UNCOVERING THE WORK PROCESSES OF TECHNICAL DOCUMENTATION AND DEFINING REQUIREMENTS FOR A CCMS – A CASE STUDY

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Abstrakti – Abstract

Teknistä dokumentointia toteutetaan erilaisilla työkaluilla. Tuotetietoja tuotetaan ja välitetään asiakkaille ohjelmilla, jotka ovat kehittyneet vastaamaan alan ammattilaisten tarpeita. Perinteisten lineaaristen dokumentointijärjestelmien ominaisuudet, kuten sisällön päivittämisen haasteet ja tiedon hallinnan haasteet, rajoittavat alalla työskentelevien henkilöiden työnkuvaa. Rakenteisen dokumentoinnin järjestelmät voivat tarjota ratkaisuja esimerkiksi päivitettävyyteen, tekstisisällön uudelleenkäyttöön, tiedon julkaisemiseen sekä tiedon hallintaan. Tämä vaihdos vaatii kuitenkin osallistujiltaan tarkkaa suunnittelua sekä uuden oppimista.

Tämän maisterintutkielman tarkoituksena on kehittää vaatimusmäärittely rakenteisen dokumentoinnin sisällönhallintajärjestelmälle erään suomalaisen yrityksen kontekstissa. Tavoitteena on kartoittaa yrityksen nykyinen dokumentointiprosessi lineaarisella menetelmällä ja sen haasteet. Tutkielman aineisto kerättiin tutkimushaastatteluilla siten, että jokaista dokumentointitiimin jäsentä kuultiin. Keräämällä tietoa käyttäjien tarpeista, odotuksista sekä dokumentointiprosessin vaiheista saatiin luotua raamit sisällönhallinnan parantamiselle rakenteisen dokumentaation avulla.

Yrityksen tarpeet sekä toiminnalliset vaatimukset sisällönhallintajärjestelmälle luotiin yhteistyössä siten, että yrityksen dokumentointitiimi osallistettiin osaksi tutkimusta. Aineistoa analysoitiin temaattisen analyysin kuusivaiheisella menetelmällä (Braun & Clarke, 2022), jonka avulla tutkimustavoitteisiin jäsenneltiin vastauksia. Aineiston keräämisen ja analyysin aikana haastateltavat osallistettiin tutkimukseen, jotta lopputulos vastaisi juuri tämän organisaation tarpeita. Tutkimustavoitteisiin pääsy vaati aktiivista osallistumista koko prosessin ajan kaikilta osapuolilta. Tutkimuksen lopputuloksena syntyi vaatimusmäärittely, joka toimii perustana järjestelmän valitsemiselle.

Tutkimuksessani tarjotaan näkökulman siihen, minkälaisia vaatimuksia organisaatiolla voi olla rakenteiselle sisällönhallintajärjestelmälle ja minkälaiselta pohjalta projektiin lähdetään. Vaikka aihe on alallaan merkittävä, empiiristä tutkimusta vastaavanlaisesta projektista on äärimmäisen vähän. Tämän vuoksi tutkimus pyrkii luomaan yhteyden teorian ja käytännön välille tarkastelemalla teoreettisia käsitteitä ja malleja käytännön kontekstissa, rikastuttaen käsitystä aiheesta.

Avainsanat Tekninen viestintä, vaatimusmäärittely, applied linguistics, temaattinen analyysi, the Information Process Maturity Model, Participatory design, lineaarinen dokumentointi, rakenteinen dokumentointi, sisällönhallinta
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1. Introduction

The field of technical communication in Finnish work environments is somewhat obscure, even though research has been made to enhance its visibility (Kormu, 2020; Lappalainen, 2014; Suojanen, 2018; Suomivuori et al., n.d.; Virtaluoto, 2013, 2015). Professionals who author information for example about their products are practitioners of technical communication, even if it is not recognized as such. These technical writers author, review, update, publish and monitor all kinds of documents, sometimes without proper resources or tools. When documentation processes within an organization prove inadequate, it is important to recognize the situation and assess the tools and policies enacted. Before improving the work processes in an organization, its members need to become critically aware of them, which is at the core of this research.

Traditional linear documentation has long been the standard in many organizations when it comes to disseminating technical information. It is however constrained by its sequential flow, meaning that the information is presented in a linear order from start to finish. The authors of linear documentation organize content hierarchically, with higher level sections containing lower level subsections. Focus is put on the documents as a whole, in contrast to structured documentation where information is structured and/or modular. The shift from linear to structured documentation represents a shift in the way how organizations deliver information effectively in actual work environments. This study will discuss a certain organization's requirements for a digital system that enables structured documentation, providing an overview of the actual requirements a company might have for such a software.

In structured documentation, content is organized into reusable components or modules with a specific topic. These components are then assembled based on the content itself, with the possibility of being interconnected and reused across different contexts. Structured documents are compilations of these unique source modules. This effectively simplifies updating them and guarantees consistency (Hackos, 2007). Structured documentation typically adheres to a standardized format, which facilitates consistency by separating content and design from one another.

The documentation team in this company has recognized the need to update their recent processes of technical documentation. Both authoring and managing content should be more efficient. The company writers have been using Microsoft Word, in other words linear documentation, when handling content within their organization. This means that they have not been able to update their content simultaneously for example, making it more time consuming.

The company managers have recognized that the situation must evolve; they are looking for a component content management system (CCMS) based on their organizational needs. The goal is to create coherent documents in the future that are coherent both in their design and content with the help of existing data.

This research is conducted as a commission in collaboration with a Finnish company that manufactures medical devices. The company works internationally. Within the company, product development is responsible for the authoring and updating of the standardized product technical documentation. In accordance with the non-disclosure agreement between the researcher and the company, no trade secrets, product development information, specific project details or other confidential details concerning the company or its strategies are published. These topics might relate to the research goals however and are processed in the data analysis section without publication. The company or the staff members are completely anonymized and therefore unrecognizable.

The purpose of this study is to present and discuss a requirement specification document based on information gathered from the technical writers and policy makers within the organization by conducting interviews and monitoring the workplace practices. The whole process of creating the requirement specification involved active engagement between the researcher and the participants, in accordance with the methodology of participatory design (Spinuzzi, 2005). The company will be provided with a realistic overview of their current areas of development concerning their technical documentation processes, which they use to determine whether any software would fit their needs. This research does not directly take part in the decision making process itself, but will provide the organization and the people working in it insight on structured documentation which will most likely affect the decision making process nevertheless.

This study draws on existing theories of content management in technical communication and information development and reflect them on the practices in the company, trying to form a connection between theory and practice. I argue that people working in professional and technical communication need to be aware of the capabilities these composition software have; creating content and managing information can take numerous forms. Research shows that instructors in technical communication need to expose their students to the range of composition software required to effectively create and disseminate content (Blythe et al., 2014, p. 2). The same undoubtedly applies to the people working as technical writers. The example that Spinozzi (2002) mentions summarizes the situation well. They state that if one is to design a photo-text book, one has to take photos and write the necessary texts. Similarly, if

one is to change from linear to structured documentation, certain requirements are brought to life.

The purpose of this research is to determine whether changing from linear to structured documentation would solve the areas of development concerning the needs of the organization. The actual acquisition of a software that enables structured authoring or its deployment, as interesting as they are, are excluded from this research. However, topics that have to be taken into account concerning the deployment of such a software are addressed and discussed in the study. At the end of this research, the requirements this company has for a content management system are discussed in more detail but also in reference to existing research and theories.

Technical documentation projects such as this have not yet been widely studied, especially in the Finnish context. Because the case study is conducted completely on the organization's terms and conditions, the conclusions drawn are also from the point of view of this company. However, the requirement specification document contributes to the wider discussion around the topic; which features in component content management systems are relevant to organizations like this. The results of this study will provide useful information concerning the matter and shed light on the issues concerning technical documentation and the processes that arise when organizations plan to change from linear to structured documentation .

2. Background information

This chapter provides important background information about linear and structured documentation, content management and information-development management. Important definitions and theories concerning the topics presented in the study are introduced and discussed.

2.1. Linear and structured documentation

Information within organizations can be authored, communicated and published through technical documents such as emails, wikis and user guides. All of the processes of communication are taken into consideration when scholars talk about technical communication (TC). Listening, speaking, reading and writing are all vital parts of TC; the processes or activities that people do to "discover, shape and transmit information" (Markel & Selber, 2018, pp. 2–16). Markel and Selber also mention that in TC there is a clear purpose and an audience. Documents distribute information in different and efficient ways to meet the needs of a specific audience.

