



TAMPEREEN TEKNILLINEN YLIOPISTO
TAMPERE UNIVERSITY OF TECHNOLOGY

MARKUS LEHTONEN
USER-CENTERED DESIGN METHODS IN ADOPTING NEW
SOFTWARE IN AN ORGANISATION

Master of Science thesis

Examiner: prof. Kaisa Väänänen
Examiner and topic approved by the
Faculty Council of the Faculty of
Computing and Electrical Engineering
on 9th December 2015

TIIVISTELMÄ

MARKUS LEHTONEN: Käyttäjäkeskeisen suunnittelun menetelmät uuden ohjelmiston käyttöönotossa organisaatiossa
Tampereen Teknillinen Yliopisto
Diplomityö, 55 sivua
Toukokuu 2018
Tietotekniikan diplomi-insinöörin tutkinto-ohjelma
Pääaine: Käytettävyys
Tarkastaja: Professori Kaisa Väänänen

Avainsanat: käyttäjäkeskeinen suunnittelu, ryhmäläpikäynti, teknologian hyväksyminen, liiketoimintaprosessin uudistaminen, temaattinen analyysi

Organisaatiot, joiden liiketoimintaprosessin kiinteänä osana käytetään jotain ohjelmistoa, joutuvat liiketoimintavaatimusten muuttuessa harkitsemaan ohjelmistonsa päivittämistä. Tällaisessa tilanteessa organisaation liiketoimintaprosessia joudutaan arvioimaan uuden ohjelmiston vaatiman työnkulun perusteella. Myös ohjelmiston hyväksymisen arviointi organisaation työntekijöiden keskuudessa on välttämätöntä, koska ohjelmiston loppukäyttäjänä muutos vaikuttaa eniten juuri heihin.

Käyttäjäkeskeisen suunnittelun periaatteiden mukaan loppukäyttäjät ovat perinteisesti osana koko suunnittelu- ja kehitysprosessissa. Kun käyttöönoton kohteena on valmis ohjelmisto, suunnittelu keskittyy pääasiassa ohjelmiston räätälöimiseen. Tämän työn tavoitteena on löytää tapoja hyödyntää käyttäjäkeskeisen suunnittelun menetelmiä uuden ohjelmiston käyttöönotossa organisaatiossa sekä tutkia, minkälaisilla liiketoimintaprosessin muutoksilla ohjelmiston työnkulkua voidaan optimoida. Lisäksi selvitetään tapoja mitata käyttöönoton onnistumista lyhyellä aikavälillä.

Tässä työssä liiketoimintaprosessin työnkulun uudelleenmäärittelyyn hyödynnetään ryhmäläpikäynti -menetelmää. Kvantitatiivinen aineisto käyttäjän tekemistä valinnoista läpikäynnissä analysoidaan, jotta opitaan lisää työntekijöiden tavasta käyttää ohjelmistoa ja tunnistetaan hiljaista tietoa käyttökokemuksesta. Samalla läpikäynnin kvalitatiivinen aineisto tutkitaan temaattisella analyysillä, jotta saadaan kartoitettua työnkulkuun liittyvät kriittiset vaiheet käyttäjän näkökulmasta.

Lopputuloksena työssä toteutetaan liiketoimintaprosessin uudelleen määritetty työnkulku parannusehdotuksineen. Temaattisella analyysillä tunnistetaan myös teknologian hyväksymiseen liittyvän teorian olevan linjassa läpikäynnin aineistosta löytyneiden teemojen kanssa, millä käyttäjäkeskeisen suunnittelun käyttöä ohjelmiston käyttöönotossa voidaan perustella. Käyttäjäkeskeisen suunnittelun iteratiivinen prosessi, käyttäjien resursointi testitapahtumaan ja henkilötyötuntien kuluttaminen tutkimuksessa voi kaikesta huolimatta olla hankala perustella yrityksessä, jonka työvoimaa tutkimukseen hyödynnetään.

ABSTRACT

MARKUS LEHTONEN: User-centered design methods in adopting new software in an organisation

Tampere University of technology

Master of Science Thesis, 55 pages

May 2018

Master's Degree Programme in Information Technology

Major: User Experience

Examiner: Professor Kaisa Väänänen

Keywords: user-centered design, group walkthrough, technology acceptance, business process reengineering, thematic analysis

Organisations that have a software as key component of their business process might run into situation where the used software needs to be upgraded to follow changing business requirements. In such cases the business process of the organisation should be evaluated against the requirements that the new software sets for the process workflow. Also, it is crucial to evaluate how the new software is accepted among the employees of the organisation, because as the end users of the software they are the most affected by the change.

User-centered design traditionally has a basic principle that users are involved into the full lifecycle of design and development process. But when a new, existing software is adopted in the organisation, design mainly focuses on the customization of the software. This thesis aims at finding out how user-centered design can be applied when adopting software in an organisation and what changes could be made to the business process of the company so that the software would be utilized in an optimal way. Also, ways of measuring the successfulness of the software adoption in short term is considered.

A group walkthrough is used as a method for redefining the business process workflow. Quantitative data about the user selections in the walkthrough is analyzed for understanding the end user interaction with the software and for finding hidden features of the process. Also, qualitative data gathered from the walkthrough is analyzed with thematic analysis method to map out patterns in the workflow that are critical from the point of view of the end user.

Redesigned workflow of business process with improvements is introduced as a result of the research. And with thematic analysis, principles of technology acceptance theory are found being in line with the themes raised from the walkthrough data to justify usage of user-centered design. Though user-centered design is found fitting with the technology adoption, iterative process, resourcing users to the test session, and allocating their time for the research purposes can be hard to rationalize as all of it is taken from the contribution of the employees of the company.

ALKUSANAT

Tämä diplomityö valmistui keväällä 2018 Tampereen teknillisen yliopiston tietotekniikan laitokselle.

Diplomityön toteutumisesta kiitän työnantajaani, ohjaajia sekä ryhmäläpikäyntiin osallistuneita henkilöitä. Erityiskiitos kuuluu diplomityön tarkastaneelle professori Kaisa Väänäselle.

Kaikkia valmistumiseeni vaikuttaneita, ystäviä ja perhettä pyrin kiittämään henkilökohtaisesti.

Mallaa ja Lauria haluan kiittää aina kun mahdollista.

Äitiä kiitän kaikesta, mitä teit eteeni.

Järvenpäässä, 21.5.2018

Markus Lehtonen

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LIST OF SYMBOLS AND ABBREVIATIONS

API	Application programming interface
BPR	Business process reengineering
dPaaS	Data Platform as a Service
e2e	End-to-end
EDI	Electronic data interchange
GUID	Universally unique identifier
PEOU	Perceived ease of use
PU	Perceived usefulness
PW	Pluralistic walkthrough
TAM	Technology acceptance model
TRA	Theory of reasoned action
UCD	User-centered design
UCE	User-centered evaluation
UI	User interface
UX	User experience

1. INTRODUCTION

This thesis is done about the adoption process of a new integration platform in the case company working in the field of data integration. Case company offers data integration services for transferring business data between different kinds of information systems that corporations use for handling e.g. invoices, purchase orders or just generic documents. The currently used integration platform has been a core component for creating business value and yearly revenue for the company. Continuous usage of the software has guaranteed that the product has been constantly improved to fulfill the changing requirements and the needs of different customers as well as the end users inside the case company. But as the data volumes increase and the requirements for transparency, compliance and managing the data comes more and more vital for the business, the company's integration platform is going to be replaced with a modern, cloud based, in-house developed data integration solution.

Another driver for the platform upgrade process is the unification of integration tools between different departments of the organisation. Mergers and acquisitions in the past have brought together a number of corporations working in different locations worldwide having their own organisation culture, customer base and tools for working. The new platform aims at having a unified environment for the whole organisation that would enable decentralized customer service intercontinentally and more collaborative ways of working regardless of the location of the department.

In the context described above, this thesis aims at finding ways to ease the adoption process of the new platform by utilizing user-centered design (UCD) methods. This chapter describes the background and motivation of the thesis with goals that are meant to be achieved in chapters 1.1 and 1.2. Also, the remaining structure of this thesis is described in chapter 1.3.

1.1 Background

UCD is a process that aims to improve the usability of a system by taking users as part of the design phase of a project [1]. But as described above, the project for upgrading the integration platform is already on a phase where the final product is deployed into usage. By this starting point it is clear that user involvement in the software development is not happening in a desired manner from the UCD point of view. Besides this, the end users of the product are also users of the current integration platform, which means they are

very well familiar with the current ways of handling integration process. This puts the new integration platform vulnerable for comparison with the previous platform which may cause expectations on how the work with the new platform should be done. In the worst case, these assumptions are in contradiction with the new ways of working which could lead into challenges and change resistance among the end users.

While the software design and development processes are in the end of their life cycle, defining the ways of working with the new integration platform will be an ongoing process as the end users start working with it. But without a pre-defined workflow process, every user will have to find out their own preferred way of working that does not necessarily follow any common objectives. These best practices can be formed as a unified workflow, but only over time if even then. By taking the expertise of the end users into account when specifying the usage of the new platform, it will hopefully be possible to create a common workflow that utilizes the functionality of the new platform without ignoring the previous ways of working. This kind of a well-defined and unified workflow can then be utilized in training and getting the end users familiar with the new platform. And for this, the applicability of using UCD methods can be explored further.

1.2 Goals of the thesis

Primary goal of this thesis is on evaluating the applicability of UCD methods in the adoption process of the new software. For having some concrete results for the evaluation and for creating business value for the case company, the business process is re-designed corresponding to findings of the UCD process. Both of these goals are aiming at answering the issue that is raised from the primary goal: how the successfulness of the software adoption process can be measured? Even though utilizing the UCD methods would be unambiguously justified in the software adoption process, the benefits of such approach should also be verified.

These goals are set into the following research questions:

- How the principles and process of UCD can be applied in adopting new software tool in an organisation?
- What kind of changes could be done to company's business process so that the new software would be utilized in an optimal way?
- How can we measure the successfulness of the software adoption process?

1.3 Structure of the thesis

After the introduction, this thesis is divided into following parts: Chapter 2 introduces the target product – integration platform – that is being upgraded. Chapter 3 explains the UCD process and principles with other related theory in a brief overview. This chapter

covers the activities related to UCD process, shortly represents the nature of different design methods in the field of UCD and goes through the concept of technology acceptance.

Chapter 4 describes the research plan that covers the ongoing process and the overall context where the process is executed, with a justification for the selected approaches. In the rest of the chapter the used and utilized design methods are listed and described. In chapter 5 the current workflow process is analyzed for designing new workflow for the upcoming platform. Walkthrough tasks are derived from this workflow and the plan for the UCD process is presented, as well as the description of the actual test session in the case company.

The results gathered from the walkthrough and user feedback are summarized and analyzed in chapter 6. Also, the work process defined in chapter 5 is re-designed based on the findings. Chapter 7 concludes how applicable the UCD methods were with the workflow planning process and what kind of improvements were made into the business process.

2. INTEGRATION PLATFORM

In the center of this thesis is the data integration platform used in the case company and the message transformation process that is done with the software. The case company provides integration and data management solutions to its customers, where data integration is a process of combining the data between different sources, and also providing a unified view of this data [2]. With the integration software in between, the sender and the receiver does not have to have unified format for the data – the data transformation is outsourced to a third party. In chapter 2.1 we review the type of integration services the case company is offering to its customers and for which kind of businesses it can be applied to. Chapter 2.2 describes details of the update process between the current and the new integration platform.

2.1 Integration services of the case company

When companies are trading goods in any field of business, it produces commercial documents like purchase orders and invoices. In a digital world this interaction is largely done in electronic format. As the amount of companies taking part in this interaction increases, the ways of working require standardization to keep the data in understandable structure for all the parties involved. For this issue, electronic data interchange (EDI) format was introduced already in mid-1960s. But as these different standards are not necessarily directly compatible with each other, some amount of work is always required for making the data interoperable. If company does not have or does not want to have such resources for handling the data interchange, they may want to outsource the work for a third party. [3]

Difficulty of data management is a result of all existing custom-built, third-party and legacy applications that different organisations are involved with. When companies maintain a great amount of data or data that interconnects in a complex way, some third-party help may be required for providing efficient, secure and reliable services for that data interconnection. Own addition to this are the law regulations when a company is handling private data like personally identifiable- or healthcare information, or payment card data. In such cases the security requirements for the data handling may expand in a way that is impossible to be handled by a single company. [4]

Integration services of the case company are answering to these third-party requirements described above. Integration services can be tailored based on the customer needs, whether it is an on-premise application data, business-to-business (B2B) or cloud-to-

cloud traffic, or some hybrid of these. In addition to data integration, the case company is also offering solutions for custom data management and data security.

2.2 Integration platform update in general

The case company where the study is executed has offered professional data integration services for almost twenty years. During this time, the size and variety of data has increased tremendously which has also introduced new kind of attributes for transmitting, processing and storing the data like compliance, scalability and real-time accessibility. The aim of the new integration and data management platform is to answer to these modern needs of customers in different business fields. Table 1 lists the requirements for which the platform is offering solutions:

Table 1. Integration platform's modular architecture

Data visibility	Data management	Integration
Reports	Metadata management	Adapters & gateway
Operational metrics	View aggregator	Audit & compliance
API layers	Elastic search engine	Event queue
Identity management	Data Indexer	Transformation
SSO	Big data core	Rules engine
BI Hook		Message broker & workflow
		Security
		Process model
		Configuration portal
		Service registry

Platform is a cloud-based solution that implements a new service model approach called Data Platform as a Service (dPaaS). The model is described as cloud integration and data management model named for its ability to provide PaaS functionality at the point of data analysis. The platform consists from three layers, presented in the Table 1: integration,

data management and data visibility. The integration layer uses customer selected integration pattern for transforming data between any two application endpoints. It also enables pre- and post-processing for data cleansing and enrichment purposes. Data management layer offers big data technology on a centralized data storage that can be accessed and modified through application programming interfaces (APIs). Data visibility layer then offers real-time monitoring activities to the data

The new integration platform will be taken into usage in the whole corporate including offices and personnel in US and Europe. However, the scope of this thesis includes only departments working in Finland. In Finland there are more than 50 people whose daily work is affected directly by the integration platform upgrade (and well over 100 people if counting all persons whose work is affected in any way). These people are working inside the integration department doing the actual customer implementations, or in customer support which is responsible for offering first-line support for any customer related issues about the integrations. The main differences between the old and the new integration platform visible to the end user are the software UI, updated workflow process and changes to platform architecture and used programming languages. The old integration platform is a Windows executable software whereas the new platform is running as web application in a browser. Both workflow processes have similarities in comparison, but almost all concepts and definitions have been renewed. From the developer point of view, the adapting to changed architecture and programming languages will require new learning, even though the microservice architecture allows accessing legacy components as well.

3. USER-CENTERED DESIGN

UCD aims to increase the utility and usability of the designed system by focusing on the users, their needs and requirements when designing the final product [1]. The end users are therefore taken into integral role of the design process in as early stage as possible to give them the possibility to share their insights of their usual workflow and to comment on the new design of the final product from practical point of view. To ensure the early involvement of users, UCD offers tools and defined procedures for executing the design process so that user involvement would be a fluent part of the project. Total benefits from using UCD are to be evaluated in a long term. The benefits are economic – like increased productivity, advanced efficiency, reduced training and support costs – and social – like improved user experience, reduced discomfort and stress and improved brand image [1]. The following goes through the basics and principles of UCD and different design activities related to it in chapters 3.1 and 3.2. Chapter 3.3 sets basis for evaluating the successfulness of the UCD process by representing evaluation methods for the process and chapter 3.4 introduces the concept of technology adoption and how it relates to the UCD process.

