TAMPEREEN TEKNILLINEN YLIOPISTO
TAMPERE UNIVERSITY OF TECHNOLOGY

TIIA TALA

# IMPROVING DOCUMENTATION QUALITY MANAGEMENT – A CASE STUDY

Master of Science Thesis

Examiner: prof. Samuli Pekkola
Examiner and topic approved by the Faculty Council of the Faculty of Business and Build Environment on 9.12.2015

# ABSTRACT

**TIIA TALA**: Improving documentation quality management – a case study
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Knowledge is an important asset for organizations to gain competitive advantage. As the amount of available knowledge has significantly increased in the last decades, also the importance of quality of knowledge has been emphasized. One common approach to manage knowledge in organizations is with documentation. Thus, as a part of knowledge management development activities, the purpose of this thesis was to suggest improvements to documentation quality management in the case organization. The ITSM (IT Service Management) documentation and the process perspective of documentation were chosen as the scope of quality improvement.

The research problem was examined by utilizing theoretical and empirical approaches. In the empirical approach, the current weaknesses, strengths, and improvement needs were gathered by using the Delphi method with three iterations. The Delphi method was conducted with the documentation management stakeholders, including participants from the organization, but also vendor side. As a result, the current state of documentation quality management in the organization was aggregated and analyzed. Based on these results and the theory, from three different improvement goals, seven improvement suggestions were presented for the case organization.

# TIIVISTELMÄ

**TIIA TALA**: Dokumentaation laadunhallinnan kehittäminen – case-tutkimus
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Diplomityö, 86 sivua, 6 liitesivua
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Avainsanat: Tietojohtaminen, Dokumentaation hallinta, Laadunhallinta, Delphi metodi

Tietämys on yksi merkittävä voimavara organisaatioille kilpailuedun saavuttamiseksi. Kuitenkin samaan aikaan kun tiedon määrä on kasvanut merkittävästi viime vuosikymmenillä, myös tiedon laadun merkitys on korostunut. Yksi laajasti hyödynnetty tapa hallita tietoa organisaatiossa on dokumentoinnin avulla. Tämän vuoksi, osana tietojohtamisen kehittämistä, tämän diplomityön tarkoituksena oli esittää parannuksia dokumentaation laadun hallintaan kohdeyrityksessä. Kehityskohteeksi valittiin dokumentaation hallinnan prosessinäkökulma, jota erityisesti tutkittiin IT-palveluiden hallinnan dokumentaation näkökulmasta.

Tutkimusongelmaa tarkasteltiin käyttämällä yhdessä teoreettista ja empiiristä lähestymistapaa. Empiirisessä lähestymisessä nykyiset heikkoudet, vahvuudet ja kehitystarpeet kerättiin käyttämällä kolmen kierroksen Delphi metodia. Delphi metodi suoritettiin dokumentaation hallinnan sidosryhmien kanssa, jossa oli mukana osallistujia organisaatiosta, mutta myös palveluntoimittajista. Empirian lopputuloksena esiteltiin kerätty ja analysoitu dokumentaation laadunhallinnan nykytilanne organisaatiossa. Empirian tulosten ja teorian perusteella, kohdeorganisaatiolle esiteltiin seitsemän eri parannusideaa kolmesta eri kehityskohteesta.

# PREFACE

This thesis was the last part of my master studies of information and knowledge management in the Tampere University of Technology. I have enjoyed my time in TUT and I will look back this as one of the best times of my life. Still I am really excited of the new opportunities and challenges that I will face from now on.

I want to thank the case organization for the opportunity to finalize my studies and conduct my master thesis from an interesting subject for them. I want to show gratitude my manager and co-workers for the support and help I have received during this process. I also want to thank the university, Tampere University of Technology, especially our professor Samuli Pekkola for all the advices he provided for my thesis.

I also want to thank the people that closest to me. My friends for all the support I have had and my parents for the belief in me and the passion for technology. I want to thank my brother for all the comments and help to polish my thesis on the last days. Finally I am grateful for my fiancé of all the encouragement during the thesis process but also during my studies. He truly managed to be the strongest pillar of support when it was needed the most.

Tampere, 25.05.2016

Tiia Tala

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## LIST OF SYMBOLS AND ABBREVIATIONS

| | |
|---|---|
| COBIT | Control Objectives for Information and Related Technology |
| DIKW | Data, Information, Knowledge, and Wisdom |
| DMS | Document Management System |
| ECM | Enterprise Content Management |
| ISACA | Information Systems Audit and Control Association |
| ISO | International Organization for Standardization |
| ISO 9000 | ISO Quality Management Standard Family |
| IT | Information Technology |
| ITIL | Information Technology Infrastructure Library |
| OGC | Office of Government Commerce |
| PDCA | Plan, Do, Check, and Act |
| TQM | Total Quality Management |
| WA | Weighted Average |

# 1. INTRODUCTION

## 1.1 Research background and motivation

Information enables us to make fact based decisions, as it helps to understand our surroundings. Thus information can be seen as an important asset for organizations. (Megill 2005) To utilize the benefits of information and knowledge, Information Technology (later IT) has been developed to provide efficient tools for manage them ever more efficiently (Becerra-Fernandez et al. 2014, p. 4). IT has also enabled the availability and amount of information to grow exponentially (Eppler 2015). This has created a phenomenon called information overload, which means that we receive more information that we can process with the time we have (Eppler 2015, pp. 217-218). This overload of information is visible in our everyday lives, for example in the amount of emails business users receive every day. According to a marketing research made by a technology market research firm in USA called The Radicati Group on 2014, business e-mail users received and sent an average of 110 e-mails per day and by 2018 the amount should grow to 140 per day (The Radicati Group 2014, table 2). Because of our limitations as individuals to utilize huge amounts of information, the greater availability and amount of information after certain point will not lead to better decisions. Instead it might disturb our actions. (Eppler 2015, pp. 217-218) Therefore all information we have should not even be attempted to be stored and shared (Megill 2005).

Still, because of the complexity and dynamic nature of corporate environment, there is a great need to gather and share quality information. The reason to provide quality information is to enable people to work and utilize the information more efficiently (Eppler 2015). This is one of the reasons information sharing can be expected to create value for companies (Megill 2005, p. 50). Also when information is used to create value, it can be seen to become knowledge (Awad & Ghaziri 2004, p. 8). The information overload and the simultaneous need for information creates challenges and makes filtering information according to the relevance ever more important. Thus when information is shared, the quality of the information and how we share this information should be considered. This way we also enable the share of knowledge.

When considering the knowledge that exists in organizations, there are different ways to approach it. In one approach, organizations knowledge can be seen to exist in two forms; as tacit knowledge in individuals and explicit knowledge in information systems and documents. Because explicit knowledge by definition should be able to be written down, it is sometimes called documented knowledge. (Awad & Ghaziri 2004) When considering explicit knowledge, documentation can be seen as a significant part of explicit knowledge

management activities, as it facilitates the knowledge storing and sharing within organizations (Debowski 2006). Documentation management activities are valuable in internal business processes, but also in communication with external business partners (Neal 2008). According to Neal (2008), investing in documentation management can be used to improve especially customer service and operational efficiency. Even though it is seen that developing documentation management activities would have potential for improvement, it is still more common for organizations to invest and try to make business more efficient with IT than with documentation management activities. (Neal 2008) Explicit knowledge management is also seen as an important part of knowledge management in the case organization and there is a need to improve the existing documentation management activities. As a part of developing these activities, the improvement of quality management of documentation was chosen as the target for this thesis.