When a document, an information product, consists of only one source file, documentation can be called linear. According to The Helsinki Term Bank For The Arts And Sciences, usually in linear documentation there is only one author for one document (Viestintä:Lineaarinen Dokumentointi – Tieteen Termipankki, n.d.). Documents are perceived and monitored as document-centric entireties. For example, in the case company one user guide equals one document, so the technical writers place emphasis on one user guide at a time. Moreover, because linear documentation has a certain linear hierarchy, an end and a beginning, reuse of the content is not possible. Pieces of text can be copied and then pasted across documents, but doing that manually is time consuming and involves risks. Linear documentation is constrained by its hierarchy, meaning that content is organized hierarchically with chapters, sections and subsections. This framework for presenting information can provide technical writers with clarity and coherence with their documents, but it offers little flexibility. Tools that enable linear documentation (such as Microsoft Word) also offer little to no options when it comes to efficient content organization, collaborative writing, publishing of documents or translation.

In the case company, the technical documentation team has managed technical writing with Microsoft Word in a linear manner. They have acknowledged some of its weaknesses as the

amount of content has increased: for example updating the existing content requires a lot of time, because each individual document has to be opened and updated manually. The copy-paste method for reuse of content has led to duplication of inaccurate or outdated information, because there is no proper revision history. There has also been challenges with the layout of the content, because customizing the appearance of the documents takes massive amounts of time. The company authorities had enough prior knowledge to be able to address the complications within their organization and discuss possible solutions. They knew that some component content management systems might provide them with answers to their needs. However, the actual process of changing from linear to structured documentation requires resources and a thorough strategy, which is at the core of this research. A shift from "only writing" to content management also requires a reconceptualization of the practices enacted within the organization.

Boiko (2005, p. 129) summarizes that when the amount of content within an organization exceeds the limits of "too much", people begin to seek for a system that would help. Furthermore, they state that once too many items or too many types of items exist, one should start the process of mapping the capabilities of a CCMS. In the case company the amount of items can be briefly summarized with the expression "too much", at least in the context of trying to manage it in a linear manner, which is why they wanted to initiate this commission. There is also a high rate of change in the content within the organization, which means that the documents need to be updated regularly. In order to improve their content management, the company management sought help to gain more insight on the existing content management tools and how they could harness them as a part of their documentation processes.

To support an organization's information structure, Clark (2007) advocates XML (eXtensible Markup Language), a customizable markup language. According to the World Wide Web Consortium, an international community that works for the long-term growth of the Web, this language (XML) is a flexible text format designed for large-scale electronic publishing (Extensible Markup Language (XML), n.d.). It is also stated that it is the most common used cross-platform way of portraying information. Clark mentions that with it, separation of form and content can be achieved. The technological separation of the two enables the creation of unified content; a single piece of information, a module, that has been properly marked can appear and be updated in multiple publications simultaneously. This is also called single-sourcing, meaning that whenever the exact module is referred to the information in it remains the same. Form, meaning designs, fonts, colors and layout are predetermined so that changes in aesthetics can be applied to all or some of the documents (Pullman & Gu, 2020).

Documentation done in this manner is called structured documentation, usually also modular documentation. Structured authoring is therefore "writing that follows the enforcement or organizational structure of content components" (Van Laan & Hackos, 2012, p. 143). The XML-based software that enable structured documentation are called component content management systems (CCMS).

Structured documentation and component content management systems divide text into components. As Clark (Clark, 2007, p. 36) states, by marking and storing a piece of content one saves time and allows reusability and repurposing for the mentioned content. According to Andersen, the publishing-oriented XML-based component content management solutions (also referred to as content management solutions) concentrate on component levels in managing the content, supporting authoring and reviewing on each independent component (Andersen, 2007, p. 64). This makes the job rotation easy to approach and will allow organizations to review content before publishing it with less effort. However, these content management solutions, software themselves, do not alone mean that documentation is successful: content creation, curation and management are a part of technical writing as well as an understanding of the information and workflow (Pullman & Gu, 2020, p. 20). No software is designed to automatically turn a document from linear to a structured version; organizing the content and managing the information architecture (where information exists, where is it published etc.) play a crucial role in content management.

Some studies have been conducted on enterprise content management systems and the affordances and possibilities of separating presentation and content from one another (Clark, 2007; Lappalainen, 2014). There has also been some research on the connection between globalization and content management. Technical communicators have experienced challenges in the global context; for example deciding whether to translate content and managing the linguistic idiosyncrasies of particular languages (Batova & Clark, 2015, pp. 221–222). Batova and Clark draw on best practices, academic works, non-peer-reviewed discourse of technical communication and translation communities in addition to their own experiences to draw conclusions about the issues of globalized content management. They also state that they have not found any research that examines the effectiveness of CM for multilingual information products or evaluate the potential complexities that are involved with it. As they summarize, "future studies could develop best practices that work across technical communication and translation-localization" (Batova & Clark, 2015, p. 231). My study focuses on the content management systems' effectiveness for multilingual information products and processes within a specific company, while simultaneously taking their technical documentation needs into

consideration, forming a bridge between academics and technical communication practitioners. Even though the deployment of a CCMS software in an organization has been studied (Ebbers et al., 2022; Kormu, 2020; Lappalainen, 2014), the overall process of changing from linear to structured documentation has not been researched in the Finnish context .

2.2. Content management

As Pullman & Gu (2020, p. 29) state, "if you conduct a survey on the CM (content management) processes of 100 organizations, you are likely to get 120 different processes". Both content creators and researchers have identified different processes when it comes to content management, but Pullman & Gu theorize that planning is at the core of CM. Clark (2007, pp. 38-39) has reviewed literature to define the term content management; it can be defined as a process of improving and organizing the management of an organization's content. The role of content management within an organization might vary based on the perspective. According to Boiko (2005, pp. 65–66) the important perspectives include business goals, analysis, professional, process and technical perspective. They summarize that content management can distribute business value, balance organizational forces, combine content-related disciplines and, for example, collect, manage and publish information depending on the point of view. Content management and the devices used to enact it are also connected to organizational globalization efforts, mostly because translations play a great role when it comes to the reasons why companies want to implement such a device (Batova & Clark, 2015, p. 222). In this case, the company authorities had already acknowledged the need for improving and organizing content within their organization, which made the process of specifying their needs easier.

However, content management (CM) is not about using a certain software for technical writing or only authoring text; research shows that CM should consider content as dynamic and context responsive (Pullman & Gu, 2020) and that the focus is on how the information has been organized. According to Pullman and Gu, creating content for an information ecosystem and keeping the information updated is a much more appropriate definition for CM, especially considering that when form and content are separated from each other in structured documentation writers may actually focus on the content itself. This is the approach this research draws on when discussing CM. Reuse and repurposing of content is enabled when a single piece of content, properly marked, can appear simultaneously in different user manuals

and other documents. Layout is predetermined in a sense; separately created stylesheets act as "recipes" for the content that is published. It can be concluded that a CCMS environment that is modular and structured requires vast knowledge of the tools that enable it (Swarts, 2020, pp. 155–156), which might be a challenge for an organization.

In their study, Batova and Andersen (2017, p. 175) sought to "gain a comprehensive picture of the roles and skills of technical communicators necessary for supporting technical communication (TC) work in component content management (CCM) environments and the implications of these roles and skills for TC education". They argue that structured writing, database search functionalities and for example reusability along with other features have dramatically changed how technical writers author and review their content and how it is managed afterwards, based on their systematic literature review of changes in roles and skills in Component Content Management Environments. I believe that these skills and roles should be considered in the process of implementing a CCMS rather than afterwards; the software chosen should be appropriate to the actual needs of the organization, aligning with its content management. The data collection section of this study will further discuss how this was done during this research.

When referring to content in this paper, the definition provided by Pullman & Gu (2020, pp. 23–24) is used: "we define content as data that has been edited to accommodate specific user needs". They theorize that in their conceptualization data means raw information that has not been processed for a specific purpose. Content is however created, something that has a purpose for consumption. For the purposes of this research, the potential differences between content, data, information and for example knowledge are irrelevant. It is only important to conclude that content is created in contrast to raw data and it is also used differently. Clark points out that because such a vast amount of content is produced electronically, the use, storage and retrieval of content electronically needs to be considered. When discussing the technologies used to manage and deliver content across a whole organization instead of publishing-oriented solutions for technical communicators, some researchers like to talk about enterprise content management (ECM) (Andersen, 2007, pp. 61–64; Pullman & Gu, 2020, pp. 24–25). In this study, all content management is seen as equal and therefore referred to as content management (CM); describing the processes enacted to create, present, deliver and storage content. Content management system (a CMS) is a software or a system built to manage content systematically. In this research, the CMS solutions are all digital and XML based, as they usually are.