3.1 Principles of UCD

The concept of UCD was introduced by Norman and Draper (1986) which was developed further by Gulliksen et al. [5]. The list of 12 key principles of UCD by Gulliksen et al. focuses on user involvement and context driven development, professionally performed development process with “easy to understand” outcome and holistic approach to unique design process [5]. Current principles for a user-centered approach are standardized in the ISO-9241-210 as a list of six points:

- The design is based upon an explicit understanding of users, tasks and environments.
- Users are involved throughout design and development.
- The design is driven and refined by user-centered evaluation (UCE).
- The process is iterative.
- The design addresses the whole user experience.
- The design team includes multidisciplinary skills and perspectives.

Explicit understanding of users, user involvement and UCE driven design aim to get the comprehensive overview of the target users of the designed product. Products are generally created for a certain target groups and lack of this user understanding exposes a major risk for failing with the design. An active user involvement supports getting knowledge

of the users and will provide “a valuable source of knowledge about the context of use, the tasks, and how users are likely to work with the future product, system or service” [1]. UCE is a way to test the design or a product with real target audience and to get a feedback of the current state of the process. UCE should also be used when accepting the final product. [1][6]

An interactive system depends so heavily on the human interaction with the product that it's impossible to create detailed design plans without this interaction element, which cannot be simulated without a product. The iterative design can complete the deficiencies of a design and improve the design on the go by finding the needs and expectations of users, that could not be revealed during the design, and adjusting the plans by using these results. In even broader view, the design should also cover the whole user experience (UX), which besides the actual system related usability properties consist of user's personality, skills, attitudes and prior experiences, as well as internal factors like job satisfaction. The design team should also include multidisciplinary skills and perspectives to cover sufficient number of different viewpoints of the stakeholders affected by the project. [1][6]

3.2 Design activities

The UCD process starts from identifying the need for UCD and creating a plan for it. The UCD process plan should define the used design methods and affected resources that can be utilized in the design. UCD process should be started as early as possible in the product life cycle so that the process can be integrated widely into different phases of the project [1]. After the UCD process plan has been created, the following four activities are initiated:

1. Understanding and specifying the context of use
2. Specifying the user requirements
3. Producing design solutions
4. Evaluating the design

First activity on the list, creating context-of-use description, is a specification of the actual working environment in which the system is or will be used. This means specifying information and details regarding actual end users and tasks that are part of their daily work, in addition to the working environment itself. Detailed description is the basis and enabler for the next activity: specifying the user requirements. In the UCD process the user requirements should be defined explicitly in its intended context of use, for which the significance of detailed context-of-use description gets emphasized. On a business level, this phase might also involve defining business requirements, of which the user requirements are a part of. Thoroughly planned user requirements are the key to a successful UCD

process since besides steering the work process and determining tasks needed to be done, they are also used for measuring how applicable the design solutions are at the end of the process. [1][7]

Producing design solutions are planned based on the context of use and may reveal new user requirements as design solutions are evaluated. Planned design solutions consist of descriptions and concepts of user tasks, interaction between user and system, and user interface (UI) in a form of use case scenarios, simulations and prototypes. Lastly, evaluation of the design should be involved in even the earliest stages of the project so that the design will receive continuous feedback from the end users and finding new or understanding already defined user needs becomes ongoing process. The collection of different UCE methods is vast, and they are overviewed in chapter 3.3. [1][7]

As the description of these four activities implies and the picture below (Figure 1) illustrates, iteration has an integral role between the activities. Regardless of the sequential order of the activity phases the process does not have to strictly follow the represented cycle. Yet there are certain outputs required from the previous steps before advancing into the next activity [1]. The goal of the UCD process is represented as the last activity: to finally meet the defined user requirements for the planned product. And the way to meet the goals is the iteration between introduced four design activities.

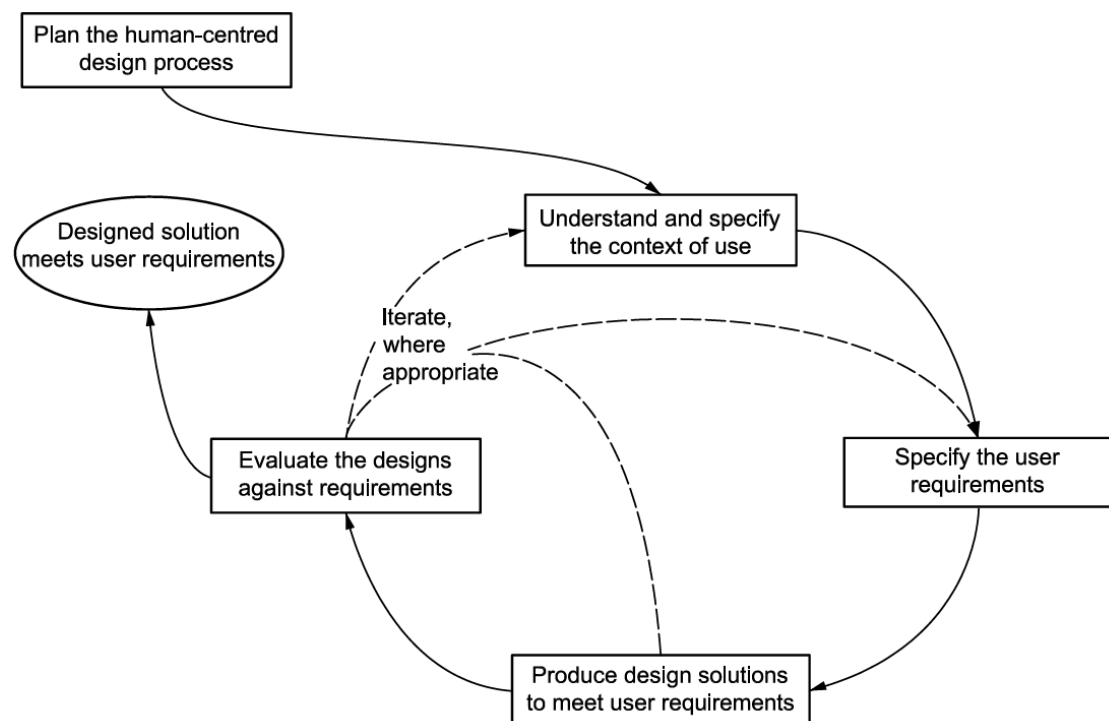


Figure 1. Interdependence of human-centered design activities (ISO 9241-210:2010)

3.3 Evaluation methods

Results of the UCD process should always be evaluated and the feedback from the evaluation should be used to improve the process. A long-term monitoring is a way to determine how well the user needs and requirements are met and monitoring requires feedback from actual end users after the deployment of the product. This kind of follow-up evaluation is often arranged within a specific time frame, e.g. six months to a year after the product deployment [1]. But as long-term monitoring happens only after the product has been released, it cannot add any value to the project during the development phase. Therefore, a short-term evaluation is mandatory for an ongoing development process. This is also addressed in 12 key principles of UCD by Gulliksen et al.: “UCD requires an approach which allows continuous iterations with users and incremental deliveries” [5]. Numerous UCE methods aim to answer to this requirement and UCE is a highly-suggested activity in the UCD process. Two of these widely used UCE methodologies are user-based testing and inspection-based evaluation.

UCE should be handled by one or many experienced usability experts but the group of evaluators for the designed product should also consist of real users [5]. This kind of user-based testing is not dependent on the amount of work spent on developing the product. In the early stage of the project the evaluated product does not have to be more than a sketch or a paper prototype of the design concept – even before the initiation of actual implementation process. As long as it is tested by an actual end user. As the project advances, more concrete prototypes can be tested and the aspect of actual working environment can be brought to test context in form of simulations. Gradually user-based testing can be utilized for evaluating how well the usability objectives are met in the actual context of use, which is a way to affect on system adoption, ease of use and user experience. [1][8]

Inspection-based evaluation can be used for complementing user-based testing, though the ideal inspection-based evaluation is planned to be executed by a group of usability experts. Also, it is in common to combine different evaluation methods in research as Van Velsen et al. point out in their study [8]. Idea of the inspection-based evaluation is to review the product or a prototype based on some guideline given to the evaluators. This guideline may be based on user requirements, usability goals, industry best practices or it may consist of some general usability guidelines and heuristics. The most profound results will be achieved when utilizing usability experts with prior experience of UCE, but also the point of view of actual end users should be taken into account. Having both kind of expertise involved – the project domain knowledge and user study experience will result in more reliable results. [1]

The purpose of any UCE method is to make the process more cost-effective. User-based testing offers a tool for following how the product development evolves and how is it accepted among the end users. Advantage of the user-based evaluation is that it can be

executed at any stage of the project lifecycle. And as a result of an early involvement, the user-based testing provides a quick feedback about the obstacles that might result from process reengineering and UI concepts during the project development that steers the design into a user acceptable direction. Inspection-based evaluation can be arranged to complement the user-based testing and it is more light-weight and quicker to carry out. Having the inspection-based evaluation before user test may help in finding and fixing major issues that could not be found in user-based evaluation, and could also affect on the progress of user-based evaluation. [1][7]

3.4 Technology adoption

One of the research questions set for this thesis is about how UCD methods can be applied when adopting new technology in an organisation. For getting a comprehensive view on that question, theory about technology adoption must be also reviewed alongside UCD methodologies. Technology adoption is a case of human behavior when a person is interacting with new technology. From the point of view of the adopter technology adoption has a lot of in common with persuasion models from social psychology. Davis et al. point out that theory of reasoned action (TRA) is an example of social psychology model that works also in the field of information technology: “TRA is an especially well-researched intention model that has proven successful in predicting and explaining behavior across a wide variety of domains” [9].

TRA suggests that a human behavior is a result of *behavioral intention* that consists of *subjective norm* and *attitude* towards the behavior. This meaning that a person has normative beliefs and motivation as the basis for the subjective norm. Individual beliefs and evaluations make the impact towards decision making in form of attitude. The actual behavior is a compound of these two. The model is illustrated in Figure 2. TRA is a foundation for many technology adoption models that are handled in the following sections. [9]

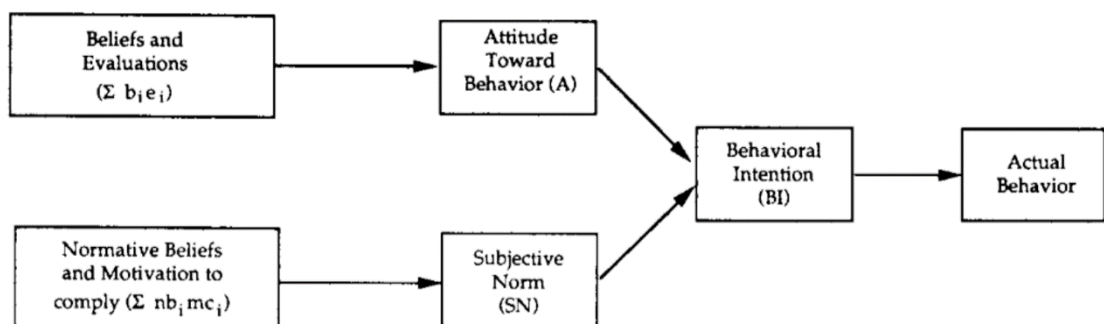


Figure 2. Model for TRA (Davis et al., 1989)

3.4.1 Variety of adoption models

As mentioned above, TRA is a basis for variety of adoption models. One of the first adaptations for information systems and also one of the most used model for computer usage behavior is technology acceptance model (TAM). This model is based on two factors that are proposed as the main determinants for persons attitude when accepting new technology: what are the *perceived usefulness* (PU) and *perceived ease of use* (PEOU) that technology at hands is offering. *Attitude toward using* and *behavioral intention to use* are determinants inherited from TRA with an addition to the original model that besides person's *attitude toward using* the system, *behavioral intention* is also a joint consequence of *PU*. Summarized, TAM predicts that if end user finds the technology being useful and easy to use, they are more willing towards accepting the system into their daily use. Figure 3 illustrates this chain of actions. [9][10][11]

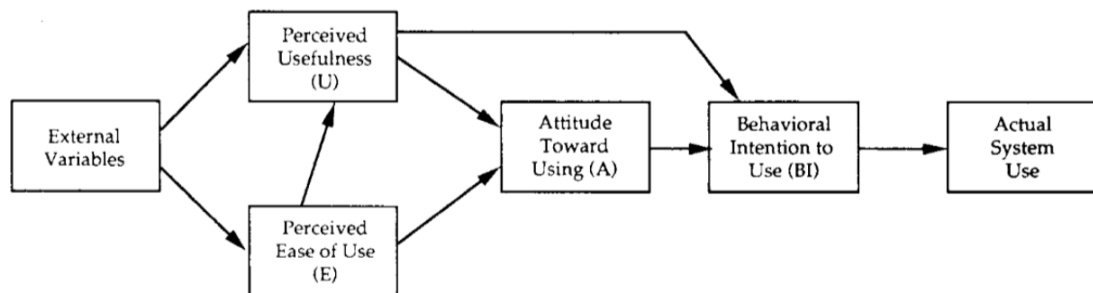


Figure 3. TAM flow chart (Davis et al., 1989)

As TAM aims to mainly predict user behavior when it comes to taking new technology into usage, it is not as generic model as TRA [9]. The approach of TAM is based a lot on individual level decision making and does not consider group effect and social influence that are usually related to corporate wide technology adoption. Also, corporate level technology adoption is often forced due to requirements coming from external initiators, TAM is based on “individual user adoption of simple technologies in voluntary situations” [11]. For these more complex technology adoption environments, other models are required as well. [9][10]

One model found from studies in more complex adoption environments is called *attributes of innovation*. Rogers (1995) describes the model with five attributes [12]:

1. Relative advantage
2. Compatibility
3. Complexity
4. Trialability
5. Observability

These characteristics are researched to be the most important attributes of innovation when it comes to the attitude towards adoption. Relative advantage is described as the individual's perception on the question if the innovation to be adopted is more preferable than the idea it is replacing. Compatibility refers to values, norms and needs originated from adopter's personal experience or influence from one's social group, and how well the innovation correlates with these parameters. Complexity is the level of difficulty to understand the innovation, and thus decreasing the willingness to adopt it. Trialability means offering the user a possibility to experiment the innovation to some extent before taking into full usage. Observability focuses on offering visibility to the results of innovation so that adopter can see the usage of innovation. This way the adopter may either be impressed by the advantages of the innovation or then just get adjusted to the impression that innovation is adopted by others as well. [12][13]

Even though attributes of innovation model is developed for needs of more complex technology adoption environments, it also receives criticism of not being enough. As in case of TAM, attributes of innovation is also seen lacking of view on organisation level utilization with larger social interactions. A variety of inter-firm level adoption models exist in literature to cover large-scale adoption cases by including appropriate determinants as external, organisational and policy factors. But as several of these adoption models and a lot of these theories exploit the introduced individual-level models as the basis, these inter-firm level adoption models are not covered in the scope of this thesis. [11]

3.5 Summary

As presented in this chapter, central feature of UCD is focusing on end users and getting their valuable insight of the workflow available for the use of design process. Therefore, including the end users to the UCD process is somewhat mandatory step in the design. Both evaluation methods, user-based testing and inspection-based evaluation are suitable for execution with end users, although the ideal inspection-based evaluation is to be executed with usability experts familiar with the problem domain at hands. Inspection-based evaluation is described as a good way of complementing the user-based testing. Therefore, some properly selected user-based testing method would be a good starting point for the UCD process.