An ideal way to manage knowledge is to share it regardless of organizational structures by efficiently utilizing technologies and established processes (Awad & Ghaziri 2004). Documentation management practices benefit from supporting technologies and processes, because only documenting and sharing essential and relevant knowledge is not enough for efficient documentation management (Gough & Nettleton 2010). As knowledge's value is dynamic, for example because of organizational changes, the significance of individual documents will also change over time. Document's value is also subjective, as a core knowledge for a person might not be that valuable for other people. Therefore to create some value from the documentation, they should be accessible and usable for relevant personnel at the right time. (Megill 2005, p. 42) Without using knowledge, the value of it is not realized. Therefore documents need a place where they can be stored and shared. All documents should be kept up-to date and when information is not relevant for the company anymore, it should be discarded. (Megill 2005) Still, the relevance of a document is often hard to determine, because even though the document is not up-to-date, it might be wanted to keep as a record or evidence of an event (Garris 2007). This management of the whole lifecycle of documented knowledge, from the creation to use and eventually to disposal, can be called documentation management. A sufficient management of documentation activities is also required to produce and maintain quality documentation (Debowski 2006). Therefore documentation should be managed efficiently for them to create value for organization. Also in this thesis the improvements for documentation quality management were examined from the point of view of documentation management.

## 1.2 Research problem

The aim of this thesis was to present possible improvements for the current documentation management activities of the case organization. These improvement were considered from the documentation quality management perspective. The scope of documentation

was limited to define IT service management (later ITSM) documentation of the organization. Therefore the research problem of this thesis was as follows:

*How ITSM documentation quality management can be improved in the case organization?*

The research problem was divided into several research questions:

- What is documentation and how it can be managed?
- What documentation quality means and how it can be managed?
- What kind of weaknesses, strengths and needs for improving document quality management can be found from the case organization?

These questions were used to provide a clear understanding and framework for the research problem in a way that answers to these questions can be utilized to create a solution for the research problem. The first two research questions were answered by using theory from relevant academic researches and publications to introduce the existing research and theoretical models related to the study. The third research question was answered with the empirical research, by investigating the current state of documentation quality management in the case organization.

## 1.3 Research goal and scope

The research goal was to present ways to improve quality of ITSM documentation management in the case organization. The document quality management improvement proposals were developed for the case organization, based on the challenges, strengths and needs for improvement in the organization. As the base of the study, it was stated by the case organization that there was dissatisfaction to the current situation of documentation quality management. For example there were no common definition that what was expected in a quality perspective from documents and how to manage the quality of these documents. As there was no a single quality improvement target area defined for the thesis, the approach for the quality improvement was gathered from the documentation management process stakeholders. To solve the research problem, the current state of documentation quality management was examined and theoretical methods and practices from theoretical perspective were presented to support the improvement suggestions.

As the thesis was a case study, the document quality management improvement practices were considered primarily from the point of view the case organization. The case organization is a large global manufacturing organization operating around the world and the organization's documentation management, during the thesis process, was conducted in a multiple different information systems that consisted of multiple different document types and structures. The ITSM documentation in scope were created and used by the organization, but also by different vendors providing IT services for organization. As

these documents were managed digitally, the thesis considered only the management of digital documents that are part of ITSM documents.

As documentation management is considered as a part of knowledge management, knowledge management frameworks can be used to explain the scope of the thesis. Knowledge management can be divided into three different components as it can be seen as a combination of people, processes and technology (Awad & Ghaziri 2004). These components are also presented in figure 1. All these affect knowledge management and should be considered when planning knowledge management activities.

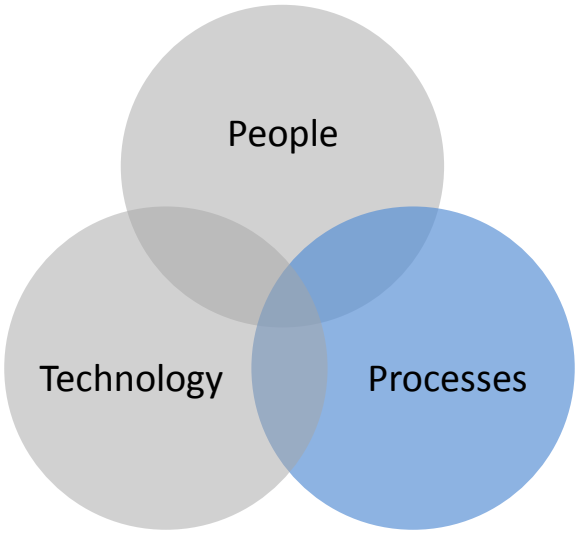


***Figure 1.*** *Knowledge management components (Adapted from Awad, and Ghaziri, 2004, p. 3).*

As the aim of this thesis was to improve document quality management from the point of view of processes, the focus when presenting knowledge management was on the process component. The technology and people were not chosen in the scope of improvement activities, but they were still considered as the factors that also affect the processes. In this thesis, knowledge management process was viewed from asset point of view thus knowledge was considered as assets that can be gathered, moved, stored, modified, and discarded in a process (Debowski 2006). This supports the improvement of documentation management activities from the process point of view.

The main theoretical scope of this thesis was documentation management as part of knowledge management. The other main defining scope was on quality management. The empirical research was conducted and based on documentation quality management perspective. The whole theoretical scope was presented in figure 2. The same areas are also reflected in the in the structure of the thesis (see figure 4). The knowledge management theory was used to create foundation for the documentation management theory and understanding on the study area. The quality management theory was gathered mostly from knowledge and information quality management studies, which was used as a base for understanding the documentation quality management. The solution for the research

problem, the improvement suggestions, was built by combining both theoretical frameworks and empirical research results.

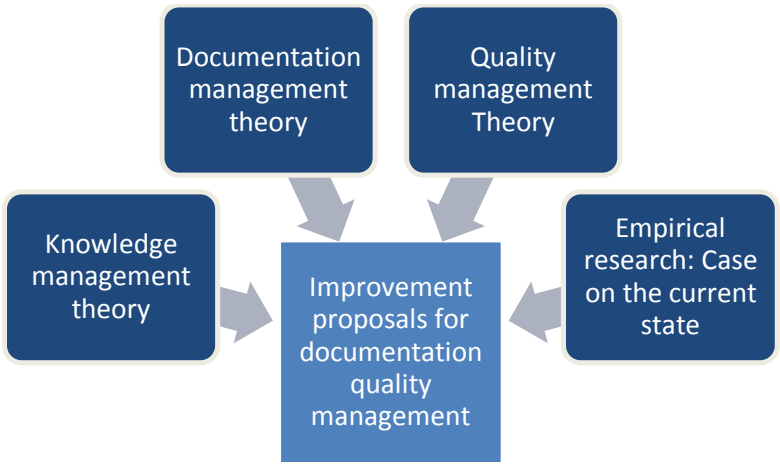


***Figure 2.*** *Research scope and goal*

Information management and knowledge management are sometimes used as synonyms or their scope is overlapping in the area of explicit knowledge management and documentation management. The positioning of documentation management in literature has not been clearly scoped between these two study areas (as explained in chapter 2). In this thesis documentation management was defined as part of knowledge management because of documentation management was also defined to be part of knowledge management in the case organization. As organization's IT processes are based on ITIL-standard, the definition of knowledge management in ITIL was utilized in this thesis. Information management research and studies were used as reference, when they were in scope of explicit knowledge management.

## 1.4 Research methodologies

Behind every research there are a philosophical questions and assumptions that affects the way the research is made. Choosing a philosophical framework might not always be conscious, because it might come from ones previous assumptions and experience. Still it is important to critically evaluate how different methodologies will affect the research and choose the best fitting approaches. (Hirsjärvi et al. 2007, pp. 125-127) In this thesis, the research methods were collected and introduced in Figure 3. The approach was adapted from the layered onion model of Saunders et al. (2009). In the model, the research methodologies can be considered to fulfil each other and the build up a base assumptions for the research.