2.3. Information-development management

Authoring, storing, updating, publishing and managing content require best practices, careful planning and management. Technical communication practitioners can be called information developers; they produce content for their organization. Scholars tend to focus on how these organizations should be managed; as Hackos puts it, information-development managers have to be adept at strategic management and for example being able to prioritize resources to each project (Hackos, 2007, p. 6). They also mention that the staff should be directed to development of effective information with a minimalist agenda, providing only the amount of content that users need. Pursuing reusable content and content management are seen as vital features of efficient performance when it comes to information development (Hackos, 2007). From the organizations' point of view, reusable content usually tends to cost less. When information is concise, brief but comprehensive, for example translation expenses are massively lower. In a structured CCMS environment "content can potentially be pulled into a number of publications that might use the same information in a document with a different overall structure" (Swarts, 2020, p. 158), meaning that the piece of information has to be translated only once.

As Hackos has acknowledged in their book, the staff involved in information-development are responsible for securing that their customers are successful. The organization is in fact the owner of that information and therefore the only authority capable of making decisions about the content, format and style of the documents themselves (Hackos, 2007). In the fields of technical writing and documentation questions of understandability and clarity are vital, because for example user guides and manuals aim to be as informative as possible: technical writers put effort into creating documentation that is efficient (Strimling, 2019). Hackos has acknowledged that with individual companies a significant amount of time spent by information developers is used on formatting text (Hackos, 2007, p. 19). Because of the nature of structured documentation and XML-based CCMS software, content and layout have been completely separated from each other, which liberates technical writers of formatting completely. This could potentially give them more time concentrating on the content itself.

3. Theoretical framework(s)

This chapter discusses the theoretical framework of this research. First, the theory of Thematic Analysis is introduced. Second, The information Process Maturity Model, which was used to gain insight of the current work processes within the organization, is discussed. Lastly, elements of Participatory Design that are relevant to this research are addressed.

3.1. Thematic analysis

In thematic analysis (TA), language is seen as creating reality, instead of the complex theoretical perspectives used in for example discourse analysis (Braun & Clarke, 2012, p. 58). However, scholars perceive "thematizing means" as one of the few shared skills across qualitative research (Holloway, 2003); researchers producing knowledge from qualitative data share similar strategies. Thematic analysis focuses on the analysis process itself, in contrast to numerous qualitative approaches, which draw on assumptions, design and data acquisition (Yanto, 2023). In contrast to many other qualitative methods, thematic analysis (TA) "is not tied to a specific epistemological or theoretical standpoint" (Yanto, 2023, pp. 3121–3122). This makes it more accessible especially when it comes to a participatory design research project. This means that the research results are iteratively constructed and co-interpreted by the researcher and the participants themselves. TA is a flexible way of working, tailored to the exact needs of a specific project, which is why it also includes a theoretical framework (Yanto, 2023).

The article by Braun and Clarke (2012) discusses how to conduct thematic analysis, demonstrating it by using their own example from one of their research projects. They also discuss the similarities and differences of similar approaches (such as conversation analysis and interpretative phenomenological analysis) that share features with the thematic approach (Braun & Clarke, 2006). Braun and Clarke also recognize that in some cases thematic analysis overlaps with other approaches, but it can be more accessible especially for those early in their research career.

TA can be conducted in a few different ways, very similar to other qualitative research approaches: "inductive versus deductive or theory-driven data coding and analysis, an experiential versus constructionist theoretical perspective" (Braun & Clarke, 2012, p. 58). For the purposes of this study, the deductive approach to analysis and data coding was chosen in

order to be more focused on the research goals. Certain topics and ideas were brought to the set of data, which means that the themes derive from predetermined concepts. The ideas and experiences deriving from the interviews hold information that is linked to those specific research topics. I draw on theoretical constructs of thematic analysis from Braun and Clarke (2006, 2012, 2022), the maturity process model of Hackos (2007) and the methodology of participatory design (Spinuzzi, 2002, 2005).

3.2. The Information Process Maturity Model

Hackos suggests a process-development methodology that identifies the primary phases of one's information-development process (Hackos, 2007, p. 23) in order to define the primary goals and processes that take place within the organization. They have successfully tested the methodology with many organizations.

The five phases of The Information Process Maturity Model by Hackos (2007)

1. *Plan*

2. *Design*

3. *Develop and validate*

4. *Assemble, evaluate and produce*

5. *Publish and distribute*

According to Hackos (2007), the structure of the whole documentation process needs to be taken into consideration in successful management of an organization, which is why such a model has been created. In this study, the steps taken in order to gain knowledge of the current documentation process were in accordance with Hackos' methodology. The design of the current information architecture (where information exists and in which forms), creation of new information (also missing information and errors), discussions with product developers and technical writers as well as the documents themselves were observed when conducting the data collection and analysis of the data.

The Information Process Maturity Model (IPMM) (Hackos, 2007) was created in order to provide standard methodology for making comparisons between efficient and inefficient information development. Even though the theory was first defined in 1992, today for example

The Center for Information-Development Management, an organization for information-development, training, and support for managers from all around the world, supports it completely, as stated on their homepage (CIDM Home Page, n.d.) . The model characterizes how some organizations manage their documentation successfully and others less so; it tries to depict "the range of characteristic behaviors that seem to make a difference in the organization's success" (Hackos, 2007, p. 33). Managers use IPMM as a tool to better understand their own organizational practices and models (Hackos, 2007, pp. 32–33), which is why it was also used to gain insight on this project. Similarly to an official IPMM assessment, in this research a preliminary questionnaire was used as a basis for on-site interviews with the documentation team members in order to meet the research goals. Examples of information products produced by the organization, mainly "instructions for use" manuals, were also reviewed.

The five levels of Process Maturity are defined in IPMM (Hackos, 2007). These maturity levels illustrate states in which organizations reside. They provide management with a model to assess the current work process and a description of how to move to the next level. The first recognized level, ad hoc, described in Hackos' book characterizes the documentation process enacted in the case company in the beginning of this project. They summarize that organizations at this level lack structure and uniform practices and have information developers "most often hired and managed by someone from another field, such as engineering or software development" that usually work alone (Hackos, 2007, pp. 34–43). Because of this, the quality of the product and how standards are applied are highly tied to the individual responsible; gathering data and doing the actual writing can be a very unique process. According to Hackos, the individuals may produce excellent work even though they are responsible for their own quality affirmation.

The IPMM assessors, practitioners who assess the maturity of an organization, focus on structure standards: how information is created and whether there are any standards such as style guides or common processes in place. When an organization plans to move from level 1 to level 2, rudimentary standards in process management, information design and technology need to be implemented (Hackos, 2007, p. 42). Consistent practices lead to consistent designs: unified writing style as well as the level of detail should be standardized in document design. Markel & Selber (2018, p. 10) have listed six major characteristics for technical documents: they have to address particular readers, help readers solve problems, reflect the organization's goals, they are produced collaboratively, use design to increase readability and consist of words and images or both. They also mention that producing a document that "conveys a single

meaning the reader can understand easily", is "as objective and unbiased as you can make them", "provides all the information readers need" and is concise makes for an excellent document (Markel & Selber, 2018, p. 11). How information is created should be taken into consideration in the process of moving from linear to structured documentation, especially if the organization intends to move to unified processes.

3.3. Participatory design

To be able to build on a coherent body of knowledge in this study, the features of participatory design are drawn on. Research conducted in accordance with the methodology of participatory design are sometimes referred to as participatory action research (PAR) (Spinuzzi, 2002, 2005). However, for clarity purposes only one definition is used in this research, participatory design. The design exists to understand a phenomenon, to understand knowledge through action. In participatory design the research goals are simultaneously addressed and engaged by both the researcher and the participants (Spinuzzi, 2005). In this case study all of the participants collaboratively engage in an action-based project that will mobilize their desires by creating a requirement specification of their needs for a CCMS software.

Like many other methods, in participatory design projects the participants' interpretations are taken into account. However, specifically in participatory design, these perceptions are perceived and monitored throughout the whole research project. The context-specificity of this method involves no fixed formula for conducting it, but collaboration is at its core. This dialectical research process took into consideration the voices of the whole documentation team during both the data collection and the analysis of the data. According to Spinuzzi (2022) what constitutes data is heavily dependent on the project itself. The various field notes were discussed and reviewed by the team and the interviews were designed and conducted in collaboration. Because the research goals and means to achieve them were discussed collaboratively, both the researcher and the participants of the research held responsibility of the success of the project.

The result of the research typically consists of designed artifacts, as is the case with this research (Spinuzzi, 2005). That is because the goal is to not only empirically understand processes, but to shape them in ways that benefit the actual workers. A properly done participatory design research brings the product of analysis back to the participants, which is then co-interpreted and co-analyzed further to meet the research goals. According to Spinuzzi (2005), this design is usually used when tools and workflows are to be changed. Consequently,

it was expected that this research shares many elements with prior PAR projects. I argue that changes of mind, distractions and losses of interest are parts of any project that involve work environments, especially when current work processes are monitored and assessed critically.

