment, a positive and open atmosphere was created through sharing view-points among the stakeholders. Participants openly expressed their personal interpretation of the current matters. Having the opportunity to meet customer representatives and perform on-site observations also allowed the researcher to be confident in her expert role and grow professionally.

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Figures

Tables

Appendices

Appendix 1 Implementation of solution-oriented use cases in the case project

1. Planned service breaks

Use Case Summary:	**Display planned service breaks in IMS**
Actors:	Planner
Preconditions	
Basic sequence	· Create the planned service break · Add planned actions (close valve, add temporary drainings, open valve, etc.) · Perform outage analysis and save the results · Change the Recording status to Approved · When the starting time of the service break is inside a predefined time the objects of the service break appear to the IMS after next polling · Start stepping the service break
Post-conditions	· Service break is updated to be Running automatically · The objects disappear on the IMS after next polling (and appear as Running planned)
Open Issues	

2. Running planned service breaks

Use Case Summary:	**Display running planned service breaks in IMS**
Actors:	Operator
Preconditions	· Plan for service breaks existing in status Planned.
Basic sequence	· Step the first action that closes a valve (some objects get unsupplied) or change the status of the service break to Running · The objects of the service break appear in the IMS after next polling · Step the plan to the end · Service break is updated to be over automatically · The objects disappear on the IMS after next polling
Post-conditions	· Service break is updated to be over automatically · The objects disappear on the IMS after next polling
Open Issues	

3.Running unplanned service breaks

Use Case Summary:	**Display running unexpected service breaks in IMS**
Actors:	Operator
Preconditions	· Unexpected service break occurred
Basic sequence	· Create the unexpected service break and enter all the wanted attributes for it (explanation etc.) · Set the service break to active · Close the valve (some objects get unsupplied) · The objects of the service break appear to the IMS after next polling
Post-conditions	· Open the valve (or change the status of the service break to be Over) · The objects disappear on the IMS after next polling
Open Issues	

4.Working areas

Use Case Summary:	**Display working areas in IMS**
Actors:	Operator
Preconditions	
Basic sequence	· Select menu action Add temporary area and draw the area · Double-click inside the rectangle · Enter address and explanation to the event · Verify that the area was added to the Tapahtumapäiväkirja · Move to IMS web view and verify that the area is displayed on the map · The area appears to the IMS after next polling · Select rectangle and go to menu Action Remove temporary area · The objects disappear on the IMS after next polling
Post-conditions	
Open Issues	

Appendix 2 Excerpt of line-by-line coding (documentation specialist)

	Interview with documentation specialist
* Functional specifications' review - first contact for documentation * Functional specification main source for documentation * Documentation allocated in requirement specification * Obtaining input from requirement specifications	The functional specifications document is one of the main written sources for starting off the documentation work. Normally, documentation specialists are allocated to the project and involved during the functional specifications comment round or review. The requirement specifications document is also available for the documentation work and used for reference, but usually documentation specialists do not participate in the requirement specifications comment rounds or review. As a development idea, the interviewee considered participating at least on a general level in the requirement specifications phase as an asset for the overall understanding of the project.
* Referring to use cases in functional specifications * Understanding tasks and goals * Seeking for information among technical content laborious * Use cases as basis for clarification with product development * Use cases as quick reference in tight schedules	In the case project, simple solution-oriented use cases with four different task flows were included in the functional specifications document. It was easier to gain an understanding of the user tasks and goals than attempting to figure it out from the technical content of the functional specifications material or by consulting product developers. The availability of written use cases resulted in eliminating faulty understanding of the functionality and enhancing the writing process especially under time pressure since less face-to-face inquiries were needed.
* Resources and timetable challenging for clarification in person * Unambiguous reference when documentation reallocated * Useful for new documentation employees	On the other hand, direct communication with product management and product develop-ment were deemed useful but doubtlessly more laborious and challenging to fit in people's schedules. Documented use cases form an unambiguous source of information, for example, in reallocation situations of the documentation tasks. Documented reference material is also an advantage for new employees on the documentation team allowing them to get a grasp of the product functions rather than the technical elements as usually described in functional specifications.
* Outlinig tasks and outcome * Executive summary and customer benefits answer question "why?" * Especially important for new document sections (functionalities)	The best understanding of the overall project is gained when the reason and purpose of the new functionality is explained in the functional specifications, giving an answer to the ques-tion "why?". This helps to highlight the goal of the actual user activity, in other words, tasks leading to a desired outcome are presented. According to the interviewee, executive summaries and description of customer benefits in addition to the use cases are sources of information for the documentation work. Written information is especially useful for documentation of new functionalities if a new section of a manual needs to be written.
* Saving time when large work peaks in many documentation projects	Use cases of the case project proved useful to the work routines of the interviewee, since the Tekla Outage Map Service was done simultaneously with other urgent documentation projects. ...

Appendix 3 Affinity diagram categories