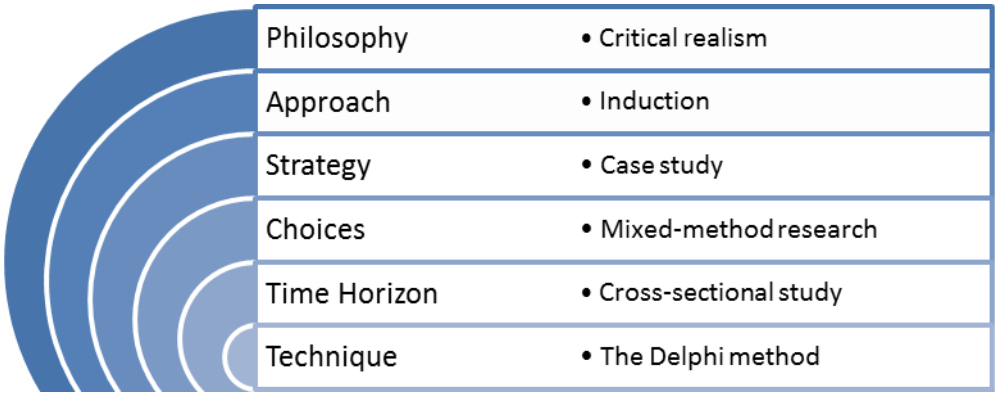


***Figure 3.*** *Chosen research methodologies (Adapted from Saunders et al. 2009)*

The researcher was working in the case organization during the study, which might imply that there were some pre-assumptions about the current situation. Still the aim of the research was to be as objective as possible and consider the problem as an outsider. In realism, as a research philosophy, the situation and objects are considered to exist even without the researcher and what researcher observes from reality can be considered as the truth (Saunders et al. 2009). In practice this truth is interpreted by the researcher which might affect the view of reality in the research. Critical realism as a research philosophy also considers the context of the research and admits that it is possible that research result might be affected by misinterpretation. (Saunders et al. 2009) This is suitable research philosophy, when the aim is to conduct objective research, but still considering the possibility for mistakes. For these reasons the chosen research philosophy in this thesis was critical realism.

The main goal was to develop an adapted solutions for the case organization, but the needs and pre-assumptions of the situation today were not wanted to be taken into consideration in the research. The solution was built on the findings made in the case organization and the research process was not wanted to be a limitation for the research. Therefore there was a need to find a flexible research approach to determine the current situation. According to Saunders et al. (2009, p. 127) inductive research approach is suitable for research where purpose of it is to explain some situation or problem, because it does not limit the researcher with certain research structure. Inductive research approach allows the research to adapt to the changes or alternative solutions that might appear during the research process. (Saunders et al. 2009, p. 127) To be successful, research done with an inductive approach needs a clear research purpose, but the theoretical framework does not need to have an exact definition. (Saunders et al. 2009, p. 490). Therefore inductive approach fitted to the needs of this thesis.

Because this thesis used a single organization as scope for the research, a case study was a natural choice for this purpose. According to Hirsjärvi et al. (2008) case studies are often used to study processes and individual cases that are closely related to their context. The subject on a case study is a case scenario or group of cases, and the aim of it is usually

to present some kind of a phenomenon. (Hirsjärvi et al. 2008) A case study strategy includes an empirical study which emphasizes the importance of a context to the research. This means that the research scope needs to be clearly defined. Also different data sources and collection techniques are often needed to be used in a case study. This way the research can have broader approach to the case study. (Saunders et al. 2009, p. 146) Yet, because of the one of limitations of this thesis was resources, only one research techniques was chosen, but it was chosen to provide an approach that was broad enough.

Quality and relevance are quite subjective depending on the purpose and usage of documents, therefore it was justified to include the experiences and opinions of documentation management stakeholders in the research. The research did not want to limit the answers only to restricted questions, therefore qualitative research methods are suitable for this research. Qualitative study methods are also emphasized in inductive research approach (Saunders et al. 2009, p. 127). The purpose of qualitative research is to consider the gathered material from several different point of views instead of testing already made hypothesis. Therefore we can define that the qualitative research objective is to revel unexpected results (Hirsjärvi et al. 2007). Still when using both, qualitative and quantitative research methods, it is more likely to find unpredictable solutions (Saunders et al. 2009, pp. 153-154). Quantitative study methods are closely related to realism and can be interpret as objective study methods, because the end results can be explained with logical reasoning. Therefore selection of the right sample of people to represent the research scope is essential in quantitative research. One characteristic of quantitative research is that the results can be presented in a table and the results can be analyzed statistically (Hirsjärvi et al. 2007, pp. 135-137).

Qualitative and quantitative study methods can be seen to complete each other, for example by visualizing different meaningful phenomena with numbers (Hirsjärvi et al. 2007, pp. 132-133). Mixed-method research refers to the choice of using both quantitative and qualitative data gathering and analyzing methods together to get the benefits of both research methods. In mixed-method research, study and analysis methods are not mixed, thus quantitative data is analyzed with quantitative and qualitative data with qualitative analyzing methods. (Saunders et al. 2009, pp. 153-154) This study method was chosen, because the result of the research did not wanted to be limited to one of these methods. Also the benefits from the both methods, the objective approach with logical reasoning but still the ability to be flexible and gather broader vision of the situation was needed.

The goal of this thesis was study the present situation, because considering a longer period of time was not seen to bring any benefits for the research. In this case, cross-sectional study strategy was a natural choice as a time horizon, because cross-sectional study strategy means that the research is concentrated on a particular time and phenomenon in one organization (Saunders et al. 2009, p. 155). Empirical research method called the Delphi method is a good tool to be used in situations where there is need for better understanding of some phenomenon (Skulmoski et al. 2007). The Delphi method of the first decade was

mostly used for forecasting. Today common applications of the Delphi method, for example in information system research, is to develop concepts or frameworks or forecast and issue prioritization or identification. (Okoli & Pawlowski 2004) The Delphi method is an efficient and flexible tool in cases when the goal is to gather more knowledge about problems and opportunities (Skulmoski et al. 2007).

The Delphi method uses a group of people that have a good understanding of the situation to generate a consensus of the answer to the research topic (Saunders et al. 2009, Skulmoski et al. 2007). Because the Delphi method results are based on the expert opinions, the point of choosing the most suitable experts in the panel can be seen as one of the most important part of the research (Okoli & Pawlowski 2004). The Delphi method can be divided into different iteration rounds:

1. In the first iteration the chosen experts will answer to clearly explained questions about the research subject area. The experts also need to provide a justification for their answers. (Awad & Ghaziri 2004) These answers will be analyzed without giving any weight on the matter who has given the answer (Skulmoski et al. 2007).
2. In the second iteration, the experts are given a summary of the answers collected from the previous iteration. Knowing the answers of the others, the experts can choose to change their answer or keep their previous answers and then give reasons for their decisions. (Awad & Ghaziri 2004) The purpose of this round is to give the panelist a chance to change their answer according to the new information they are given (Skulmoski et al. 2007).
3. From the third iteration forward, the second iteration is repeated as many times as it is needed. In the end, these answers are collected in a summary. In this way a consensus between the experts can be achieved and the answers that are not mutually agreed opinions can be discarded from the end result. (Awad & Ghaziri 2004) This iteration can be called as a controlled feedback (Skulmoski et al. 2007).

Because the next iteration depends on the analysis made on the previously received answers, the Delphi method allows to adapt the questions in the following iterations. This makes the Delphi method more dynamic and helps to gather more profound understanding about the research problem. (Okoli & Pawlowski 2004).

The Delphi method results are based on the expert opinions, therefore the point of choosing the most suitable experts in the panel can be seen as one of the most crucial part of the research (Okoli & Pawlowski 2004). It is also important to consider how and in which context the questions are presented, because wrongly positioned questions might affect to the common understanding of the subject area and thus to the accuracy of the answers. The Delphi method allows the respondents to be anonymous for the other attendees. (Awad & Ghaziri 2004) The method does not require the experts to meet physically, which is also beneficial in when using experts around the world (Okoli & Pawlowski 2004). This research method was chosen because of these benefits for this research. To

gather a broad view of the situation, the experts chosen for this research were not wanted to be limited to the same place as the researcher was. Furthermore some more sensitive problems or challenges can be found when the participants can be anonymous.