4. Method of analysis

In this chapter, the current study is introduced. The analytic choices and processes of this study are elaborated. First, the research aim and research goals are presented. Second, the selection and collection of data is discussed. Lastly, the method of analysis of this study is introduced. Moreover, describing the analytic process and the key design choices are discussed alongside aspects of research ethics.

4.1. Research aim and research goals

This case study focuses on content management in a small Finnish company in the medical industry, with a head count of less than 50. The company authorities were offering a commission for a master's degree student to help them with information seeking and the decision making process. Most of the documents reviewed for the purposes of this research were user manuals. During this research the company did not use any software focused on component content management. Technical writing was done in a linear manner with Microsoft Word. The work and information available was divided in various ways depending on the work unit and staff member in question. The company wanted to implement a CCMS for the whole organization to use. More specifically, they did not want to manufacture a completely original CCMS but choose one from the already existing ones. The aim was to improve the overall quality of technical communication, with a more specific focus on technical writing. The aim of this case study is to research which features are required of a CCMS when implementing one in a company that has previously not used structured documentation. Having collected enough data within the organization, a requirement specification was conducted, which provides a realistic basis of the company's needs for the CCMS.

This study has the following research goals:

1. Explore the current state of the documentation process and map out the company's needs for a component content management system.
2. Provide the company with a requirement specification based on the findings in the data gathered.

The purpose of the requirement specification is to agree with the software supplier on how the product should function and whether it has the necessary features to enhance the company's technical documentation needs. It also enables the comparing of component content

management system features within the existing software. The basic features of such programs include the price of the CCMS, the accessibility of the software, the ability to work simultaneously on a project, the ability to construct and stylize documents coherently and reusability of existing content. The latest being extremely important in cases such as this one where a vast amount of data already exists.

4.2. Selection and collection of data, research ethics

The implementation of a CCMS and moving to structured documentation requires vast knowledge of the current work processes within the organization and structured authoring overall. The whole documentation process should be considered: what kind of information is needed in which documents, how is it translated, how is it kept up to date and for example where it is published are important questions when it comes to structured documentation. Technical writers might also have micro level requirements for the software, which should also be considered. In this study, the answers to these questions were obtained through interviews with the personnel of the company and field notes collected during a trainee period within the organization. As Hackos (2007, p. 34) states, "interviews help to understand in depth how the organization actually functions". Additionally, the insight on the work processes gained during the trainee period within the organization was taken into account during this research and during the conducting of the interviews.

The technical documentation team in this organization has four members in it and all of them participated individually. The interviewees were informed about the upcoming research interviews formally and they gave their consent to participate. A privacy notice was also conducted. The interviews were conducted in a semi-structured manner, because it was important that there was a possibility for the interviewee to ask questions during the interview if necessary. In the interviews, which lasted around an hour each, participants were asked about their overall experiences of technical documentation, how the information architecture is conducted and what kind of challenges they have faced in their work in documentation. Perceptions of the wider need for a component management system were also considered.

The interviews were audio recorded, saved in a secure location according to JYU regulations and instructions and then transcribed. Even though removing hesitations, pauses and for example guggles is not advocated when working with data (Braun & Clarke, 2012, p. 60), the form of my data allows for a more minimalistic approach. Such details may be revealing, but because I am only focusing on what is actually said, they can be omitted from the data. The

purpose was to gather data to be used in the requirement specification, which is why the transcriptions were edited to remove any words or clauses that were not relevant. The allowances and the restrictions of the chosen methodology will be further discussed in this paper in the discussion section. For further research it would be interesting to work with a full transcript while doing TA.

This study complies with the University of Jyväskylä ethics committee's regulations concerning the researcher responsibilities in handling personal data (Simsiö, n.d.). No personal data is published in this thesis, but the interviews themselves were audio recorded. The voice of the interviewee is considered to be personal data, which is why the audio files were stored and located in the personal network drive provided by the University of Jyväskylä. The audio files should only be preserved for as long as necessary for the completion of the research, which is why after the transcription the data was completely anonymized and the audio files were safely removed. Once the requirement specification was conducted, the transcribed and anonymized text files were also disposed of.

4.3. Thematic analysis in the current study

As a method of analysis, thematic analysis (TA) aims to systematically identify, organize and offer insight into patterns of meaning in a set of data (Braun & Clarke, 2012, p. 57). TA focuses on meaning across the data set, so that the researcher can "see and make sense of collective or shared meanings and experiences" (Braun & Clarke, 2012, p. 57). Because of its accessible and flexible form, TA is used in this study to identify the common themes in the way the topic is discussed and draw conclusions based on the interviews and the field notes gathered. The relationship between the participants of this commission has to be taken into account; the researcher and the participants would impact each other inevitably. The researcher's values and assumptions would comprehensively impact both the questions asked during the interviews and the analyzing of the data.

Some scholars advocate thematic analysis's strengths especially in systematic reviews: some describe it as a "one specific approach for reviewing and synthesizing research in a systematic way" (Thomas & Harden, 2008, p. 8). Numerous patterns or themes might appear across any data set analyzed with TA, but its purpose is to identify the ones that are relevant to a specific research question, in a particularly systematic way. The disadvantages of TA depend usually on inappropriate research questions or poorly conducted analyses of data sets rather than the method of analysis itself (Braun & Clarke, 2006, p. 27). In this case study the research objectives are rather specific and they were discussed together with the company authorities.

Therefore it was more straightforward for the researcher to decide which aspects of the data to focus on and which to discard safely. The purpose of the interviews was to gather insight on the comprehensive overview of technical documentation process and the deficiencies of the linear documentation: TA allows to flexibly focus on the data in a systematical way in order to make sense of the experiences and meanings within the workplace.

The starting point for reflecting on these data is quite complex, as I had not previously conducted any research concerning technical documentation or the processes behind it. Furthermore, I had a keen analytic interest in the topic and was personally invested in it. One of the major strands of my previous research centered on language policies and the power relations related to them in the workplace, the discourses surrounding them. I believe examining the current state of the documentation process shared similar elements with the qualitative research I have conducted before: this experience most likely supported me with analyzing the data. However, the principles of conducting good thematic analysis were visited and followed during this research.

When analyzing the data, reoccurring patterned responses or meanings that captured something of importance in relation to my research objectives were reviewed. These patterns are called themes. Because of the qualitative nature of the analysis, a theme could be given considerable amount of attention in some data pieces and little in some. As Braun and Clarke (2006, p. 10) state, more instances of a certain theme within a data item does not necessarily mean the theme is more important. The researcher is to determine what a theme is. In this scenario the most prevalent feature of a theme is if it captures something significant in relation to the research objective. However, the prevalence and how it is determined could be interpreted in multiple ways. Consistency with the determination of themes was taken into consideration when it comes to this case study.

4.4. Data analysis

For the analysis I used the six-phase approach to thematic analysis, which is both a theoretical approach to TA and a way to learn how to conduct it (Braun & Clarke, 2006). Even though the phases are represented as individual steps, Braun and Clarke (2022, pp. 34–46) highlight that the process of reflexive TA is not strictly linear, but rather a progressive process. Venturing back and forth these phases during the analysis is necessary for conducting good TA, but for the sake of clarity the steps are introduced as individual entities.

4.4.1. Phase one: Familiarizing Yourself With the Data

The first phase is to familiarize oneself with the data. Immersion needed to read the data in a familiar way is very important for TA (Braun & Clarke, 2022, pp. 42–43). It can be concluded that I had a deep and intimate knowledge of the dataset, because I planned the interviews myself according to the prior knowledge gained during the internship and interaction with the documentation team. A good researcher also maintains their distance when analyzing any data; being critical and analytic is part of being a language specialist and a researcher in this field.

I worked with recorded verbal data in the form of interviews, which is why the data needed to be transcribed into written form so that thematic analysis could be done. The focus of this research is in the analysis itself and the process behind it, in regard to the research goals, which is why orthographic transcription for transcribing the interviews was used. Thematic analysis "does not require the same level of detail in the transcript as conversation, discourse or even narrative analysis" (Braun & Clarke, 2006, p. 17). Because for example details concerning speech production were not important for the research, they could be omitted. Transcribing the audio recorded data items took more time than I anticipated it would. The files were first transcribed with the help of AI and further reviewed by the researcher. After that I re-read them multiple times and wrote down notes of thoughts related to the dataset, according to the instructions given by Braun & Clarke (2022). As mentioned in the methodology section, I also had written field notes from the discussions during my trainee period, which were taken into consideration when the interviews themselves were conducted.

Throughout the whole process of going through the data I had to keep engaging critically with it, keeping in mind that I had planned the topics discussed in the interviews myself, based on existing research and the field notes. The interviewees' way of making sense of the phenomena might imitate that of mine, or they might make assumptions based on my choices. As Braun & Clarke (2022, p. 44) put it: "the idea of an analytic sensibility relates to taking an inquiring and interpretative position on data". Because I had such a clear purpose for the interviews, to gain knowledge on the organization's current documentation process and map out their needs for a component content management system, it was not difficult to have an analytic focus throughout the familiarizing phase.