Detailed benefits of the UCD process can be evaluated only in long term monitoring, but studies are indicating that applying UCD evaluation methods are causing cost and time related effectiveness on projects. Such savings resulting from an early involvement of the end users should work as the justification for including UCD process into technology adoption process. Also, the resource- and time requirements for enabling the evaluation process are not significant as user-based testing can be utilized in any stage of the project lifecycle. Same applies in inspection-based evaluation with the addition that the process

needs to be in such phase where some sort of prototype of the envisioned end product can be created for review. Both kind of evaluations are therefore feasible in the technology adoption scope as the product to be adopted should be quite well defined on the phase of planning the adoption.

Technology adoption models consist of attributes that should be compared against UCD principles when trying to find ways for utilizing UCD methods in case of technology adoption in an organisation. TAM introduces two major determinants affecting persons attitude and behavior towards usage of the adopted software system: PU and PEOU. Attributes of innovation model lists five attributes for the same cause, and specifically two of them (relative advantage and compatibility) are found positively and one (complexity) negatively related to adoption [13]. These principles from different models partially explain the similar aspects towards technology adoption. In attributes of innovation model, qualities like relative advantage and compatibility are such that could be bundled as qualities of PU from TAM. Similarly, complexity could be quality under PEOU. In whatever structure these attributes are viewed though, what is in common for these all technology adoption related principles, is that they are heavily dependent on end user and end user involvement. Just as UCD principles emphasizes. This way reviewing UCD methods in scope of technology adoption seems convenient starting point.

User-based testing offers an environment and resources to evaluate how well the selected UCD method is responding to these technology adoption principles. And results from the test session can be used for redefining the inspected work process. These correlations are covered more thoroughly in the conclusion section of this thesis, where compatibility of UCD methods in scope of technology adoption are evaluated. But it is safe to say that UCD leans to similar principles that are seen advantageous in the technology adoption scope as well.

4. RESEARCH PROCESS AND METHODS

As the UCD process is grounded on an early user involvement and embedding the user centeredness for as full length of the project life-cycle as possible, the starting point for this research is a bit challenging. The project for implementing a new integration platform for the use of case company is somewhat beyond its deployment phase as it is already taken into use in some parts of the organisation. Therefore, some of the typical features of the UCD approach are not applicable in the traditional sense of early user involvement. However, the focus of the research is on adopting a new technology to replace the existing integration platform that has been in use for doing the similar work as the future platform will be fulfilling. From this point of view the integration platform itself is not the only subject on what the UCD process can be applied to – the process of how the platform is used can also be evaluated. And for evaluating this workflow, there are two key components available to be used for the research: a released product and the actual end users. Chapter 4.1 goes through the research process describing what are the goals and what kind of approach is used for achieving the goals. Chapter 4.2 introduces the UCD methods that are used in the research and chapter 4.3 covers the methods that are used for result analysis.

4.1 Research process

Since the upcoming integration platform is replacing an existing one, users have a strong knowledge base with existing platform and are accustomed in using it. As chapter 3.4 about technology adoption indicates, one key attribute of innovation when a new technology is introduced to adopter is perceived relative advantage of the new technology compared to the existing one. Such comparison may lead to change resistance among the end users, if the usefulness of the new technology is not apparent. Also, other attributes of innovation related to the technology adoption are perceived compatibility and complexity of the system. Though the goal of the research process is not on improving the integration platform itself, finding the defects in the planned work process is a way of relieving the technology adoption process. By planning a workflow that is compatible with the customs in which the end user has used to makes it also less complex to use. This way the perceived complexity when using the integration platform gets minimized, as well as the possibly following change resistance.

First goal of this thesis is to find ways to ease the software upgrade process by using UCD methods. For this purpose, UCD methods offer a way for finding anomalies between the current and future work process by comparing the usage of the existing and the upcoming integration platform. This approach is supported by the complexity parameter defined in

the attributes of innovation model, as it suggests that new innovations should be compatible with the existing knowledge base of the end user. Still, we do not want to the old work process become a constraint when adopting new methods, so it cannot be used as a rule of thumb. But taking the old ways of working into account makes it also easier and more efficient to train the end users by focusing on the familiar workflow that has been in use for years.

Second goal of this thesis is to solve what kind of changes can be made to company's business process so that the new technology would be utilized in an optimal way. Work process for the current platform has been well defined in the course of years, but the knowledge of that workflow is transferred to new recruits mainly by hands-on training rather than using a well-designed and documented workflow diagram. In this research, we have also an opportunity to document this process in an appropriate way. The documented model of existing workflow can then be utilized for designing the new workflow by doing appropriate modifications according to the findings received in the UCD process.

Third goal of this thesis is about how the successfulness of the software adoption process can be measured. Detailed information about the benefits of using the UCD process are visible only in long term monitoring of the product usage. Same rules apply with measuring the successfulness of the software adoption process, which is very difficult task within the scope of the thesis due to the fact that the actual adoption process does not take place during the research. To some extent, successfulness of the software adoption can be justified with the theory from technology adoption models, introducing principles for executing the adoption in terms with the end user. But as this approach is not really answering to the requirements of measuring the successfulness, the results should be searched from perceptions of the end users. For this, feedback from the end users is gathered with questionnaires about the introduced workflow process.

4.2 Research methods

The selected UCD method for evaluating new integration platform should be applicable for user-based testing in the implementation phase of the project lifecycle, as it was discussed in chapter 3. Also, some inspection-based evaluation method can be utilized for complementing the results from the user-based testing. In his research [14], Wilson evaluates six different inspection walkthrough methods according to their features. Inspection methods are traditionally being arranged having usability evaluators inspecting the system at hands [15]. But in case of pluralistic usability walkthrough, or just simply pluralistic walkthrough (PW), also users, developers and other stakeholders are included as evaluators to the process alongside usability experts [14][15][16]. This entails the PW inspection method with a unique feature making it have more resemblance to user-based

testing methods. PW is therefore selected as the used UCD method in scope of this thesis. But as different inspection methods are described in the research of Wilson, they can be combined with each other to create hybrid methods for having more profound coverage on the issue at hands [14]. So, we are not just bound with the one selected method. Besides UCD methods, also method for redesigning the workflow process for the new integration platform is explored in this chapter.

4.2.1 Pluralistic walkthrough

PW is a user interface inspection method that is arranged in an evaluation session for a group of predefined participants. The method is a modification of traditional usability walkthrough incorporating group of participants from different end user groups into the process [15][16]. In the walkthrough session participants follow a set of predefined tasks which they go through both independently and as a collaborative team. As the alternate name of the method – group walkthrough – indicates, the walkthrough process is arranged for a group of users, or people who will adopt a role of a user. The group consists of four to ten participants with the following roles: *Facilitator*, *notetaker*, *users*, *product expert* and *internal evaluators*. [14]

The facilitator of the PW is the person responsible for organizing the walkthrough and preparing the walkthrough team to the following session. Facilitator will e.g. supply needed tools for the participants of the walkthrough, keep the focus of the conversation on the target of the inspection, and make sure that the conversation follows a predefined schedule and good manners. The notetaker writes down the results of the discussion during the task evaluation [14]. Evaluators of the PW group consists of representative users that are the actual end users of the product: A product expert who is able to answer to the questions of the walkthrough team about the system, and from three to six internal evaluators such as project managers, developers, engineers or usability experts [14][16]. PW session requires low amount of training which primarily focuses on preparing the facilitator for handling the walkthrough session. This including having the walkthrough in agreed time limits, keeping the conversation on track, looking after that everyone gets their say without causing any friction between the attendees, and making sure that the actual end users speak first when going through the tasks, since their input is most important from the point of view of the research. [14]

For the execution of the PW the facilitator needs to prepare some material for the use of participants. A thorough preparation might be a time-consuming process, but a well-defined material is a key to successful walkthrough session. First of all, the facilitator arranges a pluralistic usability walkthrough plan as a description of the purpose and goals, resources, tasks and procedures, schedule, and data analysis methods of the PW. The con-

sent and nondisclosure documents describes the purpose of the walkthrough for the participant, and serves as an agreement for using the results as explained in the document. Task list of correct actions is the actual walkthrough plan that the facilitator uses in the PW. It describes the correct actions for executing the walkthrough. Based on this task list the facilitator creates also the reporting form for each participant of the PW [14]. The reporting form includes screenshots of the UI in the same order as user would see them when using the actual system and a question of what actions would the participant need in the related screenshot to complete the task [14][16]. A post-walkthrough questionnaire and feedback form is an optional document for getting feedback of the reviewed system or the walkthrough session. [14]

When creating the task list for the walkthrough plan, there are some features that should be taken into account. The task set used in the PW should be held small, first of all for the time constraints of the PW, and also keeping the session pleasant for the participants. So as a start, only tasks that are absolutely required to access the product should be added in the beginning of the walkthrough. Then, tasks should be evaluated based on their frequency and criticality. Frequently appearing tasks are candidates for the PW, but also non-frequent tasks should be used, if their criticality is high enough. Other criteria for selecting tasks are e.g. the level of concern – if developers are concerned with some certain task, if the task is about a change and testing its impact on usage of the system, or if facilitator wants to have some easier task early in the PW for generating a good first impression for the participant. After all, the PW aims for having answers about the system and frustration in the start of the walkthrough could affect on the enthusiasm on answering the questions. Similarly, the order of the tasks should be so, that the complexity increases gradually. Walkthrough should include realistic tasks illustrating the core features of the system and testing the transition between the core features. The PW process is built on top of “correct path”, which should be determined by the facilitator. [14]

The actual PW session starts with gathering and introducing the participants, introducing goals, timeline and basic instructions for them, and going through key concepts and a quick overview of the system to be evaluated [14]. The reporting forms are shared for every participant and they are asked to adopt the role of the end user (as some of them are). After this, the task scenarios are walked through in cycles that include the following actions: A task with a screenshot is presented for the group, and all group members individually write down the actions they would execute to accomplish the task – in the role of the user. The discussion starts only after every participant has finished their answer and the facilitator reveals the “correct answer”. The representative users present their opinions first, followed by the rest of the group [14][16]. The discussion aims mainly for finding usability problems, but also solutions and other observations can be addressed here as long as the planned schedule allows it. After the whole task scenario is went

through, the discussion may be summarized rapidly before continuing to the next task scenario. This cycle repeats until all scenarios are reviewed. [14]

After the PW session, the reporting forms filled by the participants are collected as well as the possible notetaker notes. The data from the PW includes qualitative results from the discussions about the usability problems and possible solution ideas to these issues, and quantitative results from the number of “correct actions” in the written answers in the reporting form. Also, the “incorrect actions” in the reporting form as well as the issues raised during the group discussions are evaluated and reported. Besides the PW notes, the possible post-walkthrough questionnaire answers are to be used. The summarized data needs to be analyzed and categorized by e.g. type, number, and severity of problem. If needed and possible, new meetings can also be arranged for getting deeper understanding on problem domains addressed in the data. [14]

The advantages PW has to offer relate to getting feedback from actual end users even with an unfinished interface. PW can be arranged at any phase of the lifecycle of the project with a prototype or a sketch of the end product. The involved end-users of the product all get a change to comment on the solution at hands, which also enables rapid redesign of the product [14][16]. And since the developers of the product are included in the session, they will receive the firsthand input from actual end users, while they are also experiencing the process how the end users actually are using the product. Majority of difficulties identified with the PW relates to the size of the walkthrough group. Finding a time that fits for all the participants gets hard as the number of participants increases. Also, the facilitator of the PW has to keep the walkthrough in tracks even with a big group. Facilitator also has to create the walkthrough test cases and prepare all the required material for the test session, which can be time-consuming [14]. Requirements for preparing the evaluators are quite low, but as Hollingsed et al. have raised, the walkthrough is more representative than comprehensive in point of view of the participators resulting that “users who, at a particular step, did not choose the path the group will follow must “reset” their interaction with the interface” [16]. All this considered the PW is quite straightforward and easy to understand for the participants, the method might get costly and time-consuming and therefore is referred as “best suited for more complex systems” [14].

4.2.2 Business process reengineering

When some new activity in an organisation is radical enough to challenge existing work norms, a well-designed reengineering process is in place. One approach for handling the change is business process reengineering (BPR) – an information technology-induced comprehensive methodology for designing new business processes in an organisation

[17][18]. Simply investing in technology or production line might not be sufficient upgrade as they are only focused on improving some part of the production. In some cases, a full width examination on the structure of the production system including the managerial and organisational factors is needed for understanding the basic business process and improving it [18]. Results of BPR projects are “increases in productivity and decreases in staff” [17] in companies like Ford Motor Go., Eastman Kodak Go., AT&T, etc.

The depth of the BPR depends on the type of the reengineering process. According to Zhang et al. BPR can be divided into three types: Functional improvement, process redesign and business rethink [18]. Functional improvement focuses on reducing unnecessary tasks on the department level, process redesign is a cross-functional operation affecting to workflow, technology and stakeholders, and business rethink aims at corporate-wide improvement by redefining the business mission and vision. A timetable for these different BPR types varies from three to six months (functional improvement) up to one to three years (business rethink). [18]

BPR aims to simplify the current business process of a company by removing unnecessary activities and replacing the inefficient processes with activities that enable parallel processing, speed, service, quality and innovation [17]. To be able to discard unnecessary activities from the business process, it needs to be defined and analyzed profoundly. In their specification for the BPR, Guha et al. divides the reengineering process into a life cycle of six design stages: *Envision*, *initiate*, *diagnose*, *redesign*, *reconstruct* and *monitor* [17] (Figure 4).