The theoretical base for this study was collected from various related literature and research. The purpose for presenting theoretical background was to create an understanding about the subject and previous studies in the research scope. The theory was gathered to state the main frameworks, common study areas and results of previous researches. The theoretical base should be created by combining timely and relevant knowledge that is critically evaluated. It is also important to explain the main term used to avoid misunderstandings. (Hirsjärvi et al. 2007).

## 1.5 Research structure

The thesis was divided into four different parts: introduction to the subject, theory based on literature, empirical research conducted in the case organization, and result developed based on the theoretical and empirical parts (see Figure 4).

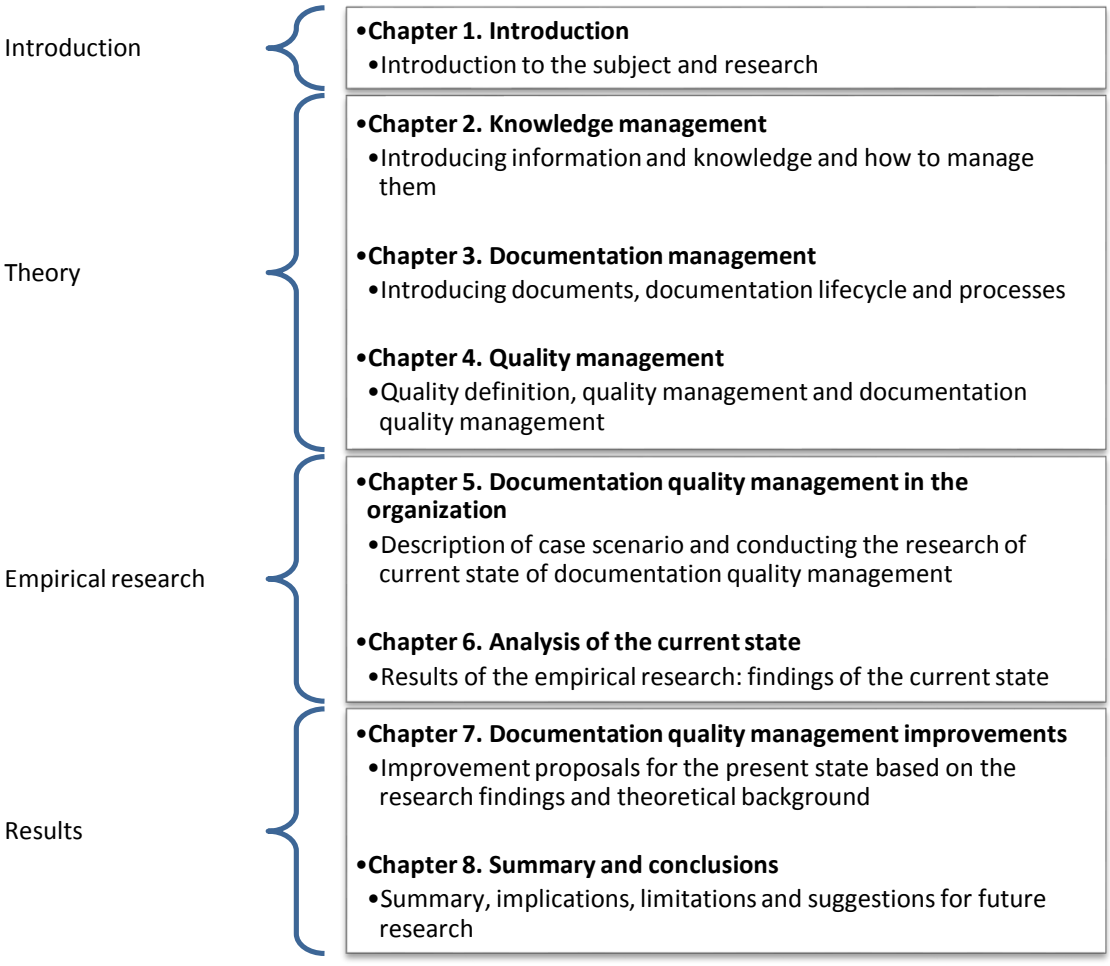


***Figure 4.*** *The structure of the thesis*

The purpose of the introduction was to define the subject, explain the goal and significance of the research and to create the research plan. One important part of the introduction was to present the background of the research, research problem and questions. Also the research scope and research methodologies were chosen as a context for the research.

In the theoretical part, the literature was presented from relevant previous research related to the study subject. This part was divided into three chapters; knowledge management, documentation management and quality management. The relevance of the literature was evaluated for example by the timeliness and the scope of the material. The used material was collected from different scientific databases and libraries, like Science Direct, Scopus, ProQuest ebrary, and Google Scholar by combining related search words; "Document", "Documentation", "Knowledge", "Quality", "Process" and "Management" .

The empirical part includes the planning and performing the research and analyzing the empirical research outcomes. Explaining the case scenario and research process was important for understanding the context of the research. In this part, it was also essential to consider the limitations and challenges that might appear during the research. In a research plan, it was important to define and choose the correct target group and define accurate research questions to reach the goal of the research. In this thesis, the used research technique was Delphi method. In the planning phase also recruiting people for the research was important. The participants chosen as document quality management experts for this research were the documentation management stakeholders: the people that are creating, approving and using the defined documents inside and outside the organization. Three iterative rounds were used to gain consensus within the research groups. The answers from each round were gathered and analyzed and the results were presented as answers to the questions presented in empirical research.

The last part of the thesis was to propose improvements for the organization according to the analysis made in the empirical research part and by using theoretical frameworks presented in the literature review. The developed solutions utilized the strengths and improve weaknesses that were found in the analysis. In the end, the presented improvements and the results of research were evaluated.

# 2. KNOWLEDGE MANAGEMENT

## 2.1 Knowledge and information

Knowledge is an important resource for organizations as it enables organizations to run their core business (Awad & Ghaziri 2004, p. 146). It is argued that knowledge is also the most important tool to endure and compete in ever more global and competitive business environments (Davis et al. 2005, p. 5). However individuals receive more information that they are even able to utilize. Thus with efficient knowledge and information management, organizations are able to gain competitive advantage by managing these extensive knowledge flows. (Lee & Yang 2000, pp. 784-785) Because of the tangible nature of knowledge, the management of knowledge cannot be applied the same meanings than the other organizational assets. Unlike other assets, the amount of knowledge does not decrease or knowledge is not lost when shared, but actually it increases and it gains more value. (Gasik 2011, p. 26; Megill 2005, pp. 6-7). This means that knowledge needs separate management methods, tools and practicalities to be effectively utilized.

To understand how to effectively manage and bring value from knowledge, the context and nature of knowledge should be defined. One commonly utilized model to present the nature knowledge in knowledge and information management theory is the DIKW (Data, information, knowledge and wisdom)-hierarchy presented in figure 5 (Rowley 2007, p. 164). The DIKW-hierarchy divides knowledge in separate levels, providing a context and describes the relations and processes of different levels from data to wisdom (OGC 2007a, p. 146; Rowley 2007, pp. 164-165). DIKW-hierarchy is sometimes also called as knowledge hierarchy or information hierarchy (Rowley 2007, pp. 164-165).

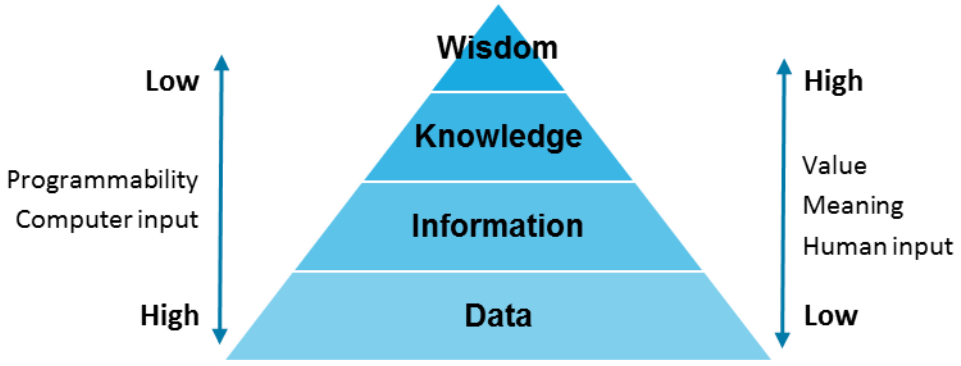


***Figure 5.*** *DIKW-hierarchy for the knowledge levels (Adapted from Rowley (2007), p. 176)*

Data is about raw unprocessed facts and statements about some subject event in unorganized form (OGC 2007a, p. 146; Awad & Ghaziri 2004, p. 36; Berztiss 2001, p. 438).