4.4.2. Phase two: Generating Initial Codes

The next step of the analysis was to generate initial codes within the data. The coding process, being engaged and systematic, involved reading each data item carefully and then pointing out segments of the text that were potentially relevant to my research goals. These segments were tagged with appropriate code labels, depending on how many different meanings were evident

in the particular segment of data (Braun & Clarke, 2022, pp. 51–53). The point of these labels is to make sense of the diversity of meaning present in the data; to gain insight and rigour. To realize the full potential of the data in TA one has to have systematic engagement with it. As Braun & Clarke summarize, looking for meaning and patterns across an entire dataset requires detailed analytic interrogation. This also prevents the idea of cherry-picking patterns that only fit to a researcher's own predetermined assumptions or ideas the meaning of which are important or evident in the dataset.

A deductive orientation to data coding was chosen for this research. The dataset provided the foundation for coding and later theme development, but the research goals (and therefore the codes developed) also reflect theoretical ideas that we as a team wanted to understand through the dataset. Existing theories of the information process maturity model and information-development project management (Hackos, 2007) provided me with tools with which to make sense of the data because of their strong connection to the phenomenon of moving from linear to structured documentation. The IPMM theory summarized quite thoroughly the steps of information development that an organization has to take in order to evolve their ways of working.

Generating codes and refining them is a process that requires time. Moving back and forth the interviews required systematic engagement, because possibly analytically interesting meanings evolved through and within the coding process itself, exactly as Braun & Clarke (2022, pp. 69–72) had theorized. Phase one and two of the thematic analysis completed each other assiduously, to a point I would argue separating them from each other might not be necessary: these steps were intertwined with each other.

4.4.3. Phase three: Generating initial themes

When looking for shared meaning or conceptual patterns within the data, Braun & Clarke use the terms theme, topic and topic summary. In the interviews, when the participant mentions something about a particular topic, a topic summary summarizes everything. The meaning is rather presented as a theme, something with its own central organizing concept, an idea that unites the theme (Braun & Clarke, 2022, pp. 76–78). "A theme in reflexive TA is a pattern of shared meaning organized around a central concept" (Braun & Clarke, 2022, p. 77). Because the task was to explore shared ideas and meanings when it comes to features wanted from a CCMS across different contexts, these themes were evidenced at a rather concrete level. The initial themes revolved mainly around the reusability of content, possible solutions to updating

content more efficiently and storing information in one place.

When shifting the analytic attention from codes to meaning patterns, themes, the connected codes were gathered together. To this research's convenience, the four interviewees shared quite many ideas and thoughts when it came to the requirements for the system. Analyzing the patterned meanings in relation to my research goals was therefore not as complicated as anticipated, especially with the help of visual mapping (Braun & Clarke, 2022, pp. 85–88). For the purpose of clarity the overarching themes were divided into themes and then further into subthemes in a visual form, keeping in mind that the analytic task was to strictly address the research goals rather than represent everything present in the dataset.

4.4.4. Phase four: Developing and reviewing themes

As Braun & Clarke suggest, thematic mapping is a great tool in order to make sense of clusters of meaning and arranging them into tentative themes (Braun & Clarke, 2022, p. 97). Phase four of the analysis revisits the themes generated before by going through them, but also going through the whole dataset with a critical approach. The purpose of this phase is to review the choices made; simply put making sure if there is a better way of arranging the tentative clusters of meaning. It can also be considered "a validity check on the quality and scope of your candidate themes" (Braun & Clarke, 2022, p. 97).

During this process, it was made sure that each theme has a singular central idea and focus rather than being too fragmented. The requirements for the CCMS mentioned during the interviews were either very broad and vague or specific micro details related to for example technical writing; they also overlapped each other in ways that were not that predictable. The boundaries of each theme had to be readjusted many times, because it was not always clear which theme subsides the other. Some themes were rejected because they simply did not convey anything important from the point of view of the research goals. However, it can be concluded that each interview was necessary in order to gain such a diverse and rich overview on both the technical documentation process and how it could be made more efficient within the organization. For example, the urgent need for support with the information architecture in this organization was something that was not originally a part of the interview design. However, several themes concerning that occurred.

4.4.5. Phase five: Refining, defining and naming themes

After reviewing the themes, it was time to actually do the writing up work. Refining the structure of the analysis is also done during phase five, because the clearly defined themes are the analysis. Some scholars like to create definitions for each theme and name them with a short phrase that engages the reader (Braun & Clarke, 2022, pp. 108–115). Engaging the reader or trying to capture the essence of each theme with a name that "operates a bit like an advertising tag-line" (Braun & Clarke, 2022, p. 112) were not in the interest of this research, because of the nature of the requirement specification: the final document establishes the basis between the customer and a contractor on how a certain software should function. Because its purpose is to provide a realistic overview of requirement before the system design states, it should be concise and follow the principals of minimalism. This does not mean however that the themes chosen for the analysis were not named during the process; because the complete thematic analysis process will not be published but the requirement specification will be, only the outcome is visible. The four major cluster themes were "general", "user interface", "deployment phase" and "price", which are further introduced in the Requirement specification (Figure 1).

4.3.6. Phase six: Writing matters for analysis

The last phase of the Practical guide to thematic analysis was writing an academic paper, a master's thesis in this case. As summarized, "writing is integral to the process of reflexive TA because your analysis takes shape in the writing you do around your data" (Braun & Clarke, 2022, p. 118). Writing the actual report and refining the parts of the requirement specification, alongside the introduction, background theory, the methodology section, the results and the discussion section are all parts of reflexive TA.

5. Results and discussion

In this chapter, the results of this research are introduced. The process of conducting the requirement specification and the implications it had for the organization are elaborated.

5.1. Creating the requirement specification

Based on the information gathered from the trainee period within the company, the research interviews and the discussions with the organization authorities, I had a realistic overview of the current status of the documentation process and the challenges in it. Based on that information, the first draft of the requirement specification was created. After the first draft of the requirement specification had been conducted, it was thoroughly reviewed and discussed together by the whole team in a continual participation as suggested by the methodology of participatory design (Spinuzzi, 2005). These discussions also functioned as a way to distribute knowledge about the basic concepts and functionalities of the CCMS software.

A requirement specification pinpoints the requirements an organization has for a software, but it also works as communication method between service providers and the client (JUHTA - Julkisen hallinnon tietohallinnon neuvottelukunta., 2024). By recognizing areas of development concerning documentation an organization produces information about the software acquisition by setting a basis for the organization's needs. With regard to the research goals, a requirement specification was conducted as a part of this research (see figure 1).

As mentioned in the background section, the whole process of creating the requirement specification is characterized by the democratic approach of participatory design. The researcher and the participants, the company documentation team, were actively involved in both identifying the areas of development and implementation of solutions to them. The knowledge to conduct the final version of the requirement specification document was co-created, so that it would be responsive to the needs, preferences and context of the company (Spinuzzi, 2005). However, as Hackos (2005) suggests, the human elements such as differing skill levels and communication challenges make managing projects complex. The preconceptions, expectations and the lack of existing background information about structured information within the organization shaped the way this research was conducted.

Developing the first draft of the requirement specification began with the conducting of the research interviews. The semi-structured interviews were conducted during December 2023.

All four members of the documentation team were asked about the whole process of documentation in its current form, how and with which tools it is being conducted and who gets to take part in the documentation process. I was interested in the sources of information (technical, human or other) when it comes to writing technical documents within the organization, how content is being published and how it is being translated. Additionally, the overall reasons why the company authorities wanted to participate in this research were discussed in order to gain insight into the technical documentation process.

A Sample Analysis Table of Tools By Class, conducted by Markel & Selber (2018, pp. 210–212), identifies the areas in which acquiring new tools support an organization's business goals. This table was used as a tool for conducting the first draft of the requirement specification, meaning that the identified topics were cooperatively discussed after the research interviews. According to Markel and Selber, the characteristics required of content management are listed below.

1. *Stores components based on metadata structures*
2. *Facilitates the assembly of components into final deliverables (e.g., DITA maps)*
3. *Provides version control, check in/checkout security*
4. *Supports automated workflow*
5. *Handles multiple file types*
6. *Facilitates handling of components in multiple languages*
7. *Supports the application of translation memory for pre-translation*
8. *Supports hypertext links and cross-referencing between file types*
9. *Supports multiple style sheets*
10. *Delivers output automatically to web pages depending upon metadata*
11. *Provides for multiple levels or archiving and restoration of archived content*

The list is not by all means exhaustive. According to Markel and Selber, the characteristics and requirements of such tools should be discussed and reviewed by the documentation team to ensure clarity and completeness. For the purpose of fulfilling the research goals, it was important to address where one finds the information needed in order to update documents or create new ones. It was also important to address whether documents even have to be updated and how often that is done. In this chapter, data transcript excerpts are presented to further elaborate the process of turning the research interviews into the final draft of the requirement specification. The interviews and discussions were conducted in Finnish, transcribed and translated into English. The first excerpt demonstrates how the current work processes can feel

overwhelming with linear documentation.