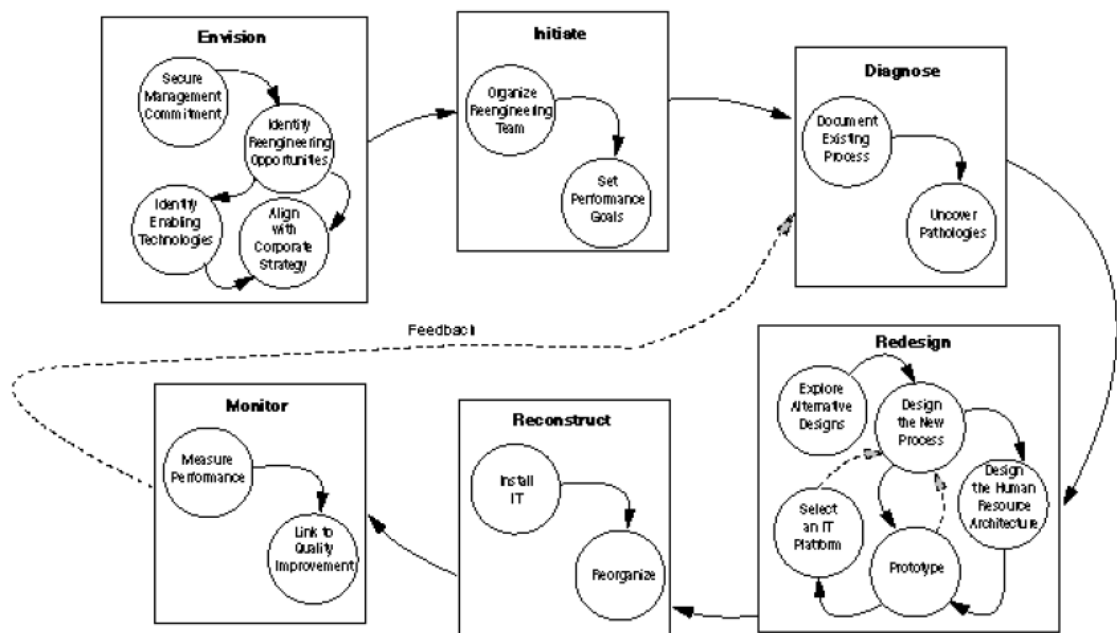


Figure 4. Six-stage process reengineering life cycle (Guha et al., 1993)

Envisioning the change is the basis for creating new processes. First the organisation leaders define the changes that should be implemented. The significance of the change must then be convinced to senior management in a way that gets them fully committed to the success of the project. In this way, every member of the department can realize the positive impact of the change even if it requires a new mindset for the work processes. After the commitment is secured, the actual processes, and tools for enabling the change needs to be found. Lastly these changes in the business needs to be aligned with the strategic goals of the company and the infrastructure of the organisation. [17]

Clear vision of the change starts the initiation stage. A reengineering team with a director responsible for the progress will be created for delivering the design and it should include members from all departments that are affected by the plans. The progress of the reengineering team needs to be evaluated, and performance goals are set for this. Following the performance goals and their achieving works as an indicator of the project state and successfulness. [17]

When the reengineering team and performance goals are set, the selected business process needs to be diagnosed. Diagnosing is a crucial stage for finding hidden features of the process. Full workflow of the current business process will be documented including all different functions, departments, users and other resources related to the process. Through a comprehensive investigation, reengineering team should reveal the flow of information between resources for finding process pathologies like “business policies, bureaucracies, and non-value-added roles” [17] that affect the overall performance of the business process. One way to solve these pathologies is to measure time and costs of each activity of the process, which will also enable monitoring of result efficiency between current and new design processes. This work becomes easier if the process can be decomposed into a smaller set of sub processes that define the whole process in a more detailed level. [17]

Redesign of the process should start from a clean table in which the existing concepts should not have effect. This means that in case there are going to be changes with the software used in the company, it requires knowing the software before selecting the process design. This minimizes the possibility of fitting the selected software in terms of the old design principles. Redesigning processes continues from where the diagnosing stage and finding the process pathologies left off. Reengineering team should find more ways to execute the process flow with time and costs efficiently, improving productivity by focusing on integration of fragmented work tasks, executing them in concurrent way, and appointing the right people as responsible for the work aiming for defined goals and objectives. Arranging human resources is a tool for productivity improvement also in a wider company level. In addition, the IT infrastructure design requirements rely on the design process model and dictates the hardware and software acquisitions. [17]

The reconstruction stage consists of two primary elements: installing software platform and reorganizing the organisational structure. The existing systems and technology update process might require full replacement of the platform, or the change can be carried out with software reengineering by reusing the existing system code in the new software platform. The benefit of software reengineering is the reusable and optimized software system, but the results should be verified against the costs of the process. The other element, reorganizing the organisational structure against the new defined process, means executing the plans of reorganizing human resources with a high considerateness if the change affects dramatically on the work of the employees. Workers in the new work environment are empowered to their new roles by giving them more control over the work process. Properly executed the control and accountability given to the employee can make the work more rewarding. New process-based organisational structure means also training the personnel for team-based management techniques, and moving from individual performance evaluation towards the team performance evaluation metrics with applicable reward structures. [17]

The last stage of the BPR is monitoring the new processes. The two parts of monitoring stage are measuring performance and linking to quality improvement. Measuring the performance is possible only through active monitoring of several aspects of the organisation, such as process time, costs, and quality, business productivity, and software systems performance. Monitoring these aspects provides a feedback loop between the monitoring stage and the diagnose stage of the BPR. This iterative nature provides a link to continuous improvement of the quality improvement management of the company. Such a loop also helps to identify processes that may need redesigning to adapt with the change.

4.3 Result analysis

User data in this research is primarily gathered using the pluralistic walkthrough method. This approach includes using both individual questionnaires and having a PW session for a group of end users. Results from a PW are a set of qualitative data from group interviews during the walkthrough, and set of quantitative data about the “correct actions” of users in comparison with the pre-defined “correct path” of the walkthrough. Results from the pre- and post-questionnaires arranged before and after PW are quantitative of their nature, but these results are mainly for evaluating the feedback on how successful the PW, and the utilization of UCD domain in the process was. Methods for both, quantitative and qualitative result analysis are introduced in chapters below.

4.3.1 Classification of result data by thematic analysis

Thematic analysis is acknowledged with its theoretical freedom and flexibility as a research tool [19][20]. To address this, Guest et al. describe in their research [19], that as

qualitative analysis generally has two approaches: exploratory and confirmatory, thematic analysis can be applied to both. In the research by Braun et al. [20], these same approaches are introduced also with names: inductive and theoretical thematic analysis, but more commonly we name these approaches by calling them respectively content-driven and hypothesis-driven approach. These two approaches mean that thematic analysis can be used by having data definition process outline the analysis or having a pre-selected theory assessing data definition [19]. Through this versatility, thematic analysis is a useful and used method for providing rich and detailed data providing core features for conducting different kind of qualitative analysis. Besides mentioned flexibility, advances of thematic analysis are relatively quickly learnability, ability to summarize key features of a large set of data and highlighting similarities across the data set. [20]

Thematic analysis is a method based on finding patterns of meaning in the data, that can be interpret as themes. Themes are subsets of the whole research data that describe some pattern that aims to give some meaning in relation to research questions. This is where the above-mentioned content-driven and hypothesis-driven approaches come in place. When looking for themes, researcher should be selecting if themes ought to be identified from content itself, or based on the theoretical point of view where defined hypothesis is a driver for determining them. The hypothesis-driven thematic analysis tends to produce more detailed analysis on some certain point of view of the data rather than the more overall descriptive analysis done by the content-driven approach. One reason for thematic analysis being so flexible results from variety of ways for defining themes. What should be remembered is that researcher should always be consistent with how themes are specified within the analysis [20].

When defining themes is about to begin, some new terms need to be introduced. Defining themes requires *coding* of the data, which is like tagging some important part of the data with a nominator identifying what is that data about. These coded parts of data are called data *extract* taken from e.g. individual interviews, walkthroughs or questionnaires, that are called data *items*. Data items combined make up a data *set*. A data set for a particular analysis again requires some defining from the researcher. A data set can be either a rich description of the data set or a detailed set of one particular aspect. A rich description is received when using some data item, a combination of data items, or all data items as the data set for the analysis. Alternatively, the data set can be assembled from some certain aspect, when only information related to this aspect are gathered from all the existing data items, thus producing a detailed set. This is a case where e.g. research question is used as a point of view for gathering data extracts. [20]

The actual thematic analysis, according to Braun et al. [20], consists of six following phases:

1. Familiarizing yourself with your data
2. Generating initial codes
3. Searching for themes
4. Reviewing themes
5. Defining and naming themes
6. Producing the report

Phase 1, getting familiar with the data means first of all transcribing the data from e.g. recorded interview into a written form. Then reading and re-reading the data, and making notations of the ideas received. A profound go-through of the data is a key to successful analysis, even though it may be a time-consuming process. Phase 2, generating initial codes includes systematically and equally going through every data item inside the data set, and coding the interesting features that may lead to finding repeating patterns in the data. The decision between content-driven and hypothesis-driven approach is already a determinant in this phase for coding the data appropriately according to type of themes wanted to be found. Some key guidelines in this phase are: coding as many patterns as possible – as you cannot know what is important beforehand, coding right away and considering unification of the similar codes later, and allowing individual extracts of data to be coded into multiple themes at the same time. Phase 3, searching the themes means gathering codes into potential themes. In this phase mind-maps and post-it-notes – any kind of helpful tool with arranging themes is allowed. Also, temporary theme placeholder for codes that seem like not belonging any main themes, like “miscellaneous”, is allowed. Finding recurring concepts having similar codes is common theme-recognition technique in this phase [19]. By the end of this phase all coded extracts of data should be bundled as a group of candidate themes. Refining, removing or splitting of candidate themes should be left for further phases. [20]

After the candidate themes are found, they should be further refined. In phase 4, reviewing the candidate themes is done in two levels: on level one researcher should go through coded data extracts in each candidate theme and evaluating if they are forming a pattern described as the candidate theme. Researcher should either rethink the theme to be more fitting with the codes, or find an appropriate theme for coded data extracts that seem to be listed under a wrong theme. After the collection of candidate themes and coded data extracts seem adequate, researcher can move on to level two of the review. Level two is a similar process, but in this level themes are evaluated against the selected data set. Phase 5, defining and naming themes should result in having informative theme names and compact definition of the scope and content of the theme. Describing themes in a few sentences is also a good way of testing whether the themes are definite enough, or should the theme be refined even further. Sub-themes can also be useful if the definition theme seems to be too broad. However, the goal is that themes are not too complex. Lastly,

phase 6 is about producing the report that includes final analysis of the themes and provides enough data extracts to support each theme. But besides data, report should be providing justification on how themes are meaningful in relation to the research questions. [20]

One important aspect to keep in mind over the course of thematic analysis is how the analysis is connected to the research [19]. Common mismatches in the analysis can happen when thematic analysis is not answering to research questions, or when data is not supporting the analytic claims that are made of it. Theoretical framework or valid argumentation to back up interpretations cannot be disregarded even though it is very uncommon for a pattern in data to be perfectly correct without any contradictions. Without thorough justification and examples provided to support it, any research results are open to suspicion. [20]

4.4 Summary

From the three research questions set for this thesis, it seems that the second goal would be the most effortless to fit with the research methodologies presented in this chapter. As the question is about what changes can be made to company's business process so that adopting the new technology would be more optimal, BPR method quite directly describes how the process of improving the business process works in an organisation. While this kind of generic business process improvement does not necessarily answer to the needs in the context of the adoption process, analyzing the gathered test data with thematic analysis can reveal those critical areas that have affect on the technology adoption process. PW is the actual UCD method that provides the qualitative test data, and seems to be useful in many ways in the context of this research: it allows having the test as group effort, offers a widely used tool for testing the defined business process and has the quantitative aspect for having test results for correctly executed tasks. The latest is especially useful feature when looking for problem spots in the workflow design.

Two remaining research questions both have some uncertainties on how the goal can be reached, but at least for the first research question those findings should come "built-in" with the used methods. As the research question is about finding ways to ease the software upgrade process with UCD methods, those findings are mainly gathered by utilizing UCD and evaluating the results received. When using the PW method, these ways to ease the technology adoption exist in the quantitative data – count of correct answers to the walkthrough tasks. The more users agree with the correct paths, the more they are leaning towards the technology acceptance. And again, the critical areas from the qualitative results can be evaluated with the thematic analysis. How to find these critical areas is another thing, which relies heavily on how the evaluation and analysis are done.

Lastly, the third research question, of how the successfulness of the software adoption process can be measured, is somewhat hard to get a justified answer. As the only certain way of measuring successfulness is the long-term monitoring, short-term equivalents at this phase of the adoption process can be only estimates of the same. For this, thematic analysis can be used for finding certain themes that represent the end user expectations of how they see the adoption process would be successful. Estimation for the successfulness can be done by comparing found themes to the correct answers from the PW tasks with open comments and post-questionnaire answers on how the new platform is answering to the end user needs. Again, the validity of this method relies on the way evaluation and analysis are done, and most likely would require future task of reviewing the received results.

5. GROUP WALKTHROUGH

The platform under review has some features that must be taken into account when utilizing the introduced research processes and methods. One of these methods is the BPR methodology utilized in research plan, described in the section 4.2.2. As the project from case company's point of view starts from an already implemented product, the BPR is utilized using the parts that are applicable for the actual project. The envisioning and senior management commitment stages of the BPR are considered done. Also, a reengineering team for the purposes of this research has been appointed as required in the initiation stage. Diagnosing the business process is the next necessary step and will be reviewed in this chapter.

The definition of the current work process was done within the reengineering team that consists of a selection of end users of the software that is being adopted. This definition is given in chapter 5.1. Tasks for the arranged walkthrough session are derived from this analysis by creating use cases from the work process used in the current integration platform. These tasks are covered in chapter 5.2. Lastly, the description of the arranged walkthrough is presented in chapter 5.3 Redesign of the workflow and other later stages are to be covered in results chapter 6.

5.1 Diagnosing the current work process

As described in the section 4.2.2, the aim of diagnosing the business process is to find hidden features of the process. These hidden features are e.g. business policies, bureaucracies or non-value-added roles that may reduce the performance level of a business process. Documentation of the business process should include full workflow and its relations between different functions, departments, users and other resources. This way the overall performance of a business process can be measured.

The upcoming platform that is under review in this research is planned to be an internal tool for handling data integrations in the case company. This means the affected group of end users that needs to be involved in the user research only consists of the employees of the case company. The reengineering team for diagnosing the current work process was formed from a selection of end users who were applicable for evaluating the upcoming integration platform by having a firm understanding of the current platform used in the case company. Having the team in place for the company needs was also a starting point for the BPR work for this thesis.

This reengineering team included six persons from different departments of the organisation, including integration-, platform engineering-, development- and application support teams. I was a representative of the implementation resource from the integration- and platform engineering teams with two implementation managers with a high hands-on experience of the current integration platform and workflow related to it. This expertise was there to ensure that the core business of integration was handled by utilizing the best practice guidelines that have been learned through the years of work. One person was a manager from the application support team responsible of the transparency aspect when troubleshooting problems in the data flow process. This means having a visibility to every transaction inside the workflow process through logging and proper error message handling. Two software developers, who were involved in developing the platform, were assisting the rest of the group on new customs and concepts as they were persons who had the most experience on working with the upcoming integration platform.

The purpose and responsibility of the reengineering team was to explore the new platform by hands-on activity and demoing the usage of it through simple examples. Besides the investigation work, the reengineering team constructed a flowchart as a description for the workflow currently in use with the integration platform. This workflow is presented below in Figure 5. This flowchart represents the typical integration setup which includes the least amount of steps for creating a working integration between customers. The model is simplified and generic as the actual implementations usually have more complexity and iterations. But in the simplest cases the full workflow can even be equivalent to the described model.

The actual integration workflow starts after the customer end-to-end (e2e) message routing has been planned with related parties. The initial work is to create the companies into the integration platform, if they do not exist yet. The company creation requires some information about the company, most importantly the business ID, which is used as the endpoint address in the routing context. If the companies already do exist, we can check if appropriate interfaces exist for the cause, or should new ones be created. The inbound interface takes care of getting the transported message into the platform and handling the transformation and modifications to message content. Respectively, the outbound interface sends the message onwards in the process after the required changes have been made for the message.

After the endpoint interfaces are created, a set of routing rules are added to the inbound interface so that certain type of data will be transported into its corresponding endpoint. Firstly, this means setting up the transportation layer, in which the protocol of the file transfer is selected and configured according to customer transportation type. Secondly, it requires looking through the message content for certain data entries that are used for deciding to which counterpart the message should be appointed to according to the

planned process. One example of this kind of information could be account number of the recipient. On the outbound interface side, the transportation information needs to be configured according to the receiving endpoint, in a same way as described in the case of inbound interface.