It can be defined as symbols, pieces of information, or observations about events, environment, or objects (Becerra-Fernandez et al. 2014, p. 4; Rowley 2007, p. 166). Data is highly depended on computer input (Rowley 2007) and because it does not have any contextual meaning, it is also highly certain (Berztiss 2001, p. 438). Data has the lowest value of the levels of information, because it cannot be used as it is (Wiggins 2012, p. 48). But as data is highly programmable, it can be collected together to create numerical and statistical information and it is usually managed with information systems (Becerra-Fernandez et al. 2014, p. 5; Wiggins 2012, p. 48).

Unlike data, information contains understanding about the context and relations and it is related to some meaning or purpose. Information can be created by aggregating formatting data in a form that it can be interpreted. (OGC 2007a, p. 146; Awad & Ghaziri 2004, pp. 36-37; Lee & Yang 2000, p. 783) When defining information, it can be said to be data that has a context and purpose (Becerra-Fernandez et al. 2014, p.4). Therefore information can be seen as facts or description of a certain subject or as an answer to a question (Wiggins 2012, p. 48; Rowley 2007, p. 166).

Like information can be derived from data, also knowledge can be refined from information (Awad & Ghaziri 2004, p. 37). Knowledge can be developed when information is tested, interpreted, analyzed or applied in a certain context (OGC 2007a, p. 146; Debowski 2006). In ITIL v3's definition of knowledge, it exists in people in a tacit form as their experiences and values (OGC 2007a, p. 146). When thinking of creation of knowledge, it can be argued that knowledge is crated with induction and information with deduction (Berztiss 2001, p. 438). If two different organizations have the same information, the result of evaluating it might be different. This is because knowledge is often received with experience, which means that for information to be knowledge, it needs awareness or familiarity of that gained fact (Wiggins 2012, p. 48). Therefore knowledge can be seen as a combination of information, experience and skills (Rowley 2007). Thus knowledge is needed to use information (Berztiss 2001, p. 438) and knowledge in somebody's perspective can be information for somebody else (Lee & Yang 2000, p. 783).

Wisdom is in the top of DIKW-hierarchy and it has the most valuable knowledge asset in an organization (Rowley 2007). Wisdom can be defined as an awareness of certain context and it has the highest level of understanding and context of the knowledge levels. (OGC 2007a, pp. 146-147). Wisdom is the most valuable level of knowledge and its value comes from able to create and apply solutions, interpretations and answers to questions and problems. Thus wisdom increases efficiency and quality when making decisions. Wisdom can be also seen as utilization of previous levels; how knowledge and information are used and what judgements can be made according to them. (Rowley 2007)

The knowledge levels also imply that knowledge can be created from information and data, which means that knowledge can be created with a process of refining data to information and information to knowledge (Gao et al. 2008, p. 10). When going up to the

DIKW-hierarchy, the uncertainness grows while human input and the value increases (Rowley 2007; Berztiss 2001, p. 438). Thus when there is a need to gain knowledge or wisdom, it is crucial to understand the importance of human involvement. Even though it is common to use DIKW-hierarchy to define these levels of knowledge, there are still differences of how these levels are interpreted. One reason for this is that information and knowledge has been studied on different theoretical frameworks and study areas, a common definitions of the nature information or knowledge has yet been created (Rowley 2007).

Other common way to define knowledge, is to divide knowledge into two types; tacit and explicit knowledge (Wiggins 2012, p. 36). This divination to tacit and explicit knowledge and the dynamics between them was introduced to knowledge management by Nonaka and Takeuchi (1995). Tacit and explicit knowledge can sometimes also be called as know-how and know-what (Awad & Ghaziri 2004, p. 47). Tacit knowledge is personal knowledge within people and gained with experience (Choo 1996, p. 334; Nonaka & Takeuchi 1995, pp. 9-10). Because of its nature, it is hard to articulate to other people or formalize (Lee & Yang 2000, p. 784; Choo 1996, p.334). As tacit knowledge is hard to explain and it cannot be documented and shared as easily as explicit knowledge can, it creates its own challenges on knowledge management (Debowski 2006, p. 18). Tacit knowledge is also more difficult to find and reserve within organizations. As it can only be stored inside people, it also might be easily lost from organization with employees without sharing it. (Debowski 2006, p. 18; Awad & Ghaziri 2004, p. 47). Common way to share tacit knowledge is through human-to-human communication and teaching (Awad & Ghaziri 2004, p. 47). Explicit knowledge, unlike tacit knowledge, is formal knowledge (Choo 1996, p. 334). Because of its form, explicit knowledge is easy to articulate and it can be easily captured and shared through documents, databases and other records (Rowley 2007, p. 174; Lee & Yang 2000, p. 784). Explicit knowledge is knowledge that can be documented and shared without direct contact with another person or organization (Awad & Ghaziri 2004, p. 47; Lee & Yang 2000, p. 784). The relationship between explicit and tacit knowledge should be understood, since transferring knowledge from tacit to explicit form to create new knowledge is important for organizations (Choo 1996, pp. 334-336). When considering the levels of knowledge on an organizational context and from managerial perspective, there is usually a need to have more specific explanation and differentiation between the types of knowledge to define the whereabouts and usage of knowledge.

## 2.2 Knowledge in organizations

The knowledge that exist and is used in organizations can be called organizational knowledge (Debowski 2006). Organizational knowledge can be also considered from different perspectives. Debowski (2006) defines organizational knowledge as combination of individual knowledge, tacit and explicit, within people and corporate knowledge in e.g.

information systems and archives (Debowski 2006, pp. 18-19). Davis et al. (2005) presents organizational knowledge from two different perspectives, from pragmatic view and system theoretic view. Also in Davis et al. (2005)'s approach, the division between the knowledge of individual people and knowledge in documents, systems and processes is taken to specify the knowledge inside an organization (Davis et al. 2005). These two perspectives are used to explain the knowledge in organizational context. The organizational knowledge as presented by Debowski (2006) is illustrated in figure 6.

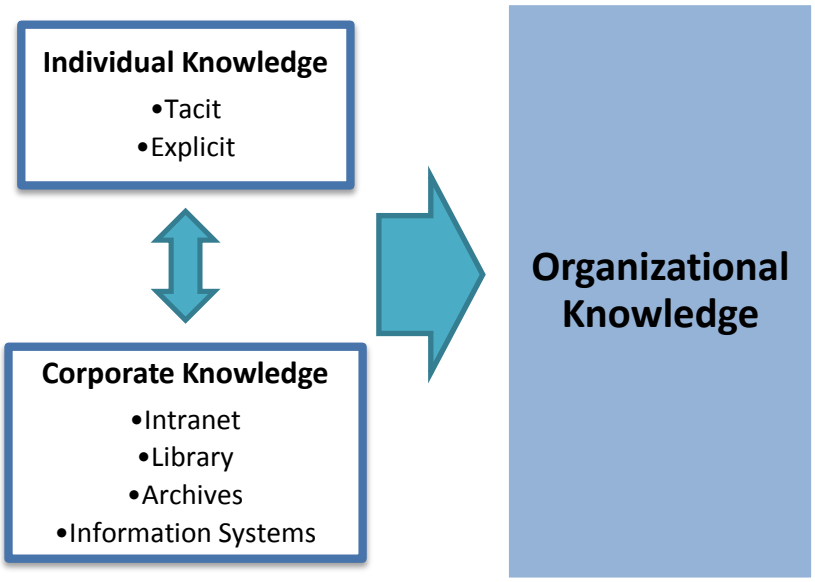


***Figure 6.*** *Organizational knowledge (Adapted from Debowski 2006, p. 19, figure 1.2)*

Because of knowledge usage in operational work or exchange between different parties in organization, knowledge as an asset might remain in organization even after the individual that had initially had the knowledge leaves the organization (Berztiss 2001, p. 438). Knowledge assets can be stored within organizations processes and applications and employees can store tacit knowledge within skills, experiences and competences (OGC 2007a, p. 215). Still, the creation of new knowledge emerges from individuals and interactions between them (Nonaka & Takeuchi 1995, p. 13). Explicit and tacit knowledge can also be transformed to another form, with externalization and internalization (Davis et al. 2005). Because tacit knowledge is easy to lose, organizations often try to transfer tacit knowledge into explicit corporate knowledge, for example in form of policies, process definitions or analytical methods (OGC 2007a, p. 215).