Data transcript excerpt 1.

"Paljon tuotteita eli paljon ohjeita, paljon kieliversioita eli paljon hallittavaa. Ei millään muista itse kaikkea ja sitten ihan vaan niinku nytkin oon päivittänyt yhtä kuvaa varmaan kahdeksaan ohjeeseen niin avataan kaikki kahdeksan ohjetta täällä erikseen ja vaihdetaan se yksi kuva sinne joka ikiseen kun sen olisi voinut vaihtaa kerran että se olisi joka paikassa"

"A lot of products which means a lot of documents, a lot of translations which means a lot to manage. There is no way to remember everything on my own and then well right now I have updated one image to maybe eight user guides so that means that I open all eight guides here separately and change that one image there in each of them when it could have been done once so that it would update in all of them"

As exemplified with the data excerpt 1, the technical writers within the case company had trouble organizing information in their documents. There are also challenges when it comes to the overall content management, because of the amount of documents to manage. In linear documentation tools, namely Microsoft Word, content is created as a single continuous document. Because of this, there is no efficient mechanism for updating information within the documents simultaneously. It is not only time consuming to manually update the individual files, but the lack of reusability may result in duplication of inaccurate information, as evidenced in data excerpt 2 and 3.

Data transcript excerpt 2.

"Siis se on kanssa just se että kun vaan niinku mennään tämmöisiin että muutetaan tommoisia niinku nippelitietojuttuja että se ihan oikeasti kanssa muistat niin kun vaihtaa ne joka paikasta. Yhden numeron vaihdoit jonnekin, että sä sitten muistat vaihtaa sen sieltä toisestakin paikasta."

"It is just that when we talk about things like changing things like trivial things that in fact you have to remember to update them everywhere. When you changed one number somewhere, that you then remember to change it in the other place as well."

Data transcript excerpt 3.

"Mutta jotenkin se on hankalaa tai sitten ei ainakaan tulisi sitä, että siinä menee sekaisin, että jossain paikassa on uusi (tieto) ja jossain on vanha (tieto) ja sitten se vanha (tieto) lähteekin elämään sen uuden (tiedon) sijasta"

"But somehow it is difficult or then at least it would not be so that one gets confused, that in some places there is new (information) and in some places old (information) and then the old (information) starts living its own life instead of the new (information)."

The challenges of updatability exemplified in the data excerpts 2 and 3 have to do with linear documentation: without proper version control it is easy to lose track of changes and end up with possible conflicting versions of information. When it comes to for example user guides in the case company, the technical details of the products are often mentioned multiple times within a specific document. If the documents have to be updated regularly, keeping track of these details can be frustrating with linear documentation (see data transcript excerpt 2 and 3). By enabling single sourcing, maintaining content in a single source and publishing it to multiple formats, authors of structured documentation do not have to rely on their memory for the most recent versions of information. Because CCMS software break content into reusable components that address a specific topic or concept, a technical writer may focus on the actual content within the component. Structured documentation tools most often include content management and version control capabilities that allow their users to track changes and manage revision history.

Because of reusability and single-sourcing being the basic functionalities of a CCMS, requirements concerning the overall reusability of content were excluded from the final draft of the requirement specification but discussed thoroughly with the documentation team. After a basic level of knowledge had been achieved about the core features of structured documentation, it was decided that the requirements for the software can be more specific. However, requirements regarding the monitoring of revision history and language versions were left in order to gain more insight into how they actually work in the software. For example in the final version of the document, the requirement "Does the system support universal content types and tags? (clean XML or SGML, LW-DITA, DITA)" (see figure 1) was included because the participants agreed that there should be room for flexibility: if a software has its own unique coding language, it might be difficult to change systems in the future.

The core of structured content authoring lies within the separation of content and layout. Because of this, it was vital in the interviews to also address how much time is currently being spent in formatting the content with the current documentation tool. As data excerpts 4 and 5 suggest, formatting in linear documentation can be time consuming and frustrating.

Data transcript excerpt 4.

"Koska kyllä mulla menee siihen hyvin paljon aikaa, että mä hoidan ne muotoilut kuntoon. Oli se sitten niinku uusi dokumentti ennen kuin se menee kääntöön. Ja sitten kun se tulee käännöstä, koska kielet on aina eri pituisia, niin sitten tarvitsee kuitenkin aina katsoa, että saa ne sivutukset hyvin."

"Because yes it takes very much time for me to handle the formatting so that everything works. Be it like a new document before the translation. And when it comes back from translation, because languages are always different length, then someone has to always go through the pagination so that everything is well."

Data transcript excerpt 5.

"Kun on jotain tyylejä taikka asetuksia pohjissa taikka muuta ja on vähän eri aikakauden pohjia ja niitä kun kopioi sitten dokumentista toiseen niin yllätys yllätys tuleekin jotain ihmeellisyyksiä. Muotoilut rupeaa temppuilemaan ja se on niin kun turhauttavaa ainakin."

"When there are styles or settings in the style bases or something else and there are bases from different time periods and when you copy things from one document to another then surprise surprise something odd comes up. Formatting starts doing funny things and it is well frustrating at least."

Linear documentation tools embed formatting directly within the document itself with the help of various formatting options. These options might however lead to inconsistency, fragmentation of formatting rules and frustration. Data excerpts 4 and 5 exemplify how within the case company the technical writers use a lot of time to formatting the documents. Formatting changes in linear documentation must be applied manually to each document. As mentioned earlier, content and layout are separated in structured documentation. Structured

documentation tools have sets of predefined formatting rules and specifications, style sheets, which provide a systematic for applying consistent layout across multiple documents. This means that the author does not need to worry about pagination because the formatting rules are predetermined by the style sheet, leaving more time to focus on the content itself. These rules can be defined and applied consistently across documents, promoting visual consistency and coherence. The information in the modules can be published in various designs with multiple style sheets. Data excerpt 6 exemplifies how in the case company authorities wished the same information could be presented in different ways with structured documentation.

Data excerpt 6.

"Niinku konkreettisesti, jos on yksi tiedonlähde niin se halutaan todella esittää eri tavalla. On se sitten käyttöohje, nettisivu tai painettu esite tai joku mitä haluaa. Tieto on sinänsä sama faktatieto on sama, mutta ulkoasu halutaan ihan erilaiseksi."

"Like concretely, if there is one source of information and we want to present it in different ways. Whether it is a user manual, web site or printed manual or whatever. The information is the same factual information, but we want the design to be completely different."

As this is a feature in all CCMS software, the topic of formatting was not considered as a part of the requirement specification but addressed within the documentation team. However, we later added a question whether the customers are able to customize the style sheets themselves and whether there is a possibility to add third party documents or pictures to the documents. The concern presented in data excerpt 6 also applies to who gets to actually affect the design of the style sheets, the customer themselves or the service provider.

Mobilizing the desires for a CCMS required understanding of which features are considered self-explanatory. As the participatory design research approach suggests, the researcher and participants worked together as active contributors of the project throughout the research process. Interpreting the findings of the research interviews shed some light on the areas of development in the documentation processes that had not previously been discussed within the organization and allowed for the company authorities to learn about structured documentation. When the basic idea of structured documentation became clear, more specific requirements for the CCMS arose. For example, creating content in the modules in a coherent way could be assisted with a random-access writing memory, as suggested by data transcript 7.

Data transcript 7.

"Just se vaan kun että miten sä luot samanlaiseen dokumenttin niin kun samanlaista tekstiä. Se on iso murheenkryyni. Lausetasolla on tosi paljon samaa, että se ois samalla tyylillä tehty ja käytetty samoja sanoja. Jonkinlainen kirjoitusmuisti on ehdoton."

"Just that how do you write similar kind of text to a similar kind of document. It is a big challenge. In the phrase level of text there is a lot of commonalities, so that it would be written in the same style and with same words. A random-access writing memory is a must."

Specific requirements concerning the actual technical writing were of interest to the company workers as exemplified by data transcript 7. This is why questions concerning writing work in progress were included in the "General" section of the final requirement specification. Locking work/objects in progress or changing the status of an object as well as having a random-access memory all specifically relate to macro level writing requirements for the software. The integration possibilities were in accordance with the systems used in the company. Requirements concerning the user interface centered around the usability and ease of use of the software, as data excerpt 8 illustrates.

Data transcript excerpt 8.