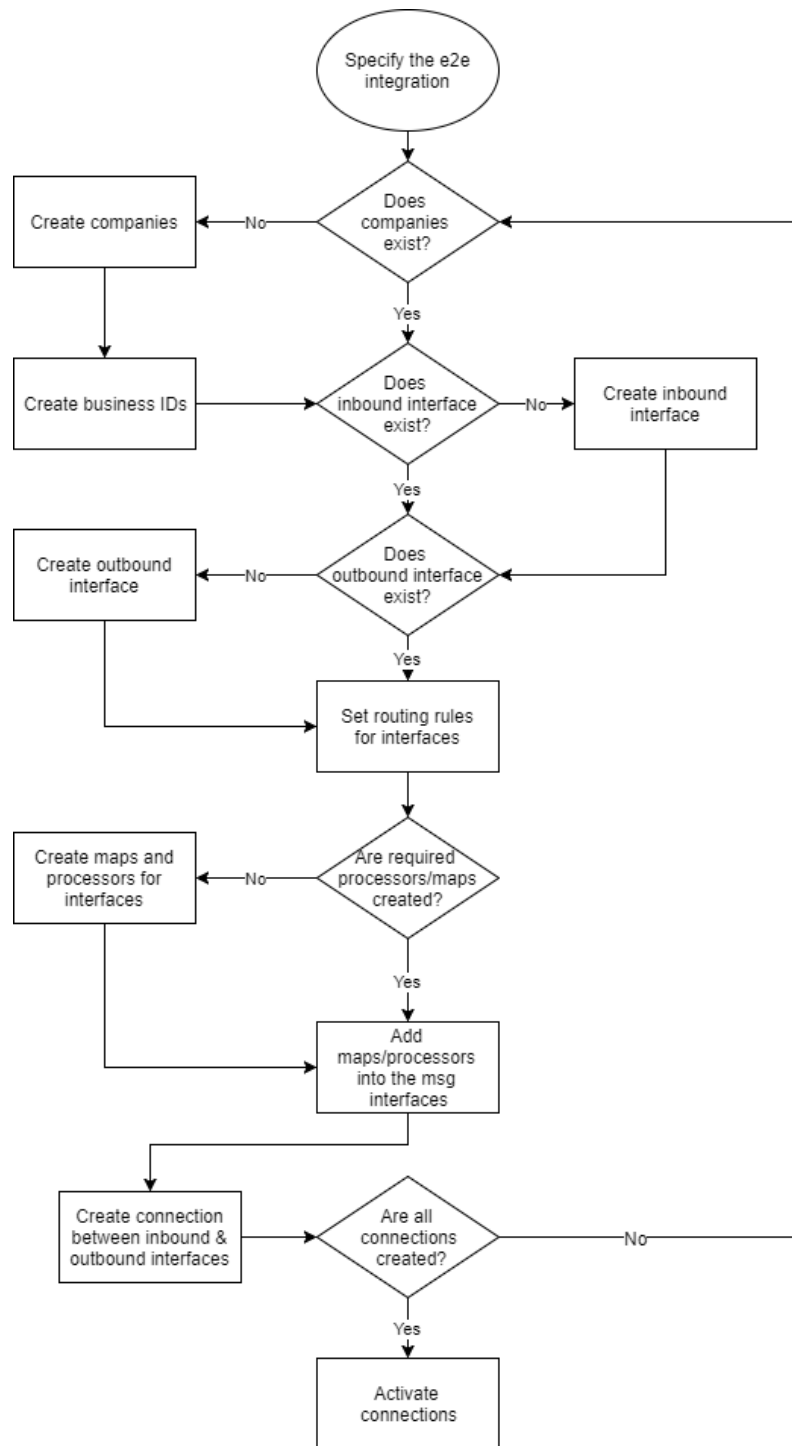


Figure 5. Flowchart of the current workflow with the old integration platform

The core component of integration process in the platform is mapping. Data mapping is a transformation process where corresponding data elements in two different message types are paired in a way that the data can be transformed between message types without losing or corrupting the information that is transformed via data. In this way, the data semantics does not change between different message types even though the structure of the message type may be completely different. The message data is mapped element by element using a mapping tool that connects the corresponding elements with each other. These maps are uploaded to interfaces in addition to scripted processors that define additional logic of interface implementation. Processors may for instance modify the data content by changing its encoding.

When both endpoints – inbound and outbound interfaces – are able to make required modifications to the data going through, these endpoints are connected. Connection is the layer that combines different endpoints together creating the actual integration, called pipelines in the integration platform context. Pipeline can handle data exchange between different customer systems. The connection may be a simple one-to-one connection between two endpoints, but may as well include more complexity to the connectivity by creating one-to-many or many-to-many connections between multiple endpoints. It's also possible to add functionality to this layer for modifying data between the two endpoint interfaces. As soon as the connections are verified to be working as planned, they can be activated for production usage.

5.2 Constructing walkthrough tasks

Using the flowchart presented in Figure 5 as a basis, the walkthrough tasks in the context of new integration platform are created for to be tested on the PW session. While upcoming and existing integration platforms are completely different tools, the work they are fulfilling remains the same. Therefore, the starting point for constructing walkthrough tasks is to find out all needed steps for carrying out the existing workflow in the context of new integration platform. First, we must specify the e2e integration case, as the first action in the workflow indicates. A simple example was selected, because the new integration platform had very few existing components for creating more special integrations. Created example case is described as follows:

- *We have received an assignment to add a new recipient “Lab Receiver Oy” for the existing company “Lab Sender Oy” by using the following party information:*
 - *Party identifier of the receiver: ISO6523 (business ID): 003712345678*
 - *Message file format of the receiver: Edifact-Orders*
 - *Task-script to be used (processor): edifact-track_ns*

With the next task in the workflow flowchart there is a difference between the new and old way of working. Currently new companies can be added through the platform. In the new platform, companies are added into the background system with another tool, and companies are later imported to the integration platform. Therefore, “creation of companies” -step is shown to the walkthrough participants instead of having it as an executed task. This solution also supports the technology adoption theory, as the first tasks of the walkthrough should be easy to execute for maintaining the motivation of the participants. After the new company exists, corresponding party identifier is to be added. This refers to the business ID given in the assignment details. Also, the document type (or message file format as described in the assignment) is added to the system.

After party identifiers are added, the actual integration – pipeline between the endpoints is created. In this step, previously created business identifier and document type are added as party identifiers in the pipeline parameters. Pipeline creation also involves adding an activity into the pipeline, and a task inside activity – both of which are terms related with the new platform. During the implementation of the research, the activity concept is considered possibly to be discarded from the final version of the platform. Therefore, the activity creation step is only presented without inquiring how the participants would proceed in the situation. Adding the task to activity includes adding the task script presented in the assignment into the pipeline process. After this is done, the task configuration is added as required by the task script. Fewness of existing task scripts in the platform is one reason for keeping the example simple. This fact also causes that task configuration is incomplete and therefore only shown to the participants. Finally, after the pipeline is fully created, the pipelines described in the assignment are connected.

When having the walkthrough, after each fulfilled action, participants of the test group are returned to the main menu view. Also, the following task description is not presented for participants at any time, but the question before these action points is presented like “After this task is done, what would you do on this screen to get to the next screen?”. So, having these supplements in the planned walkthrough, the walkthrough tasks for the PW session are:

- 1) Importing new sender company (demonstrated)
- 2) After the company has been added (main menu view)
- 3) Creating business identifiers
- 4) After business identifier is created (main menu view)
- 5) Document type creation
- 6) After business identifiers and document type creation (main menu view)
- 7) Creating new pipeline
- 8) Creating activity (demonstrated)
- 9) Adding a task to activity

- 10) Configuring task (demonstrated)
- 11) After receiver pipeline has been created (main menu view)
- 12) Connecting pipelines

These tasks are presented to participants as a slideshow filled with screenshots – one task per slide. Some slides are printed to each participant as a reporting form on which they will fill their answers.

5.3 Arranging walkthrough

Group walkthrough was arranged in the case company premises, in a meeting room with enough table seats for each participant. Most suitable time for the walkthrough was inquired from each participant and fitting meeting time was eventually found from the following week. A nondisclosure document and a pre-questionnaire for gathering demographic information and expectations of the participants was sent three workdays before the walkthrough. As a preparation for the walkthrough session, reporting forms were printed for each participant. Reporting form was modified from the walkthrough plan constructed in the previous section. It included the task list of the “correct path” for using the system with answers removed from the tasks. When participants arrived into the meeting, the nondisclosure document sent earlier was signed and some sweets were also available for everyone as a reward for attending to the session.

Test group consisted of one facilitator/notetaker, six end users and one product expert. Me, as the research contributor, worked in the unified role of facilitator and notetaker. The walkthrough session mainly included responsibilities of the facilitator role, since notes of the session were gathered by recording the conversation and answers written down to reporting forms by participants. Unfortunately, none of the internal evaluators, such as platform developers and integration project managers were not able to attend. Therefore, the role of product expert was fulfilled by implementation manager supervising the walkthrough. Having the most experience in using the upcoming integration platform, and being part of the reengineering team, the implementation manager had enough information for taking the responsibility of the product expert. One platform developer was still reserved so that if any more complicated questions would be raised, the developer could be invited to answer those questions. This assistance however was not needed and the walkthrough was carried out with the group described in this section.

The end users taking part in the walkthrough included three implementation/technical specialists, two business analysts – one of which a trainee, and a platform solution engineer. Job description of implementation specialists consists of doing data mappings, creating and configuring connections and routing, and developing transformation scripts – the core work of the integration platform. Business analysts are involved in customer

communications and analyzing their business requirements as the specification for the use of customer implementations – of which they are partially or fully also involved in. Platform solution engineer creates custom implementations in customer projects that require special knowledge of the platform related functionality and development. This group of people was selected to the walkthrough, since it represented all central roles related to the work done in integration department.

In the beginning of the group walkthrough slides, the background of the thesis was introduced. This including the purpose and goals of the research, group walkthrough method as a concept, and the structure and timeline of the walkthrough. Before going into walkthrough tasks, some central concepts of the new platform were presented with common rules for the walkthrough session. Rules emphasized that there are no incorrect answers, and that the research is concentrating on the workflow process instead of details of the integration platform. Walkthrough tasks were fulfilled in the order presented in section 5.2 above. After each task that required an answer from participants, there was a five-minute break on which the participants could write down their view on what the next step would be. When answers were written in the reporting form, the “correct” answer was revealed and free conversation was allowed for five to ten minutes about the task at hands. Finally, after all walkthrough tasks were covered, participants were given an opportunity to have a conversation about the integration platform solution in general. Reporting forms were returned to facilitator at the end of the walkthrough session. A post-walkthrough questionnaire form was sent to each participant on a same day after the walkthrough, with a possibility to give feedback about the testing session overall.

6. RESULTS

Using thematic analysis as the result analysis method requires some approach related selections that should be considered before starting the actual analysis process. As this thesis aims to answer three research questions defined in chapter 1, those questions should be taken into account when collecting the data set to be used in thematic analysis. This means the analysis is having theoretical (hypothesis-driven) approach, as described in theory about thematic analysis. Theoretical approach requires that data sets are selected to answer some specific aspect of the research. In this case, each research question is used as the particular point of view for the detailed data set collection. Data items constituting the data set for this analysis includes notes gathered from the PW including pre- and post-questionnaires arranged before and after PW. These data items include mainly qualitative data received from using the method. Quantitative data from the structured parts of questionnaires and “correct path” calculations from the PW task list are used for supporting the finding from thematic analysis. These findings and other observations about the design solution are overviewed and analyzed in chapter 6.1. Chapter 6.2 describes reengineering of the work process introduced in chapter 5.1 with principles from the BPR.

6.1 Analysing the group walkthrough results

As the demographic information gathered from the pre-questionnaire results shows, the research group consisted from six participants of age 25-34. Job titles represented in the walkthrough were implementation/technical specialist, business analyst, and platform solution engineer. The daily work of the participants consists heavily of integration platform usage, since five of the six participants reported they are using the existing integration platform “constantly” as the one remaining person also uses it “often”. Other options in the scale were “sometimes” and “almost not at all”. Level of knowledge and experiences about the new integration platform is low among the participants. Information about it has been mainly received from few demos with high level architectural presentations. Expectations about the platform are related to used scripting language, workflow changes, and stronger separation between test and production environments with user role restrictions. Below we dive into the qualitative and quantitative results gathered from the UCD process.

6.1.1 Qualitative results from walkthrough

Qualitative results are received from the open-ended questions of the pre- and post-questionnaire, and the pluralistic phase of the PW process. These data items form a data set

for each research question that defines the aspect from which the data extracts are gathered from. We continue the thematic analysis by one research question at a time.

1. How the principles and process of UCD can be applied in adopting new software tool in an organisation?

The first research question revolves around replacing the old integration platform with the new one and evaluating on how UCD can be helpful with that. Since utilizing UCD is something we are evaluating based on the two systems at hands, the more narrowed down aspect for thematic analysis in this case is “usage of the platform”. This aspect aims at finding themes that represents the core functionality in both integration platforms – old or new. It does not matter to which platform the selected data set refers, since both systems are fulfilling the same work intended, and we are looking for patterns meaningful in both systems.

After the aspect for first research question is determined, the data set is gone through finding for data extracts related to the aspect defined. After the codes were listed, the initial thematic map was created including the candidate themes created based on the codes related to similar patterns in the context. This initial thematic map can be seen in Figure 6.

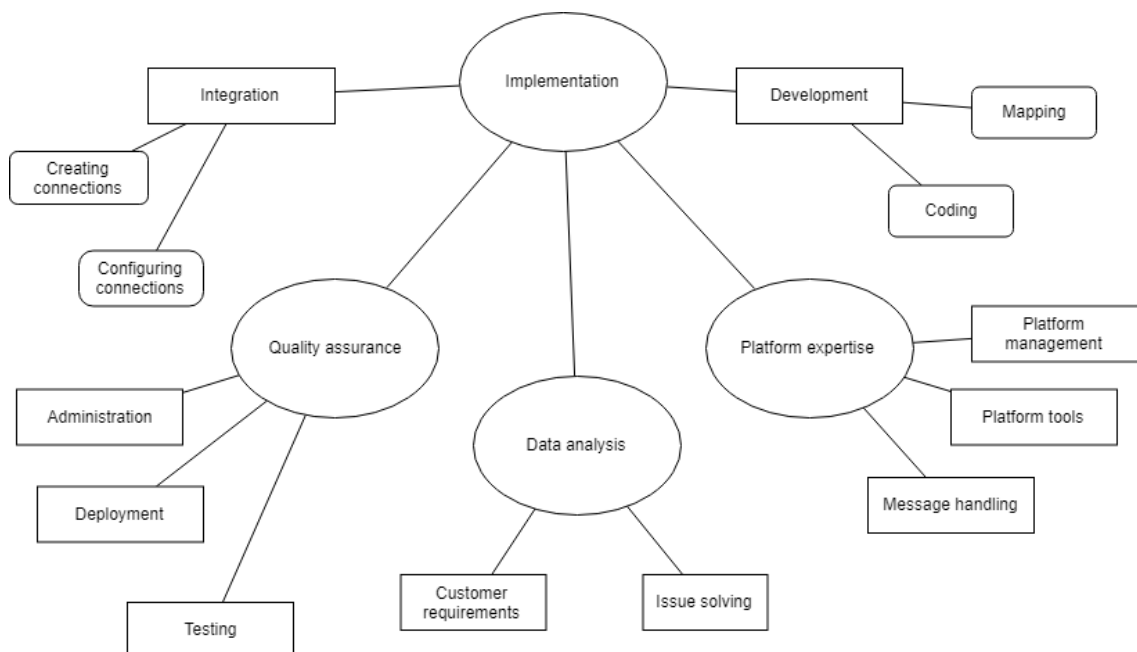


Figure 6. Initial thematic map for the aspect “usage of the platform”

The initial thematic map is mainly a collection of different theme candidates attached together. For that there is most likely some overlapping or unrelated themes in the first map version. Therefore, the candidate themes should be reviewed as the theory of the-

matic analysis describes. Data extracts, that are coded, are reviewed themes they are defining are reconsidered. Then, either the codes are found a better definition or the themes are fixed more accordingly to the codes under it. Also, themes are reviewed according to the research questions as the aspect for the data set.