The Debowski (2006)'s approach to the organizational knowledge defines the sources and storages of knowledge within an organization. Davis et al. (2005)'s perspectives considers the division emphasizing more in the point of view of the knowledge management process. When considering the organizational knowledge in the process perspective, the divination of explicit and tacit knowledge is more distinct (Davis et al. 2005). Davis et al. (2005) explains ways how to approach organizational knowledge from two different views; in system theoretic view and in pragmatic view. In the system theoretic view, the

source of knowledge are e.g. documents, systems, processes and the knowledge is considered as explicit knowledge. In pragmatic view, the knowledge is seen in tacit or intuitive form that exist only in people and communities. (Davis et al. 2005)

These divisions of knowledge are quite similar and use the same terminology, explicit and tacit knowledge, is also used to support the definitions for organizational knowledge. Still there are some fundamental differences of how knowledge is viewed in these models. If knowledge is examined from pragmatic view and knowledge is defined to be tacit in nature, knowledge can only be created by interpretation which depends on that person's previous experiences and knowledge (Davis et al. 2005). When this approach is taken, knowledge cannot actually be managed by anyone else than by the individuals themselves. In this case the knowledge management can be seen as the individual's own responsibility which might make knowledge management practices irrelevant for companies. (Wiggins 2012, p. 49) In cases when knowledge is viewed from pragmatic view, the explicit knowledge, as defined earlier, can be seen as information in nature (Rowley 2007, p.178). This is one of the reasons that knowledge and information as concepts are mixed with each other or used as overlapping definitions when information word is replaced with knowledge (Wiggins 2012, p. 49). Some researchers do not even separate knowledge and information as terms, because of the difficulty of separating them from each other (Singh 2007, pp. 170-171). Thus sometimes knowledge management can also be seen to include data and information management activities (Wiggins 2012, p. 36).

These previously presented Debowski (2006) and Davis et al. (2005)'s approaches separates the knowledge sources and storages to people and system and the knowledge types to tacit and explicit knowledge. Even though the approaches are quite similar, there is still a differences of how knowledge is viewed and how explicit knowledge is seen to be placed in an organizational perspective. According to these approaches, explicit knowledge can be found and stored in people, but also in a documented form. These two different models show, that there are different understanding of explicit knowledge in theoretical researches therefore explicit knowledge's placement has not been clearly defined between information and knowledge management as illustrated in figure 7.

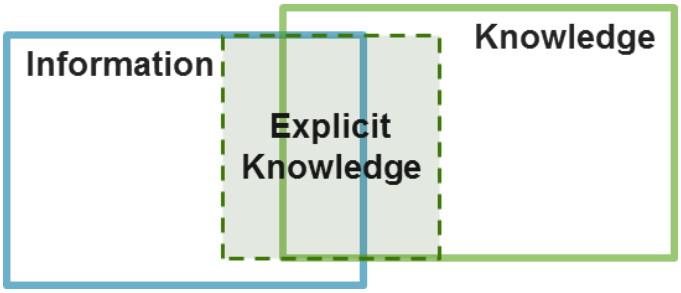


***Figure 7.*** *The scope of explicit knowledge in theoretical literature*

Because there are different approaches to explicit knowledge but also to the definition of knowledge and information, there is a need to define these expressions in the context of

this research. Because explicit knowledge has been closely connected to documents (Singh 2007), also in this thesis documents are defined as explicit knowledge. Still, for example ITIL v3 standard takes more of a pragmatic view of knowledge and defines that documents are a way to store information in knowledge management activities (OGC 2007a, p. 146). Even though in this research explicit knowledge is considered more complex than information, explicit knowledge can be seen in literature as a part of both, information and knowledge management (Singh 2007), as knowledge from system theoretic view and information from pragmatic view. Therefore selected literature from both different areas of research are utilized to explain explicit knowledge management and especially documentation management practices. For the sake of clarity, knowledge and knowledge management are used as the terms to explain the main scope of the research.

## 2.3 Knowledge management definition and purpose

According to ITIL v3, knowledge management scope includes the management of knowledge, but also information and data when they are used to refine knowledge (OGC 2007a, p. 145). Because there are different ways to define the term knowledge itself, also knowledge management has different approaches depending on the context it is presented. Knowledge management can be approached from the DIKW-model, by defining that knowledge management's purpose is to manage these levels and refine knowledge from data and information (Rowley 2007). Knowledge management can also be approached from asset point of view that defines knowledge as an asset that can be managed and transferred within an organization with different knowledge management activities (Debowski 2006, p. 16-17). For the sake to approach documentation management from process perspective, as defined earlier, knowledge is viewed from asset point of view.

The interest in knowledge management has increased by the formation of more demanding and challenging organizational environments (Davis et al. 2005, p. 4). According to Awad and Ghaziri (2004, p. 14) one important driver for knowledge management in organizations is a need to increase the performance and value of work processes. The other is a need to be agile and to react quickly on environment changes. (Awad & Ghaziri 2004, p. 14). To achieve these competitive advantages, knowledge management practices are about using the organizational knowledge to making better decisions (Singh 2007, p. 173). Knowledge management aim is to allow the right people to access the correct information when it is needed to make fact based decisions but also to avoid repeating similar mistakes (OGC 2007a, p. 146). Knowledge management pursues to close the gap of communication between those that have knowledge and those that need it, aiding knowledge workers to provide knowledge for decision makers (Singh 2007, p. 177). Thus the ultimate goal is to make better decisions based on quality knowledge, but also to improve the efficiency of organization by reducing the need to rediscover knowledge (OGC 2007a).

In order to be successful success, knowledge management activities should be closely aligned with organization's strategy and goals (Rubenstein-Montano et al. 2001). and knowledge management practices should be adapted to organizations. Therefore knowledge management practices and purposes may differ from organization to organization (Singh 2007, p. 177; Rubenstein-Montano et al. 2001). In a business organization, the purpose of knowledge management is usually to provide an appropriate working environment, manage and facilitate the working of knowledge workers (Gao et al. 2008, p. 13). The different types of organizational knowledge, the explicit and tacit knowledge, should be taken into account when planning knowledge management activities in organizations. This means that knowledge management strategy should involve the management of the organizations explicit knowledge, but also the facilitating organizational learning and flow of tacit knowledge between individuals. (Gao et al. 2008, p. 11; Singh 2007) Because knowledge management should be developed to manage organizational knowledge internally and externally (Rubenstein-Montano et al. 2001, p. 5), all important knowledge contributors and needs should be considered in the design of knowledge management activities.