"Käyttöliittymän pitäisi olla semmoinen, että kun niitä dokumentteja on satoja, se käyttöliittymä on sen näköinen, että sä hallitset satoja ohjeita ja niillä on kieliversiota. Että se näyttää siltä, että sitä on helppo hallita. että ne se saa sillä järkevästi jäsenneltyä tuotteittain tai jotenkin silleen niinku paketeissa."

"The interface should be like so, that when hundreds of documents exist, the interface looks like you control hundreds of user manuals and they have language versions. That it looks like it is easy to manage, that they can be sensibly organised by product type or somehow in packages."

The intuitivity of the software can be difficult to assess, especially by the service providers themselves. Data excerpt 8 suggests that the case company authorities wish for the software to have sensible content management features. The final version of the requirement specification

has an inquiry about folders to store objects to further elaborate how content management is done within the software. Being cloud-based was essential for the company, as they do work partly remotely. Requirements concerning monitoring of the revision history and language versions focus on how exactly are they done with the specific software, seeing as they are basic functions of a CCMS.

The "Deployment phase" and the "Price" sections focused on the actual resources needed in order to deploy the CCMS. Based on the information gathered from the service providers' websites and initial discussions, the overall cost of a CCMS software can consist of a myriad of pieces: the purpose of the "Price" category of the requirement specification is to break down these pieces so that they become clear for the customer. Resources needed in the deployment phase of such a software were also of interest to the company authorities because they had not participated in such a project before. As mentioned in one of the requirements of the final version, "moving from linear to structured documentation requires time and support in our case" (see figure 1). After a thorough discussion, the researcher in this study convinced the participants that the final draft of the requirement specification should include a whole section for questions concerning the deployment phase of the CCMS. This is in accordance with the general aim of a requirement specification, to function as a guide of the company's specific requirements for the success of the project and providing guidance for both the customer and the service provider.

With its final form, the requirement specification depicts a realistic overview of the current status of the technical documentation processes and the areas of development the CCMS software could provide solutions to. Some of the requirements of the final version are more focused on the technical writing itself, while some focus on the deployment phase and the price of the software. It is directly linked to the organization's content management, as is the whole process of conducting it. Once the requirements had been defined and reviewed, the requirement specification document could be used as a Request For Information (RFI) or a Request For Proposal (RFP) (Hackos, 2007, p. 213), providing comparable information about different software. By having a requirement checklist the customer is able to ensure that the CCMS actually does what was documented in the response. The features of the most prominent component content management software will be compared and reflected with the findings of the data gathered.

Requirement specification. The central features wanted from the system	Comments Is the feature a part of the basic system or part of an expansion?
GENERAL	
Can the system lock work in progress content for the editor?	
Is there a possibility to lock an object from use or mark it as obsolete?	
Can you change the work status of an object and/or a complete document? (finished, obsolete, published)	
Does the system allow reports on for example the status of language versions?	
Does the system have random-access memory for writing? How does it work?	
Does the system scale up well? We would start first at instruction manuals and possibly move eventually to other documents.	
Integration possibilities, interfaces between programs? • Vertex Flow, PDM-system • Sharepoint • Excel	
Does the system support universal content types and tags? (clean XML or SGML, LW-DITA, DITA)	
USER INTERFACE	
Is the system cloud-based?	
How easy to use and intuitive the text editor is? We have a lot of documents to control, for example folders to store objects would be simple.	
How do you monitor the revision history of an object? Does the system log changes for traceability?	
How do you monitor language versions of objects or where an object appears?	
Is there a possibility to add third party documents/pictures?	
Does the content editor have a WYSIWYG user interface? For example access to the XML-code is not necessary.	
Can we create or edit content output layouts? How does it work?	
DEPLOYMENT PHASE	
Is it possible to get support in the information architecture process? Moving from linear to structured documentation requires time and support in our case.	

Evaluation of the schedule of the deployment in the demo phase? How long / how much effort will it take to transform content to being structured?	
Is there a possibility for on-site support at the start of the deployment phase? Error messages / support requests, answering them?	
PRICE	
Price of the license per editor per month? How many licenses does the contract allow?	
The amount of the bullet payment in the deployment phase?	
The amount and price of the content output layouts?	
The price and form of required education?	
Different additional features and their price: for example automatic translations, translation memory, predictive text, integrations, enhanced server security?	

Figure 1. The final version of the requirement specification

5.2. Structured documentation tools

The tools and environments in TC change rapidly because of the technological development rate, which is why reviewing them is necessary. Hackos (2007) and Markel & Selber (2018) state that assessing the tools used within an organization should be conducted annually to ensure that they follow the strategies enacted. I argue that developing thorough requirements is even more necessary when acquiring new (technological) tools, which is why a qualification specification was conducted as a part of this research. Service providers are motivated to demonstrate their products, but careful planning prior to that is vital for the process. By neglecting thoroughly developing requirements "you may omit from your requirements something that you did not know existed but would be extremely useful to meet your goals" (Markel & Selber, 2018, p. 212). Moreover, the service providers might not provide the necessary information without the client specifically asking for it.

Some organizations do not assess their information development regularly, even though tools such as the IPMM (The Information Process Maturity Model) (Hackos, 2007) exist. By doing so, the actions that make a difference in the organization's success may not be always recognized, leading to inefficient practices and processes. Investing in technical documentation may enhance the quality of the documents and therefore affect the customer experience, especially when it comes to user manuals. I argue that the relation between the quality of a user manual and user experience go hand in hand, which means that investing in technical

documentation may affect an organization's success.

It should be once again mentioned that simply purchasing a tool does not equal managing content properly. However, according to Van Laan & Hackos (2012, p. 139), technical writers should be aware of the right tools to deliver quality structured content with XML, books (manuals), pamphlets, and data sheets, web page content and Help. They also state that many organizations use XML in order to streamline documentation production and content reuse. In the case company, the technical communicators were engineers, who had no education background in linguistics, humanities or technical writing. The lack of knowledge of the existing tools affects an organization's ability to develop their documentation processes, because the company authorities might now know about the possibilities that these software offer. However, professional managers have obligations to the organization as they facilitate the flow of information from the industry to the user (Hackos, 2007): organizational growth and education should be considered in order to develop the processes enacted.

5.3. The importance of content management in TC

Once the requirement specification is conducted and distributed, preliminary presentations and demonstrations of the products can be arranged. However, the actual benefits of changing from linear to structured documentation may seem vague and hard to understand. Some may think that CCMS software are for example too expensive given that they only affect authoring of information. Nevertheless, Suojanen (2018, p. 50-51) mentions that implementing structured documentation has to do with mostly financial reasons, because the content can be reused and therefore resources can be distributed elsewhere. So why should an organization strive to enhance their documentation? What is good technical documentation?

Simply put, good technical documentation takes what is best for the users into consideration (Van Laan & Hackos, 2012, p. 159). When done correctly, these documents effectively meet the quality expectations of the consumers of this information and the organizational objectives at a larger scale. However, as Virtaluoto (2015) summarizes, the re-structuring of the IT industry has had massive impacts on the field of technical communication in Finland. According to them, cost pressures within organizations tend to lead to poor content management, because the effects of high quality documentation on for example user experience are not recognized. I argue that content management plays a critical role in successful technical

communication. Hackos (2007, p. 15) states that most people in the technical documentation industry "find comfort in getting something out the door", but if this content is useless for its purpose and audience, it continues to cost more than it is worth and does not fulfil the customer's needs. I argue that poor content management does not always equal to less resources used: for example, poorly written user manuals may lead to accelerated customer service, which also requires resources.

5.4. The organisational implications of structured documentation

According to Markel & Selber (2018, pp. 188–189), occasionally the key information of products may be written separately in various ways, even though they can be nearly identical or only have very minor differences. If an organization wishes to reduce the amount of this so called unintentional duplication, new tools might be required to support it and the way technical writers work and assignments are handed out has to be changed. In the case company, the product information was scattered in various formats in various sources; keeping score of which information is updated can be difficult. According to the documentation team in the case company, the copy and paste -method in Microsoft Word can duplicate pieces of content, but there is a possibility that an outdated version of information "starts living its own life" (see data excerpt 3) within the documents. This is due to the limitations of linear documentation: each document is unique.

The CCMS software enable creating a single source of information that can be assembled into separate documents. The modules in structured documentation, if managed properly, hold updated information that updates in every publication the module appears in. This applies to minor pieces of information such as names of the products or particular parts, or more broad information organisms, depending on the information architecture. These programs also enable having access to and being able to monitor revision history. Organizing the information in a structured way might also decrease the costs of translating content. "As the structure of the DITA XML content remains the same in the translation process, this solution is also language-independent" (Heinonen et al., 2022, p. 12). In the case company, the Word-documents were occasionally translated as unique entities, even though they shared similar words, sentences and even paragraphs. This might lead to unnecessary translation, which can be avoided with structured documentation. A module only needs to be translated once (to a specific language) for it to exist in multiple publications.