In this redefined thematic map, visible in Figure 7, we can see that “integration” and “development” sub-themes are not separated anymore, but they are all merged into the “implementation” theme. Also, connectivity related sub-themes are merged as “configuring connections” under “implementation”. One main theme – “data analysis” – from the initial map is removed. This is due to the fact that process of analysis is actually not related in point of view of “usage of the platform” directly, since analysis is mostly done outside the platform. Still, “issue solving” is a valid theme related to platform usage, and it is moved under the theme “quality assurance”. The remaining main theme, “platform expertise” includes data extracts describing platform functionality that are used for quality assurance work in the platform. Therefore, this theme with its sub-themes is merged into “quality assurance” forming a more descriptive “continuous monitoring” main theme. After these naming changes, focus of the “administration” is similar with its “continuous monitoring” main theme, so they are also merged. This way we finally have the thematic map having themes in their most atomic form.

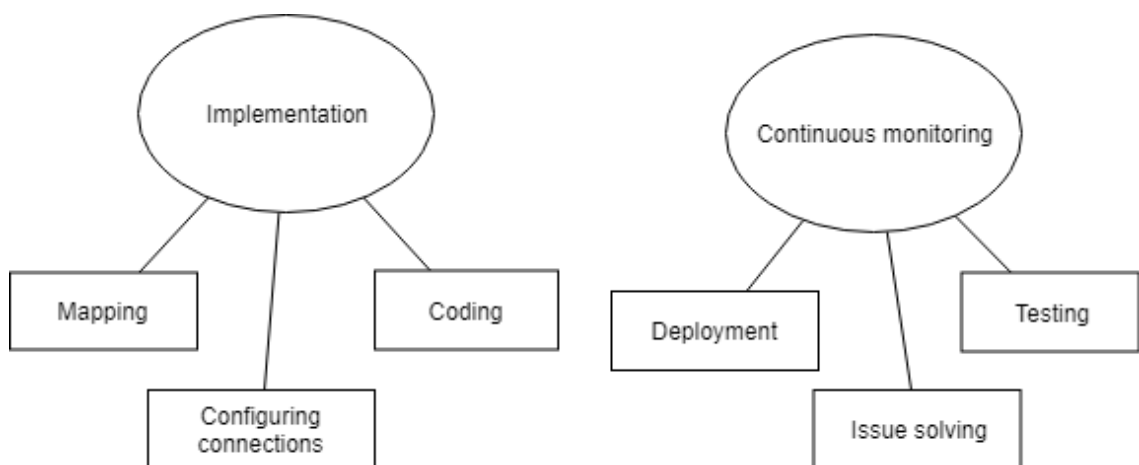


Figure 7. Redefined thematic map for the aspect “usage of the platform”

From the point of view of the first research question, themes in the picture above are describing the data extracts of that specific aspect gathered from the data set. Most recurring data extracts in the data set were concerning creation and configuration of integration connections, testing these connections, and ways of working when having issues with integrations. Main theme “implementation” is answering to need of any kind of configuration that is related to integration as well as mapping and coding tasks. Such implementation expectations were described by the end users like “I am hoping for more customer specific opportunities when implementing new integrations and duplicating connections which still require a lot of manual work” or “I would like to have templates for so called

basic-cases”. Other main theme, “continuous monitoring”, is a generalized theme for any kind of testing, issue solving, or any other administrative or management related tasks that are done with the platform functionality. Especially visualization of message handling was an existing feature that was feared to suffer from the platform update, as described: “new technology adoption raises concerns like it is very technical and we will not get same kind of visual UI as before”. Visualization and ability to navigate in UI were the most raised ones in the list of most important features of the existing platform. One answer described this as: “ability to navigate quickly from message/component to another – a functionality that steers the implementation”. These defined themes are valid when investigating how the process of UCD can be applied in adopting software in the organization, and they are described in Table 2 below.

Table 2. *Definition of themes for the aspect “usage of the platform”*

Themes	Description
Implementation	Any integration related implementation that can be done directly or indirectly with the integration platform
Mapping	Adding, updating and configuring data maps into connections using the integration platform
Configuring connections	Creating, configuring and parameterizing the connections between endpoints with the integration platform UI
Coding	Developing processors, adapters or any transformation related scripts within or outside of the integration platform and viewing the codes with the ability to update them through the UI
Continuous monitoring	The created customer implementations are monitored for quality through platform visibility, that enables users to look for and fix issues, in addition to automated notifications raised by the platform
Deployment	Solutions are separated between different environments (e.g. test and production) and deployment between different environments is handled in structured and standardized process
Issue solving	In case of any issues within the connectivity, there should be visibility for searching and analyzing the issue through the UI
Testing	Testing is automated and test cases can be implemented and triggered in the UI with having visible results after test run

Next research question from the point of view of gathering data extracts is about company's business process, and how it could be improved so that the new platform is well received:

2. What kind of changes could be done to company's business process so that the new software would be utilized in an optimal way?

Here the narrowed down aspect for thematic analysis is "issues/enablers in the process", as the good and the bad solutions in the business process are determining the optimal way of usage. Again, this is a version independent aspect, since both old and new platforms can reveal such solutions of the process. This aspect is similar with the aspect presented for the first thematic analysis above, but the main difference between them is with the focus on the process instead of the platform itself. This way, the aspect is wider and allows also quality related details, e.g. slowness of the system, from the data set, in addition to the platform usage related data extracts. With this defined aspect, the data set is again processed for related data extracts. The initial thematic map for this phase is illustrated in Figure 8.

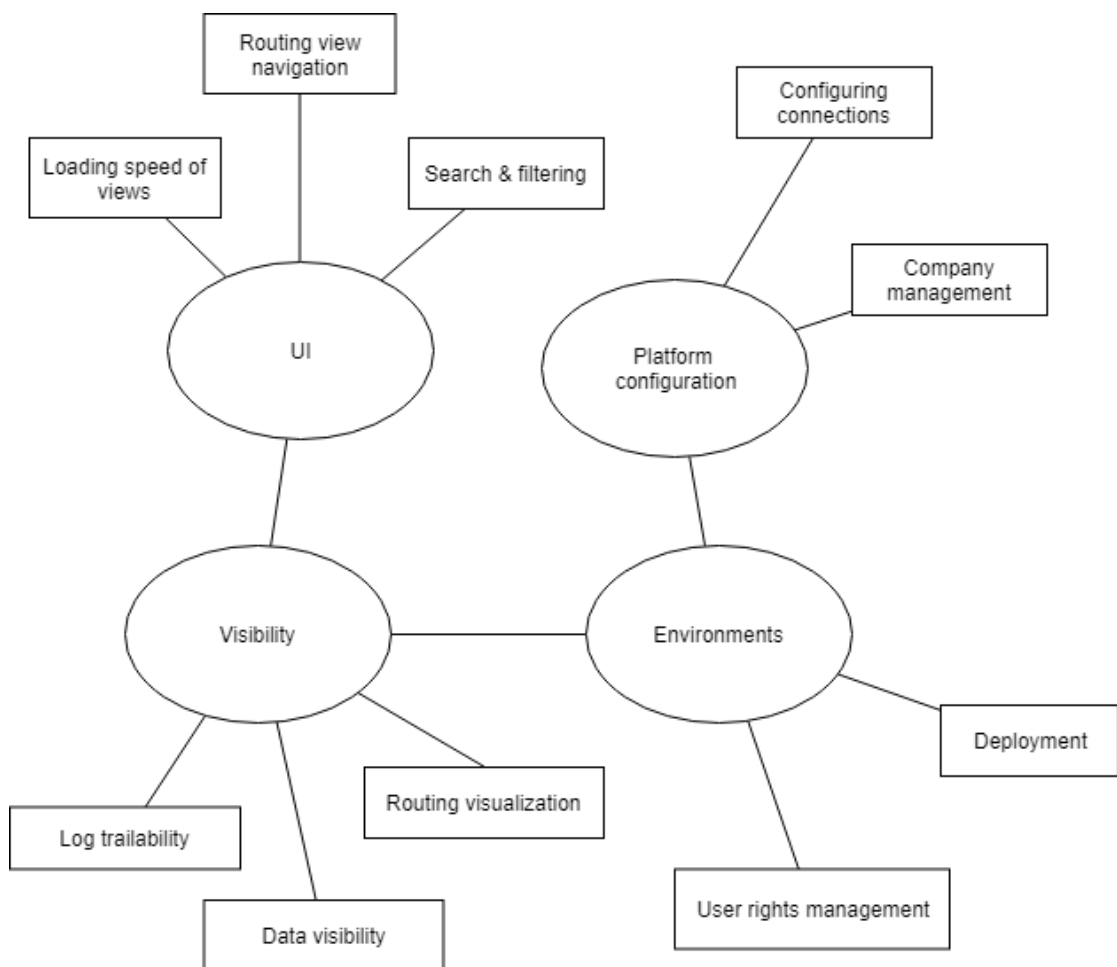


Figure 8. Initial thematic map for the aspect "issues/enablers in the process"

The initial thematic map is again reviewed for overlapping and too generic themes and redefined in Figure 9 below. “Environments” is a solution wide theme affecting on everything else in the thematic map, so it is melded into the existing themes. Themes “user rights management” and “deployment” are unified as “test/production interaction” which is moved as a sub-theme of a “platform configuration”. “Configuring connections” sub-theme is not adding anything new to its main theme “platform configuration”, so they are merged. Same thing is done with “data visibility” by merging it with its main theme and naming it as “message visibility”. Similarly, “routing view navigation” with “UI” is forming new “UI navigation” main theme. Under the new “UI navigation” theme remaining two sub-themes are unified as more generic “speed of the platform”. “Routing view navigation” with “UI” is forming new “UI navigation” main theme. Under the new “UI navigation” theme remaining two sub-themes are unified as more generic “speed of the platform”.

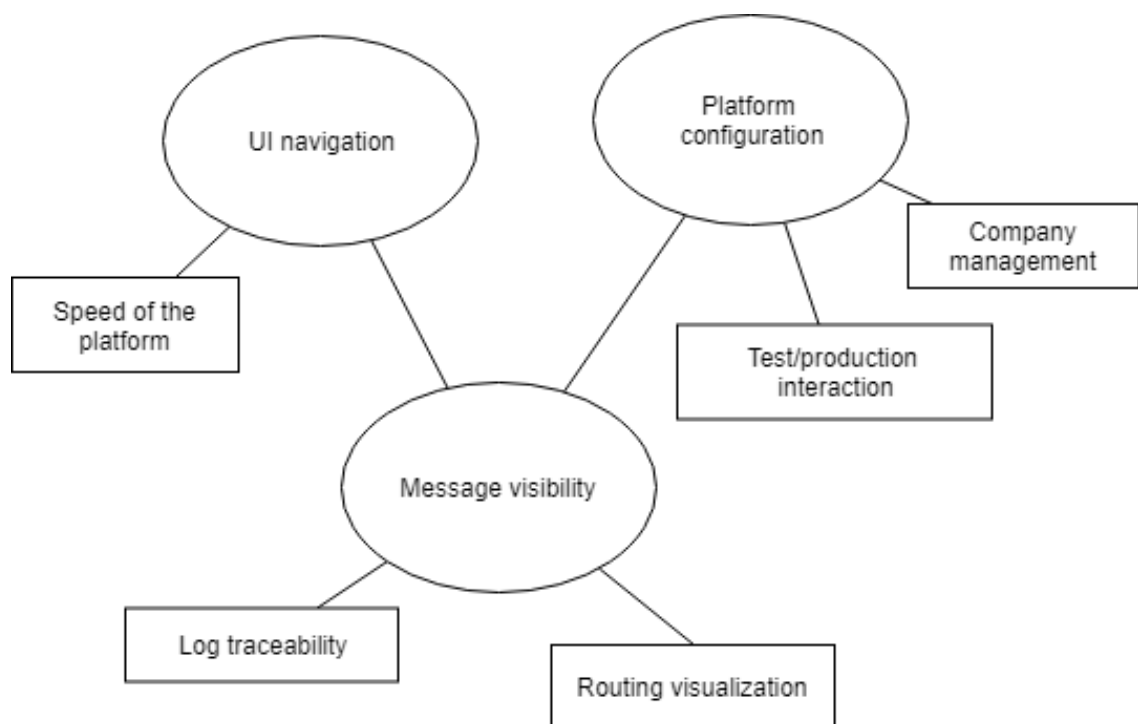


Figure 9. Redefined thematic map for the aspect “issues/enablers in the process”

Themes in the redefined thematic map represent most raised data extracts from the data set. Again, visualization and ability to navigate in the interface were emphasized subjects, alongside configuration attributes in the platform. Basically, these themes are very similar with the ones received in the thematic analysis from the point of view of the first research question aspect – but more from the process point of view, as the difference between two research question aspects profoundly is. “UI navigation” theme combines navigation point of view with the quality expectation of the end users, e.g. speed and adjustability as described in questionnaire answers: “I wish that the UI of the new platform is not too stiff” or “I have many times hoped for functional solution for tabbed interface”. Theme “message visibility” covers visibility of both data payload and routing structure. Other

sub-theme related to visibility is “log traceability” acknowledged from the existing platform with data extracts like: “logging when changes are made” or “logs that can be searched with multiple attributes and message metadata”. “Platform configuration” theme is very similar to the “configuring connections” theme found in the first research question phase, but involves more specifically the interactions between test and production, such as deployment. This is supported by the user requirements like: “more clearer restriction between production- and test systems” and “more automated production deployment process would be nice”. Sub-theme “company management” refers to division of enterprises and the organisations under them, as described with the questionnaire answer: “it would be useful to see which businesses relate to each other and therefore do better solutions for routing and identifying customer”. The themes represented in the thematic map are described in Table 3 more detailed.

Table 3. Definition of themes for the aspect “issues/enablers in the process”

Themes	Description
UI navigation	Created integration solutions can be searched, tracked and navigated through in a convenient manner inside the platform UI
Speed of the platform	Searching and browsing the integrations should respond to user actions in a pace that makes the UX convenient
Message visibility	Message payload and other data related to message handling is visualized and formatted for the work of the end user
Log traceability	Logs are informative and comprehensive and aims at helping the end user in issue solving in the platform
Routing visualization	Route and connections used in the integration are visualized so that it is helpful for end user
Platform configuration	Creating, configuring and parameterizing the connections between endpoints with the integration platform UI
Company management	Handling relations between companies having interconnections with each other
Test/production interaction	Integrations are implemented in test environment separated from the production, and having deployment process between the environments

Last research question to be used as the aspect for gathering data extracts is:

3. How can we measure the successfulness of the software adoption process?

For finding themes that represent the adoption process successfulness criteria for the end users, the aspect for thematic analysis should refer to expectations that end users have towards the adopted system and how they see the system being appropriate for their usage. The narrowed down aspect for the research question in this phase is “opinions/expectations about the system”, describing any answers from end users of how they feel about the adoption process. The initial thematic map based on the data extracts gathered in this phase is illustrated in Figure 10.