The improvements in recent decades in IT sector has provided various solutions to manage organizational knowledge. These developments have also increased the interest in knowledge management area. (Davis et al. 2005, p. 4) Therefore it is understandable that system orientated view, with emphasis on technology, is the most commonly chosen approach to knowledge management (Freeze & Kulkarni 2007, p. 94). IT has been closely connected to knowledge management, because of the possibilities and tools it offers to knowledge management activities.IT can be used support knowledge management when there is a need to store and provide access to knowledge for knowledge workers. (Wild & Griggs 2008, p. 496) For example, e-mail, instant messaging and intranets have provided efficient ways for organizations to share and transfer knowledge (Singh 2007, p. 175). Still organizations should not consider the knowledge management practices only as IT problem (Rubenstein-Montano et al. 2001). IT can be seen as an important enabler of knowledge management activities, but it cannot be used to solve all knowledge management related problems, because of its own limitations (Davis et al. 2005, p.12). By emphasizing knowledge management activities only to technology related solutions, limits the scope of knowledge that can be managed with knowledge management process (Freeze & Kulkarni 2007). This is the case with tacit knowledge, as some personal knowledge cannot be stored as corporate knowledge and expert skills or understanding are hard to be computerized (Berztiss 2001, p. 439). This creates distinct issues in organizations and the challenges to transfer this kind of knowledge are visible everywhere (Deloule 2009, p. 78). There are also challenges in utilizing IT in knowledge management to efficiently extracting knowledge from knowledge sources and generating knowledge, but also applying and evolving of knowledge (Wild & Griggs 2008, p. 496-498). Therefore IT should be seen as enabler or facilitator, not as the main scope of knowledge management (Singh 2007, p. 175).

## 2.4 Knowledge management process

Knowledge management is a process of managing the individual knowledge in knowledge workers and professionals, but also corporate knowledge in organizations (Gao et al. 2008, pp. 11-12). One knowledge management's target is to transfer individual knowledge to corporate knowledge, with gathering and formalizing knowledge whiting organization (Berztiss 2001, p. 439). Also the aim is to internally create or acquire from external sources new knowledge for organization (Wild & Griggs 2008, p. 495). To achieve these goals, it is essential that all necessary knowledge is available and utilized (Singh 2007, p. 177). Knowledge capturing to IT systems will help with the accessibility of knowledge, but even if knowledge is accessible, it does not yet mean that knowledge is used (Berztiss 2001, p. 439). Knowledge should be stored for the purpose that it will be useful for some other person in the organization (Taskin & Van Bunnen 2015, p. 159). Therefore before designing knowledge management process, there needs to be an understanding on where the knowledge will be utilized (Berztiss 2001, p. 439).

Because there is no standard framework for knowledge management, there are several different ways to present knowledge management functions in organization. ITIL v3 defines that in knowledge management, an organization should concentrate on retrieving, sharing and utilization of knowledge (OGC 2007a). In all of these three parts, the value of knowledge is refined. Similar categories can also be found from other definitions of knowledge management process. For example, Gao et al. (2008, p. 3) define these as acquisition, transmission and use of knowledge and Awad and Ghaziri (2004, p. 14) as capture, codification and share of knowledge. As combining these approaches, this thesis presents Dinh et al. (2013 p. 103)'s model that has divided knowledge management into four different functions; creation, organization, transfer and application of knowledge (Dinh et al. 2013 p. 103). Dinh et al. (2013 p. 101) approached the knowledge management process model from information driven perspective, thus similar approach can be used for documentation management. To further understand knowledge management process, these four parts are explained in more detail. Rubenstein-Montano et al. (2001) has made a literature review from different knowledge management frameworks and found also several similarities between different approaches. To gain broad approach to the subject, this research is also used to introduce the knowledge management process framework.

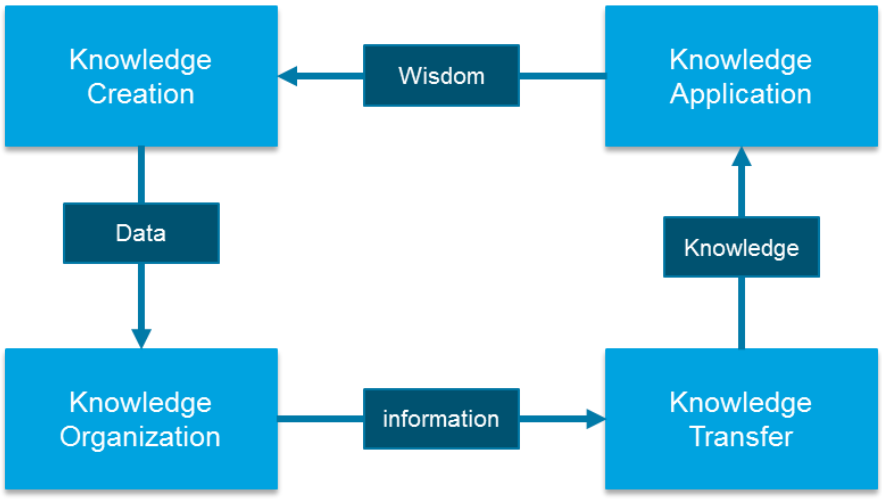


***Figure 8.*** *Knowledge management activities (Adapted from Dinh et al. 2013 p. 103).*

The first function of knowledge management process is the creation of knowledge to have it in organization as individual knowledge or corporate knowledge. Rubenstein-Montano et al. (2001) found that this phase of the process was defined either as capturing or creation of knowledge (Rubenstein-Montano et al. 2001). Even though knowledge capture and creation are usually connected to each other as one phase, there are differences of how to approach these process phases. When there are need for knowledge that does not exist or the knowledge that exists is not sufficient enough, there is a need for creation of new knowledge. New knowledge creation is done internally in organizations (Awad & Ghaziri 2004, pp. 190-191). If the framework considers data and information as the source of knowledge, as in DIKW- framework, the knowledge and wisdom creation phase can be places in the end of the framework (Rubenstein-Montano et al. 2001). In an approach that utilized the DIKW- model as a base for knowledge management activities, the knowledge creation means the insights received through refining data to information for example with data mining techniques or decision-support systems (Gao et al. 2008, p. 10). Otherwise, knowledge creation is usually connected to the first phase of knowledge management framework (Rubenstein-Montano et al. 2001). When knowledge already exists, knowledge capturing and the evaluation usefulness of knowledge has more emphasis than the originality of knowledge (Awad & Ghaziri 2004, pp. 190-191). Knowledge can be captured or acquired from inside or outside of the organization from people or for example knowledge repositories (Gasik 2011, p. 25).

After knowledge has been created, the next steps are to organize and transfer it. When referring to organization of knowledge, it also includes the storage of it (Dinh et al. 2013). Rubenstein-Montano et al. (2001) describes the next phase can be also called as combination and distribution of knowledge. When knowledge has been created, it is said to exist inside individuals, teams or processes, but also for example in documents, applications, discussions, best practices or databases. Before knowledge distribution, it might need to be extracted from the knowledge source. (Wild & Griggs 2008, p. 495) To efficiently use this knowledge, it should also be applied to the context it will be used in (Gasik 2011).

Thus while planning these activities, the user of knowledge and the situation where the knowledge is used and shared should be considered. To make knowledge sharing more efficient, knowledge should be stored (Rubenstein-Montano et al. 2001) in a form and place from where it is possible to be accessed. In this phase, also the types of knowledge and knowledge classification should be considered. When the knowledge classified into tacit and explicit knowledge, the approach to these functions are different. (Rubenstein-Montano et al. 2001) Tacit knowledge can be transferred with socialization for instance through interaction between people. When tacit knowledge is transferred to explicit knowledge or knowledge already exists as explicit knowledge, it can be shared through a medium, for example with document or oral statement. (Gasik 2011) When knowledge is transferred to corporate knowledge, this can be also called as knowledge codification (Gao et al. 2008, pp. 11-12; Awad & Ghaziri 2004, p. 14; Rubenstein-Montano et al. 2001).