If an organization develops a single-sourcing strategy, it gains time to for example work more closely with their content and gain customer understanding from their experiences (Hackos, 2007, p. 19). However, "storing content for reuse requires rigorous maintenance so that any piece of content has exactly one location and can be easily located by the writers" (Van Laan & Hackos, 2012, p. 146), which means that the information structure has to be carefully planned. Because of the need for vast amount of support during the information architecture phase of the deployment of a CCMS, it was decided that the topic should be included in the requirement specification. According to the Information Process Maturity Model, introduced earlier in this paper, mature organizations plan their projects well and have solid processes in place. Now that the organization members better understand the demand for united processes and standards in order to create effective information products, they may develop and transition to the next level of the IPMM (Hackos, 2007, pp. 31–37).

All CCMS software have solutions for work rotation. Collaborative writing tools in them allow reviewing and commenting on other writers' work so that the outcome is as effective as possible. According to the Cisco Systems (a worldwide technology giant) midyear report from the year 2010, more than 75 percent of those who took part in the research agreed that collaborative writing is critical to the success of their job (Cisco Midyear 2010 Security Report, 2024). Collaboration allows for a wider knowledge base to have an impact on the document, might improve communication among employees and for example motivates employees to help organizations grow and develop (Markel & Selber, 2018, pp. 62–80). According to Markel and Selber, it does however require more resources, namely time and therefore money, than individual writing. Because structured writing enables reuse of the content, I would argue that changing from linear to structured documentation may allocate time from actual writing to collaborative writing and reviewing of documents. Especially when an organization's documentation has a considerable amount of reusable content, for example their products have similar parts, this should be considered in the process.

In the case company the information was scattered and the technical writer(s) relied on their memory in order to gather required content for publications such as user manuals. According to the interviewees' responses, keeping track of the latest versions of the documents and their completion is time consuming because of this unclear structure of information. The change from linear to structured documentation does not only change the ways in which content is being authored, but it also plays a significant role in all the stages of content management. Because the CCMS software enable organizing information in a structured way based on the

organisation's needs, technical writers do not have to rely on their memory in order to find the "most recently updated" source of information. This architecture of information can however be time consuming because the software work very differently compared to the tools that enable linear documentation. Implementing structured authoring within an organization and converting the existing documents takes time (Van Laan & Hackos, 2012, p. 145). Some service providers offer either internal or external sources to support the successful deployment phase of their customers, but it is important for the organisations themselves to be able to adapt and learn.

Markel & Selber (2018, p. 189) state, that introducing structured authoring to technical writers before acquiring an XML-based CCMS software might be efficient during the process. Concentrating on redesigning the content and pursuing an efficient minimalist agenda may help when changing the authoring environment, but it also helps with organizing the content in a structured manner. The case company authorities had little prior experience of structured authoring and the CCMS software, but the more practical details concerning technical writing as well as the broader effects structured authoring has for an organization were discussed thoroughly during this research. It could be concluded that a better understanding of such software was one of the most important results of this research. The discussions and research interviews that led to the development of the requirement specification not only made the members of the documentation team aware of the actual capabilities of the software, but also shed light on the broad organisational changes that could entail. Additionally, assessing and critically reviewing and becoming aware of the current work processes raised important discussions within the organisation.

The co-creation of knowledge within the organisation involved processes of dialogue and reflection when it came to the current process of creating content. As previous participatory design research suggests, encountering situations in which individuals do not necessarily know what they want or have fear of change are common (Spinuzzi, 2002, 2005). Thematic analysis also acknowledges that each project is unique, emphasizing the importance of the context and specific goals of the project (Braun & Clarke, 2006, 2012, 2022). This research focused on the requirements for a CCMS software, but the interpretations and comprehensiveness of them evolved throughout the whole process. It would be misleading to suggest that the research followed a strict plan which resulted in a fixed solution for all the areas of development. Rather, the whole process of conducting the requirement specification functioned as a reflection of how technical communication is being enacted within the organisation and therefore contributed to

managing information development with more sound processes.

The best practices for technical documentation seem to derive from careful strategic planning to ensure the development of content the consumers of that information most need: according to multiple scholars planning beforehand seems to make a difference in content management (Blythe et al., 2014; Hackos, 2007; Markel & Selber, 2018; Van Laan & Hackos, 2012). Nevertheless, technical documentation practitioners and authorities responsible for distributing resources do not always recognize the importance of successful or efficient documentation. The "just get something out the door" mentality may actually work because of the lack of resources when it comes to technical writing. For example, justifying the possible time allocated to collaborative writing might be difficult if the organization does not recognize its benefits. Especially in the cases when user feedback is not gathered in a regular basis, the content management professionals may not recognize the areas of development in their information products, creating a very optimistic illusion that there is no need to develop it further. Information development managers are however responsible for being aware of the state of their own work processes and the best practices in their industry, so that they can be implemented in their own organisations (Hackos, 2007).

6. Conclusion

The research goals presented earlier in this paper were to determine the areas of development in the documentation process in order to tailor specific requirements for a CCMS software in the form of a requirement specification document. The professionals working in the case company were not previously familiar with XML-based content creation, having only worked with Microsoft Word. Gathering information within the organization and providing the company authorities with enough information about the topic in order to create requirements for a CCMS required active collaboration. Critical assessment and reviewing on both the current work processes and the company's needs for a structured authoring software resulted in a finished product that depicts a specific organization's requirements for a technical communication tool.

The results of this study add to earlier studies, but also provide knowledge. The lack of empirical research on technical communication, especially in the Finnish context, makes this research specifically relevant. A similar thesis has been written on requirements definition and system evaluation of a content management system for structured documentation (Kormu, 2020). However, the process of conducting the requirement specification differs notably between this research and theirs. In Kormu's thesis the requirement specification is conducted in collaboration with Etteplan, a company that creates solutions for businesses. It is possible that this paves way for misunderstanding, because the current work processes need to be carefully elaborated to someone who is not necessarily part of the organization. Because the requirement specification document should realistically reflect the organization's needs, I argue that the process can not be completely outsourced. However, leveraging external expertise may accelerate the implementation timeline of a CCMS. Ensuring collaboration throughout the whole process and that the final outcome is tailored to the specific context of an organization are the most vital points either way.

This research focused on the requirements an organization has for a possible solution for their technical documentation needs. The findings of this research, the requirements gathered for the specification document, provide answers and real-life benefits for a certain Finnish company. With the aid of this research the practices and policies enacted within the company were discussed, the areas of development in the documentation process were mapped and a requirement specification was conducted based on the data. The goal for the company is to be able to reuse content in an efficient way, to be able to create documents that are coherent in their content as well as design in their future technical documentation with the help of

structured authoring. The features of the most prominent component content management software, a system that enables structured documentation, will be compared and reflected with the findings of the data gathered. However, a person managing information-development should always remember that one solution does not fit all environments (Hackos, 2007, p. 19).

Based on this research, changing from linear to structured documentation might be a solution for certain problems in technical writing. With the help of implementing single-sourcing as a part of an organization's strategies, the duplicated and sometimes incorrect sources of information are eliminated, making the workflow more organized and less time consuming. Being able to update modules in multiple publications simultaneously is one of the most prominent differences to linear documentation; opening each file individually and updating information manually takes a massive amount of time when there are hundreds of documents that need to be updated. However, organizing the information in a structured way requires resources and commitment. Converting the existing documents takes time, depending on the amount of content. If the organization requires massive support during the deployment phase of a CCMS, they become exceedingly dependent on the service provider.

The CCMS software reviewed during this research differ tremendously from for example MS Word that was used in the case company. Learning to use these new tools requires commitment and patience; structured authoring contradicts with linear authoring in multiple ways as acknowledged in this study. The deployment phase of a CCMS also requires expertise and knowledge of its own. Thorough reviews of both the whole documentation process and the information products themselves have to be conducted in order to create a successful information architecture in a structured work environment. Because this study focuses on the processes before the implementation of a CCMS, future research should focus on these topics in order to gain more insight of the whole process of changing from linear to structured documentation.

Because of the rapid rate of development when it comes to the content management software, the requirements may differ tremendously compared to earlier studies. CCMS software, the XML-based solutions designed for technical writers, continue to develop and gain new features as technologies advance. Some service providers actively gather data from their customers in order to develop their product further; because these software require commitment from both parties (the client and the service provider) mutual understanding and communication is vital for success. The methodology of participatory design (Spinuzzi, 2005) applies in both defining

the requirements for a CCMS and the implementation of one, because they require active collaboration. Additionally, internal communication and willingness to pursue more sustainable methods of working within an organization are needed when it comes to changing the whole process of authoring and managing information.

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