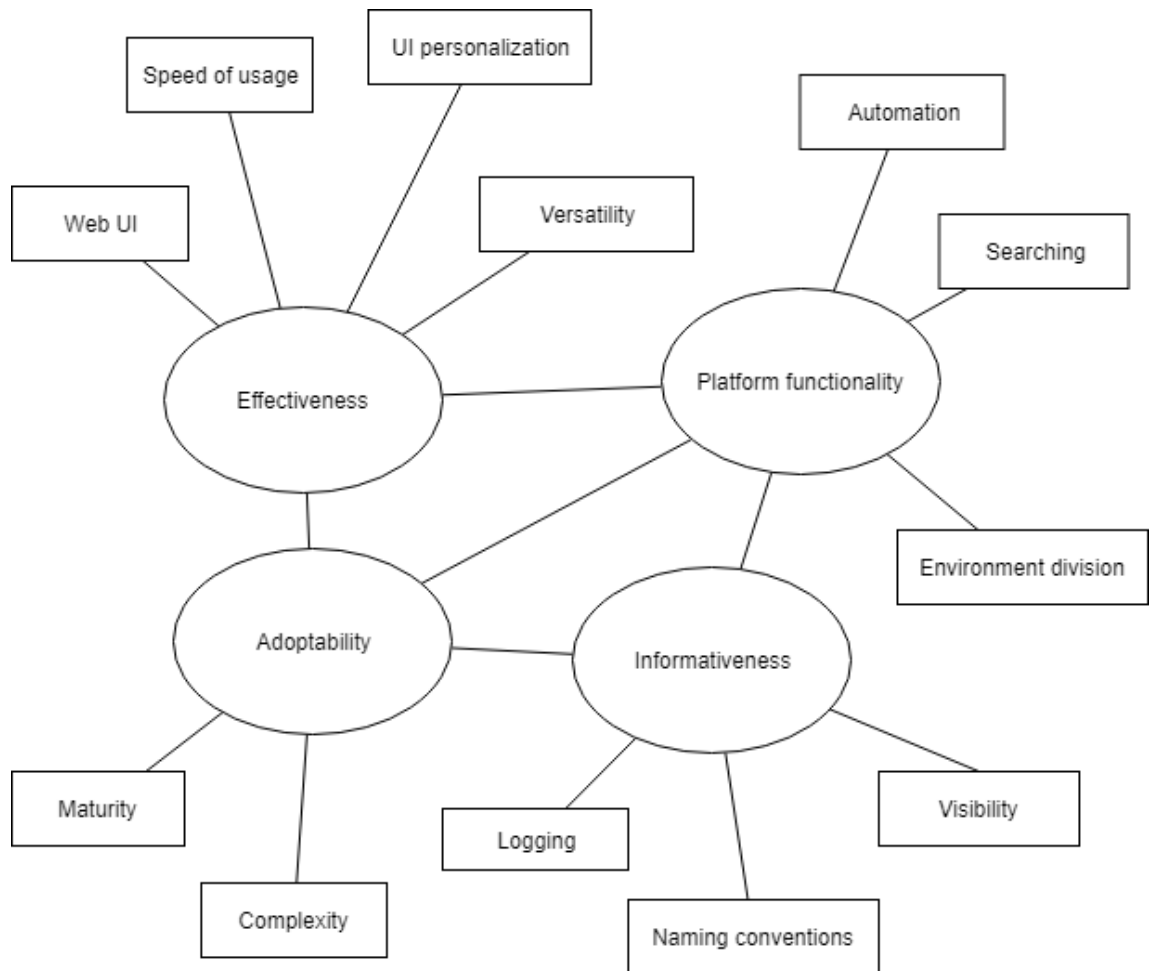


Figure 10. Initial thematic map for the aspect “opinions/expectations about the system”

After reviewing the initial thematic map, it requires unification of overlapping theme candidates. “Adoptability” as a main theme is something that appears as a result of the other main themes in the map. Its sub-theme “maturity” comes from how platform functionality evolves, as correspondingly complexity points more towards the effectiveness of the platform. Therefore, sub-theme “complexity” is added under “effectiveness” and “maturity” merged to “platform functionality” to form a new “platform maturity” main theme. Now

“effectiveness” theme includes sub-themes “complexity” and “versatility” that are all details of the platform. These three themes are joint together as main theme “platform adequacy”. As the remaining main theme, “informativeness”, and its sub-themes can be seen as part of the platform maturity, they are merged. Now sub-themes “logging” and “searching” are themes related to visibility, so they can be combined as well as “visibility tools”. One sub-theme, “UI personalization”, was also removed from the redefined map, because it was found too specific to be used as a theme, and the personalization functionality was moved to “general design solutions” part in section 6.1.3. The redefined thematic map for the third research question is illustrated in Figure 11.

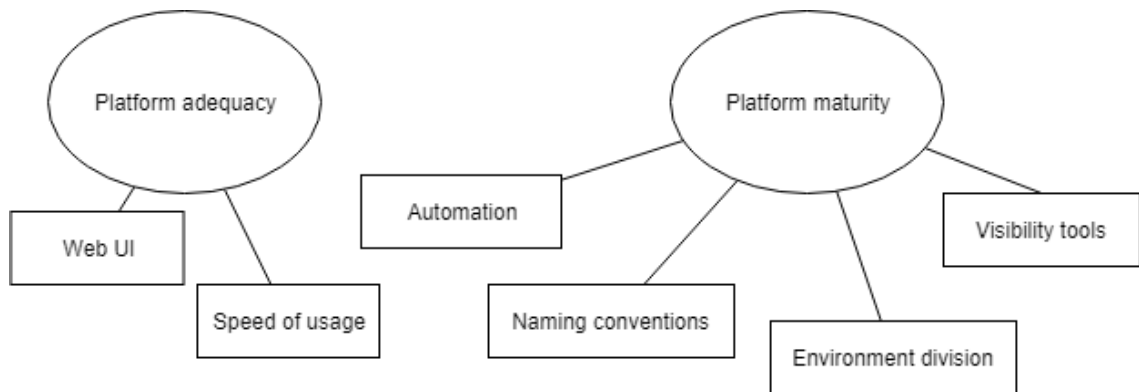


Figure 11. Redefined thematic map for the aspect “opinions/expectations about the system”

In the “platform adequacy” main theme, sub-theme “web UI” could have been fitted to its main theme, but as the web UI adequacy in contradiction with the old desktop application appeared in the questionnaire answers several times, theme was kept in thematic map. Web UI interface was described in the answers as: “less applicable for heavy work use than desktop applications, even though more fashionable”. Other quotes about expectations for the new platform included: “attaching different services to message handling chain gets easier” and “there is no more need for responding ‘it cannot be done’, while it is more about figuring out what is the best way of doing it”. Data extract for expectations of platform maturity included quotes about how future system would be: “more directed process, where design, testing, and deployment phases are clearer” and “technically more adaptive enabling modern solutions”, as well as having: “ability to make better or at least automated testing” and “possibilities to implement extensive integrations more adjustable with scripting – even lowering human errors”. Examples about sub-theme “naming conventions” are handled also in the “general design solutions”, as there were many instances of such found in the walkthrough session. Finally, descriptions for themes in redefined thematic map are given in Table 4.

Table 4. Definition of themes for the aspect “opinions/expectations about the system”

Themes	Description
Platform adequacy	Platform is used for creating versatile and effective solutions to even more complex integrations
Web UI	Web UI should offer the same functionality as with the old desktop application without any downgrades in usability
Speed of usage	Searching and browsing the integrations should respond to user actions in a pace that makes the UX convenient
Platform maturity	Platform includes required functionality in easily adaptable manner, and development aims at making the platform correspondent to the requirements of the end users
Automation	Testing the implementations and deployment to production is a steered process using script automation for decreasing any manual work
Naming conventions	Form headings, main menu items and such naming conventions are descriptive and helpful to end users
Environment division	Integrations are implemented in test environment separated from the production, and having deployment process between environments
Visibility tools	Searching and analyzing the issues can be done conveniently through the platform UI

6.1.2 Quantitative results from walkthrough

As a part of the group walkthrough, pre- and post-questionnaires were sent to participants of the walkthrough session. Answers to the open questions of the questionnaires has been used in the thematic analysis and more further reviewed in “general design solutions” section below, but the questionnaire also included rating scale questions that will be investigated here. Both questionnaires had three similar questions, from the point of view of the old integration platform in the pre-questionnaire and about the just tested upcoming integration platform in the post-questionnaire. The scale used on the questions was from one to ten, and answers were received from all participants. The results received is illustrated in Table 5.

Table 5. Average of collected results from pre- and post-questionnaire

Question	Old platform	New platform
How effective (fast and flawless to use) the system is?	6	6
How well does the platform support the work you do?	8,17	6,5
How pleasant is the platform?	7	6,5

On the group walkthrough session, the answers to the walkthrough tasks were also collected to the reporting sheets, from where the correctness of answers were evaluated and categorized into the Table 6 below. The categories selected for the answers are “correct”, “partially correct”, “alternate route”, “incorrect” and “discarded”. Correct and partially correct answers are considered to indicate that the task was understood and done according to the correct path of the walkthrough. Alternate route means the answer was not correct, but could be determined as alternate route in the workflow execution and should be considered as possible point for modification in the planned workflow. Incorrect answers are such that are not possible to be executed in the task context. Discarded results are deserted from the answer table for some reason that should be explained in detailed description of the task results.

Table 6. Collected answers from group walkthrough tasks

Question	Correct	Partially	Alternate	Incorrect	Discard
1. After the company has been added	4	-	-	1	1
2. Creating business identifiers	1	-	-	5	-
3. After business id is created	2	-	1	3	-
4. Document type creation	-	3	-	3	-
5. After business ids and doc type creation	1	1	2	2	-
6. Creating new pipeline	-	3	-	3	-
7. Adding a task to activity	5	-	-	1	-

8. Configuring task	-	-	-	-	6
9. After receiver pipeline has been created	5	-	-	1	-
10. Connecting pipelines	6	-	-	-	-

In the first question the respondent was supposed to answer what should be done after the company was added to the system. One answer was discarded from the results since it consisted a step that was shown in the slides describing the initial setup for the first task. The possibility of too fast pace of the presenter cannot be ruled out for this, so this answer was disqualified. In question 2 the creation of business identifier in the platform UI was tested. One reason for high amount of incorrect answers here was due to too generic title of one of the form fields: "Name". This was also pointed out in the discussions after the answers were written. In question 3 was asked what to do after business id was added. Here every incorrect answer was about selecting a path that was not suitable in the designed workflow. This can be interpreted as a defect point in the designed process for the new platform. One answer was also an alternate path for the used workflow: Task script creation was suggested in this phase, which would not have affected on the end results, and might be considered as place for modifying the workflow. In question 4 the document type was created. This question was having new kind of view for functionality on the new platform and contained maybe too much of form fields, so the result of no fully accepted answers might be explained with this. In question 5 the next step after document type creation was asked. This question started from similar situation as in question 3 but two of the answers were suggesting the same path as in the previous answer also. In addition, the task script creation was suggested two times as the alternate paths, which should be evaluated as a possible place for modification.

Question 6 started the pipeline creation. This question as well as question 4 were having new view for functionality and again included a lot of form fields, so because of this reason no fully correct answers were accepted. In question 7 task was added inside pipeline activity. This task included new functionality, but it was mainly well understood and executed as in designed workflow. In question 8 the added task was to be configured. The used task in the platform had a script that was mainly having pre-filled form fields, so the whole question was skipped in the walkthrough. In question 9 the last step after pipeline creation was asked. This task was similar to old way of working, and pretty much had only one choice left, so it was mainly well understood. Last task in question 10 was about connecting pipelines and as being self-explanatory and similar to workflow used with the old platform, it was fully correctly answered.

6.1.3 General design solutions and other observations

During the walkthrough and in questionnaires, general finding and observations were also inquired from participants. These findings are explored and finally listed in Table 7. Findings are handled in order of prevalence in the research data and evaluated impact on the adoption process. First issue that was commonly noticed during the group walkthrough session is naming conventions in the platform. In many cases heading in form views were considered vague or too general. One instance of such was in creating business identifier task, where headings “domain name” and “name” were confusing and hard to tell the difference. Heading “name” was referring to identifier number and “domain name” to business identifier type (ISO6523 in the task context) which should become clear from the heading name. As one comment summarized the problem: “more thoroughly thought headings would lead to better UI”. Another comment emphasized that “UI does not restrict the user so much when creating the integrations, so a lot of attention should be regarded to naming conventions in the beginning of the deployment process”.

Repeating observations about the functionality of the platform was e.g. about integration configuration, which was considered more time consuming in the new platform as with the existing one. At the same time some participants pointed out that this might be the situation only in the beginning of usage and that configuration also enables more features for the integration. Also, another troubling issue was seen at task script modification view, where source code of the task script can be updated through the UI. Though useful feature, a worry was raised due to fact that commenting was not mandatory with when updating the script. This enables changes to go through which cannot be tracked afterwards. Usually this work is done locally from end users computer using version control system, where user is forced to comment, but in the UI-view this step was passed. Still the updater name is logged which was found comforting.

Minor observations were related to usability features of the platform. For example, UI was judged for its way of using popup windows. As commented: “I don’t like UI that obfuscates the background of popup windows so, that text cannot be copied from under it anymore”. This feature was told to disturb working with the configurations, as some information to the popup windows was needed from the view under it. Another observation related to help pop-up icons in the system, which did not offer any information at all. Seems that they were still as placeholder, but would be crucial for having some instructions when going live with the platform. Also, main menu items were considered being in incorrect order from the point of view of the process. Possibility to arrange the order of component icons in the main menu was hoped functionality. Component icons were also seen somewhat uninformative, as some of the components were using the same icon. Lastly, one issue raised was universally unique identifiers (GUID) used in the platform.

They were seen as a downgrade from the old platform, where identifier is created as running number. As running numbers are usually not as long as GUID, they could be memorized for some cases, as many of the participants are doing with the current platform.

Table 7. *General findings from the integration platform in priority-order*

#	Finding	Type
1.	More descriptive headings in the UI form views	Usability of platform
2.	Integration configuration more time consuming than before	Functionality of platform
3.	No mandatory commenting logged when updating task scripts through the UI view	Functionality of platform
4.	UI with popup windows obfuscating its surroundings, and thus disabling copying text from the background	Usability of UI
5.	Information popup icons are placeholders – not including any information	Usability of UI
6.	Main menu components are in non-applicable order from point of view of the process	Usability of UI
7.	Some main menu component icons are uninformative (e.g. usage of the same icon with different components)	Usability of UI
8.	GUIDs in the platform cannot be memorized in contradiction with the running numbers in the old system	Usability of platform

Few positive findings were also listed. Navigation links in the platform were already addressed as user expectations in the thematic analysis, and at least in the task script view there was many ways to navigate to components using the searched script. Another nice feature was form fields that were seeking content dynamically from the full length of the component name – not just from the beginning of the name.

Generally, expectations of the upcoming platform were realistically cautious, since it is known that the ways of working will be changing. One comment summarized the workflow change as: “tools of the new platform are very different compared to old platform, so I assume that the workflow is more complex in the new platform – at least in the beginning of the deployment”. One example of change in ways of working was addressed

in the user rights management: “the ‘deny all, and allow only when needed’ principle will be shaking the customs in the office”. The maturity difference between new and old platforms was realized in comment: “current platform is a product of a years of development, so I am not assuming that the new platform functionality is on the same level right in the beginning”. Still one concern is the hurry, in which the platform is deployed: “I wonder is there enough time to learn the new way of doing things, as there are customer schedule requirements in the background”. But there were also comments, that indicated that the platform update was having its upsides, e.g.: “it is different, but the sense behind the solutions can be seen”.

6.2 Reengineering the work process

Redesign of the business process starts from where the diagnosing phase ended in section 5.1 The redesign task is appointed to reengineering team according to BPR theory, but it is now conducted as the empirical part of this research. Aim of the BPR is to find more ways to execute the process flow with time and cost efficiently, improve productivity by focusing on integration of fragmented work tasks and executing them in concurrent way. Fragmented work tasks and concurrencies were explored in group walkthrough task answers listing in Table 6. Based on those findings, a workflow for the new integration platform was designed in Figure 12.

If the redesigned workflow is compared to the original workflow presented in Figure 5, some changes can be seen. Starting from the creation of companies: in the new platform the process is slightly different as the companies should be imported to the platform after creation. After this, as it was found in the results from the group walkthrough task answers, there were two alternative paths found referring to the task script creation. As they both were suggested after creation of routing parameters, these two tasks are marked as concurrent tasks in the flowchart. The next task, after the concurrent tasks are executed, is simply “create missing pipelines” as the inbound and outbound directions are not separated same way as in the original workflow. After pipelines exist, created routing parameters and task scripts are added to the pipelines. One task that is missing here, compared to the original workflow, is creating and adding maps. Adding maps to the configuration in the new platform context is done in the task configuration phase, following the routing parameters and task script adding. Adding maps was not tested as a part of the group walkthrough, and therefore is missing. Map creation, on the other hand, is a separate task with another tool, so leaving that out of the workflow can be justified. Rest of the workflow, mainly about connecting pipelines, is similar to the original workflow, with the one addition that connection does not need activating in the new platform.

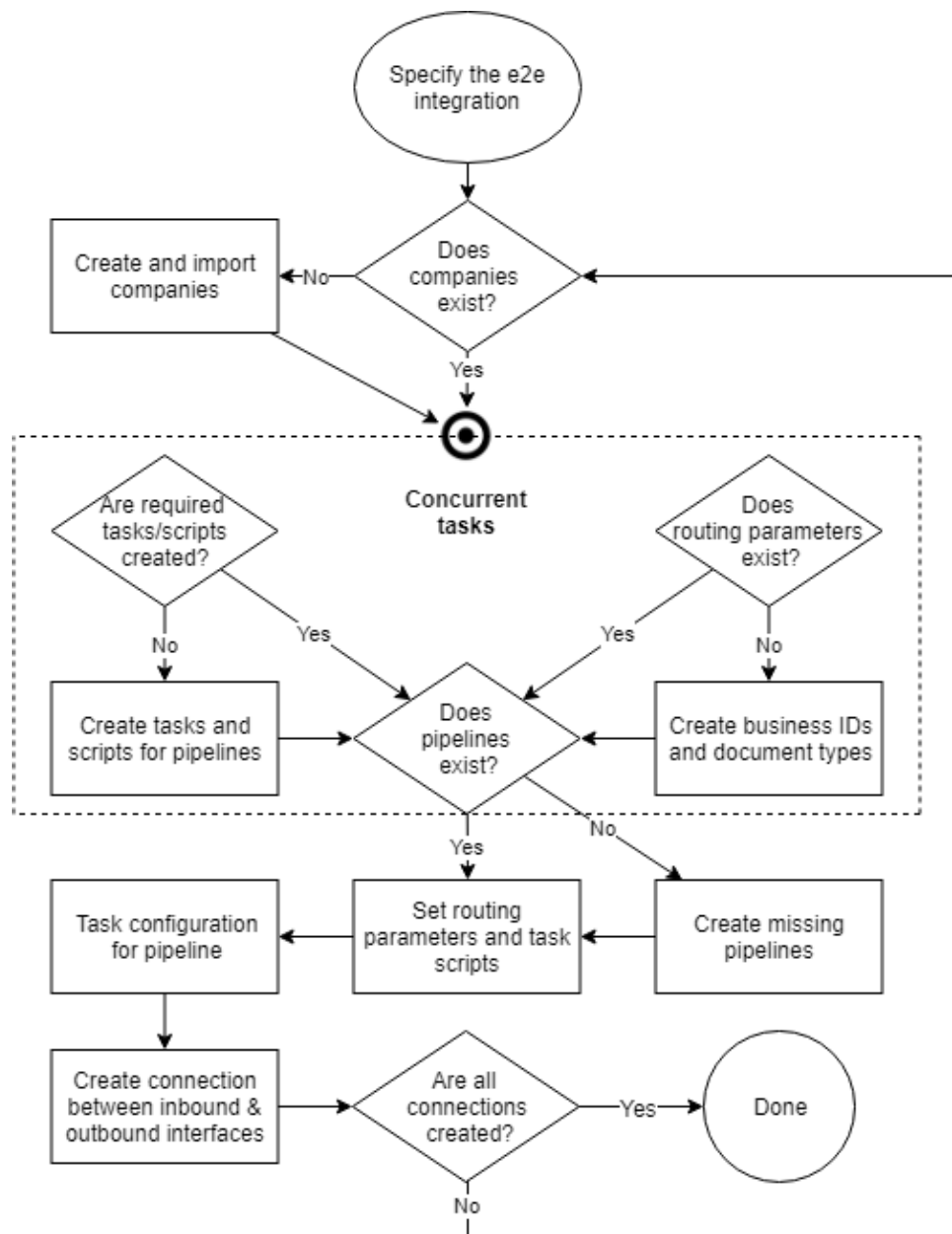


Figure 12 Flowchart of the redesigned workflow for the new integration platform

7. CONCLUSION

This chapter describes the conclusions and summary based on the gathered research results presented in chapter 6. Content of this chapter consists of the following parts: sections 7.1, 7.2 and 7.3 are evaluating the results for three research question defined in the beginning of this thesis. Section 7.4 entails details that could be further reviewed as a future work. Section 7.5 includes self-assessment on the execution of walkthrough and other UCD methods as well as feedback received from participants of the walkthrough.

7.1 How did UCD methods fit in the research?

The first research question for this thesis is about clarifying how the principles and process of UCD can be applied in adopting new software in an organisation. The UCD method used in this thesis, group walkthrough, is based on PW method that aims at gathering data from the actual end users. This data consists of their insights of the planned workflow for the software as well as design ideas on how the UI of the system could be improved. The group walkthrough is fairly easy to be arranged in an organisation, since it is done as group session that occupies all resources at once. As a comparison, having user testing with one person at a time, while the data would probably be more detailed, it would require facilitator to participate in every test session held. On the other hand, finding an appropriate time for the meeting where whole walkthrough group could attend to can be difficult. While UCD principles define that testing should be done iteratively, some results about the status of the system can be achieved by arranging a single walkthrough. Having the iterative process would be optimal, but would also engage resources for even longer period and thus is, again, more difficult to arrange.

As the two main criteria for persons attitude towards technology acceptance are PU and PEOU, a good way of affecting these criteria is to have the business process carefully defined, thus easily adaptable. In the scope of the business process workflow improvement, most important goal of the used UCD method was to gather meaningful data for improving the workflow of business process of the new integration platform. The test data is received from the answers given to the walkthrough tasks, general notes from the group walkthrough session, and pre- and post-questionnaire answers. What was noticed as a result of the group walkthrough, is that a lot of opinions, expectations and improvement ideas were gathered with a fairly small group of people. But the questions and tasks defined for the group walkthrough, and the way the results from it are evaluated determines the usefulness of the data. The proper task scripts for creating an example test case of e2e integration was missing and therefore e.g. one configuration related task was forced to be

skipped in the group walkthrough session. Also, mapping – which is one of the core functionality of the existing platform – was left out from the walkthrough tasks for this. Group walkthrough would be ideal for testing action points that are found to be problematic in the existing workflow, but due to low level of usage of the platform, such action points did not exist yet. This is one of the things that could be achieved with iterative user testing as one of the UCD principles suggests.

Other way of receiving data for workflow improvement is thematic analysis that was utilized for the data collected in the walkthrough. If we compare the resulting themes in the Table 2 to the redesigned workflow in Figure 12, the workflow mainly illustrates the “implementation” part of the themes. “Continuous monitoring” is something that has not been fitted into the investigated workflow. But by having the thematic analysis, we can find these hidden needs in addition to the walkthrough process and the answers received from the participants in it.

Majority of work that is required for having group walkthrough or analyzing the received data is done by the facilitator of the test session. This way the resources required from the company are moderate and to some extent a matter that company can also decide. This makes involving the UCD approach into the software adoption process much more acceptable from the company point of view. No specific restrictions were found that would make the UCD methods non-applicable with the technology adoption, but the problem is to define how profound the UCD process should be for having one. The standpoint can vary a lot based on which stakeholder is asked. And as already defined in this section, room for improvement has already been found in the walkthrough process defined in this research scope.

7.2 How was the business process improved?

The second research question for this thesis is about finding out what changes can be done to company’s business process so that the new software would be utilized in an optimal way. In the BPR method, the redesign process is handled by integrating fragmented work tasks and finding ways to execute them in concurrent way. This was implemented in the redesigned workflow in Figure 12, by evaluating answers received from the walkthrough tasks in Table 6. Some tasks were unified in comparison to the original workflow flowchart in Figure 5, basically because the changes in concepts used between the two integration platforms or changed ordering of some tasks. Such tasks were “create missing pipelines” as the inbound and outbound pipelines were not separated anymore in the new platform, and unifying the business identifier and document type creation into one task, since these steps are subsequent in the new platform workflow.

The major difference between the old and new business process is in the concurrent tasks included in the redefined workflow. Task script creation and routing parameter creation were found being concurrent steps in the process, because those steps were suggested as alternative path in the group walkthrough task answers in two instances. One thing that is not evaluated related to these tasks is the duration of execution and how well does the tasks align in timeline based on that duration. Based on my own observations, the routing parameter creation would be faster task, and the difference between execution times grows linearly with the complexity of the task script. Also, the pipeline creation step might be seen as concurrent task with the other two mentioned before, but this would require further definition as well. Regardless of these uncertainties, the possibility for doing the tasks concurrently was wanted to emphasize in the redefined workflow, as exploring the tasks from the concurrency point of view could be helpful with redefining the work distribution related to the workflow.

In addition to analyzing the workflow task answers, a thematic analysis was done to reveal the critical parts that have affect on the technology adoption process. Themes defined in the analysis using the aspect of “issues/enablers in the process” are described in Table 3. Based on the listed themes, only the “platform configuration” theme is covered in the redesigned workflow in Figure 12, but without the theme about “test/production interaction”. This and a task for testing the implementation could be included into the redesigned workflow to involve the test/production interaction into the workflow. Other listed main themes indicate that more workflows should be illustrated in addition to the one redesigned in this thesis, as it covers only one point of use of platform usage. Some issue solving related workflow would be appropriate of the “message visibility” theme, as it would describe how visibility tools of the systems are utilized. This would also require the platform to be mature enough for doing such integration that could be issue-tested later. Themes “UI navigation” and “speed of the platform” should also include some UX testing to verify the functionality of the platform being convenient to use. These tasks are to be evaluated as future work.

7.3 Evaluating the successfulness of the adoption process

The third research question for this thesis is about evaluating how can the successfulness of the software adoption process be measured. Since the aim was to find a short-term answer for estimating what are the attributes of a successful software adoption, thematic analysis was used with the aspect: “opinions/expectations about the system”. This approach aims at revealing themes that represent the end user perceptions of the acceptable system. Resulted themes are described in Table 4. Two main themes raised in the analysis are “platform adequacy” and “platform maturity”.

Theme “platform adequacy” refers to platform functionality being versatile enough for creating increasingly complex integrations. As a part of this, sub-themes “web UI” and “speed of usage” represent the non-integration related functionality that was raised from the qualitative data from the group walkthrough. These themes are similar to PU determinant of TAM, which supports the idea of “platform adequacy” being an attribute of successful technology adoption. Theme “platform maturity” refers to functionality being easy to adapt with. Sub-themes “automation”, “naming conventions”, “environment division” and “visibility tools” are specifically raised from the qualitative data as themes that are making the platform usage easier for the end user. Correspondingly, these themes have similarity with PEOU determinant of TAM. The validity and coverage of these attributes would require more investigation, but in the scope of this thesis, attributes in Table 4 can be proposed as initial attributes for measuring the successful adoption process from the technology adoption point of view.

Results gathered into Table 5 are from the pre- and post-questionnaire concerning how end users perceive usage of the new and the old platform. As both questionnaires had similar questions and they were answered in short time period by the same persons, the results are aiming at being coherent from the evaluation point of view. The results indicate a slight decrease of average grades for the new platform tested in the walkthrough, except for the case of “how effective the system is” (effectiveness) where both platforms have a same average grade. The decrease of grades for questions “how well does the platform support the work you do” (platform support) and “how pleasant is the platform” (pleasantness) is expected with the comments received from the end users during the walkthrough as the expectations are that a lot is changing in the process. From the themes point of view and their correlation with the TAM, effectiveness is part of the “platform adequacy” and PU, and platform support is part of “platform maturity” and PEOU. Pleasantness is not as easy to divide between the two themes and can be evaluated here as being partially related to both PU and PEOU. With this division, the maturity of the platform would require more attention in platform development as it is the theme affected by the decreased grades. Platform adequacy is the more prepared theme for its non-changed grade with the effectiveness.

7.4 Future work

Theory about technology adoption was utilized in evaluating the successfulness of the adoption process. One idea that raised while going through different models related to technology adoption was that some more educated method for predicting and explaining user acceptance or rejection of a computer-based technology might be useful for the cause. Now the evaluation was left a bit vague and conclusion created only for the solution in scope of this research. More generic solution could have shown more interesting and valid results.

Other future tasks found during the research relate to improving UCD utilization for the case company's business process. As described in the UCD theory, iteration is a centric part of the UCD process and having the group walkthrough more than just this one time would be helpful in e.g. revealing problem points in the design and measuring the maturity of the platform. Some room for improvement was found in the workflow definition process as well. As concurrent tasks were already added to redesigned workflow, the pipeline creation step might be seen as concurrent task as well. Also, other platform usage related processes could be illustrated as a separate workflow, as suggested in this chapter. Some issue solving related workflow would be appropriate for evaluating the message-, routing- and log visibility as well as navigation in UI. Also, some UX testing would cover more aspects of how the user is perceiving the platform usage, e.g. speed of the platform.

7.5 Self-assessment and feedback

Some problems were ran into when having the group walkthrough session. One answer to a task was had to be discarded, since the answer included parts that were covered in the preparatory phase of the walkthrough. Too fast pace when going through the preparatory information could not be ruled out, so the answer was discarded. Similarly, one question in the walkthrough was fully skipped, since the example form showed in the task was already pre-filled by the system, and did not leave anything to be figured out to the participants. This was also related to the platform maturity, since a decent example could not be found for the walkthrough session. Still, these problems emphasize the meaning of proper preparations to the test session. In the research process executed in this thesis, my personal knowledge about the tested integration platform seemed to be a blocker for achieving the full potential of the group walkthrough. Though the conversations and questionnaire answers from the end users were extremely important and revealed a lot of information, the walkthrough tasks were found a bit vague as the functionality of the new platform was not fully realized.

The post-questionnaire for the walkthrough participants included also questions about how the walkthrough session itself succeeded. Written observations about the walkthrough included comments about the how the session was arranged. The atmosphere in the walkthrough was commented as "and sincere and session was logically walked through". From the schedule point of view time was "occasionally running out when had to think what should be written in each field of the task". Also, "assignment was a bit unclear about what has been created before and what was supposed to do next". One answer commented the walkthrough as "good first experience about the new platform". Besides the open question, walkthrough was also graded from one to ten. First question was about walkthrough usefulness and average of the answers was 7.83 with the lowest score being 4 and the highest 10. Second question was about how did the walkthrough manage to offer a comprehensive coverage of the platform and its functionality. Average

of the answers was 7.33 with the lowest score being 2 and the highest 10. Based on these answers, the walkthrough at least seems to have been useful in some level to the participants.

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