The last phase of knowledge management process is the utilization of knowledge (Dinh et al. 2013). To utilize the knowledge, it should be accessible when needed and in a form that make it usable. In the knowledge management process, the utilization of knowledge means that the knowledge is used and adapted to the work task it is needed for. (Haas & Hansen 2007, p. 1134) When knowledge management is considered in a project point of view, the use and application of knowledge comes before the share of knowledge (Gasik 2011). This is because the knowledge usually is captured or created for the projects knowledge needs, but the same knowledge can be utilized also in other tasks. Still knowledge seen as an asset does not mean that is should be seen as a static resource (Freeze & Kulkarni 2007, p. 101), but more as a dynamic in nature (OGC 2007a, p. 146). Thus knowledge management should always be considered as continual improvement process, not as a onetime solution (Rubenstein-Montano et al. 2001, p. 5). Rubenstein-Montano et al. (2001) argues that for the knowledge management framework to be successful, all of the activities, technologies and methods used and improvements to them to be made should be designed while considering the organization culture they are implemented in. Therefore feedback and learning should be considered as important part of knowledge management activities and the framework should include one or more feedback loops between the functions to ensure an iterative knowledge management process. Gathered feedback also helps to maintain the quality of the knowledge, but also the knowledge management systems and process. (Rubenstein-Montano et al. 2001) Also maintaining of knowledge (Rubenstein-Montano et al. 2001) and protection of knowledge (Gao et al. 2008, p. 11-12) that has been stored, should be considered as part of knowledge management activities.

# 3. DOCUMENTATION MANAGEMENT

## 3.1 Documentation as knowledge management tool

As defined previously, documentation is one way to manage explicit knowledge. Even though ITIL v3 defines documents as *"information in readable form"* (OGC, 2007a) documents can be seen to be more than just information. Megill (2005) describes a document as *"collection of related information, held together by a set of meanings that come from the author (and the intention of the author) and the user (and the perception of the user)*" (Megill 2005, pp. 36-37). When knowledge is seen as a corporate asset, a document can be defined as a combination and a construction of these knowledge assets (Freeze & Kulkarni 2007, p. 94). Like in the definition of knowledge, also in the definition of documents using information and knowledge terms are quite mixed depending of the source of the definition. Freeze and Kulkarni (2007, p. 106) explains that knowledge in documents is in highly explicit form and the difference between information and knowledge in documents depends of the purpose of the documents. When the document answers question "why", but instead of "how", it can be seen as a knowledge document. (Freeze & Kulkarni 2007, p. 106). In this thesis documents are defined to be compositions of explicit knowledge, information or knowledge, which can be interpreted by someone.

Documents are created and utilized in situations where the context of the issue is previously known (Freeze & Kulkarni 2007, p. 104). Thus the fundamental purpose for documentation is to share and store knowledge (Faircloth 2014, pp. 355-356; Deloule 2009, p. 79; ISO 2008) and documentation can be seen as one of the most traditional ways to share knowledge (OGC 2007a, p. 146). Documentation is an essential tool to store the knowledge that has been created or retrieved, because some details of work might be forgotten if they are not repeated over the time (Faircloth 2014, pp. 355-356). For example it is possible to run a successful project with minimal amount of documentation, but it is hard to repeat the same success by people out of the project team without documentation or understanding of why certain decisions were made (Henry 2016, p. 181).

When using documents as knowledge transfer medium, one benefit is that a receiver and distributor do not have to be in direct a contact with each other (Haas & Hansen 2007, p. 1136). This allows the source or receiver of knowledge to be out of organizations boundaries. Because documents can be created internally or externally of organization, sources of knowledge in documentation can be for example employees, vendors, customers or public publications. (Freeze & Kulkarni 2007, pp. 96-98) Another benefit of documentation is that the knowledge transfer does not have to be limited to one moment, but the knowledge can be retrieved when needed. A good documentation helps organization wide communication, but also in communication with different stakeholders. (Henry 2016, p. 181) A basic example of internal communication that utilizes documentation are project

teams. Project teams communicate and document for example decisions made, concepts created, and lessons learned during projects for other internal parties to transfer learned knowledge to support their work. Documentation is also important way to communicate to external stakeholders and management. External stakeholders might need documentation such as specifications and requirements as a basis of cooperation. Management can utilize documentation to control and evaluate progresses. There might also be legal and financial requirements for documentation of certain information. (Oehme et al. 2014, p. 428) Documentation might also trigger for other knowledge transfer activities as the document user might end up to contacting the document contributor for more information about the subject (Haas & Hansen 2007, p.1136). Thus the lack of documentation can be seen to also assist a development of silos inside organization (Henry 2016, p. 181).

Documentation target is to prevent on wasting resources in reinventing and by repeating same mistakes over again (Henry 2016, p. 181). With Documentation, some consistency of actions can be achieved, for example with instructions of how some task should be executed and what is the purpose of doing it that way. Documentation should provide individuals a chance to repeat the documented action afterwards. Documents can also be used to explain past events to predict the coming changes, for instance changes to applications over time can be documented for future use. Some regulators demand for documenting to track actions, and depending of a company and size of it, different regulations might demand for a certain level of documentation of these actions. (Faircloth 2014, pp. 355-356). In high risk or critical environments where quick problem solving and safety is required, like in hospitals, documentation is especially essential (OGC 2007a, p. 208).

A document as a definition does not only refer to a traditional text document (Freeze & Kulkarni 2007, p. 98). When talking about digital documents, the documents can be combinations of several files containing pictures, formatting and even parts of them can be managed in some other files (Megill 2005, p. 35). Generally documents can be defined to be structured or unstructured documents. Structured documents are commonly in text based form, for example project reports or publications. (Freeze & Kulkarni 2007, p. 98) One example of these are records. The purpose of records is to be used as an evidence, as they consist of information of some event or a fact (ISO 2008; Megill 2005, p. 35). The name for structured documents come from the fact that the knowledge is the document can be found in the same structure in similar type of documents. Unstructured documents can consists of combination of pictures, videos, audios, or even audio clips (Freeze & Kulkarni 2007, p. 98). Even though most of organizations documents are in unstructured form, there are several different challenges for organizations how to manage them because of the nature of the documentation (Dinh et al. 2014 p. 3543).

## 3.2 Documentation lifecycle

When simplifying act of documentation, it is about creation of a document by codifying knowledge about a specific subject into a document and uploading the document in a

place that it can be accessed by others when needed (Haas & Hansen 2007, p. 1136). Still documentation should be more than just an act to store information (Faircloth 2014, p. 356). One way to explain what it meant when talking about documentation, it to view if from the document lifecycle point of view. The documents lifecycle can be explained to include five stages: concept and document generation, review and refinement, finalization and approval, ongoing reviews and archiving or disposal (Faircloth 2014; Gough & Nettleton 2010). These five stages are presented in figure 9.


***Figure 9.*** *Document lifecycle (Adapted form Faircloth (2014) and Gough & Nettleton (2010))*

Every time a document is created, it needs to be created for some purpose (Wiggins 2012, p. 66) and documents should be refined for the context they will be used for (Haas & Hansen 2007, p. 1136). Thus a document lifecycle starts when a document need is approved and a concept for a new document is generated and after this the actual content creation can be started and a draft version of a document can be created. In this phase also an initial revision of the documents needs to be done. (Gough & Nettleton 2010) Document creation can be done several different ways. It might mean just free creation of a document, creating a document to a software a specific and structured document layout or just replicating a document to another form (Wiggins 2012, p. 66). Documents are usually created to have a long life span and to be modified if needed (Freeze & Kulkarni 2007, p. 100). Because of this, there can be a formal review and revision of the document. (Gough & Nettleton 2010). Before the document is published, a finalization and approval of the latest version of the document should be done (Gough & Nettleton 2010) to ensure the quality of the document (Faircloth 2014, p. 356). Also some internal policies or regulation might demand documentation approval in organizations (Faircloth 2014). After document has been approved it is made available for use in a place it can be accessed (Gough & Nettleton 2010). To create value from documents, there is a need to adapt the knowledge for the use and continually evaluate and improve the documentation with ongoing reviews (Haas & Hansen 2007, p. 1136). Alongside the ongoing reviews, documents should be also updated whenever any changes occur. Additional updates might be needed because of knowledge of the subject grows over time. By reviewing and updating documentation, it will help to keep it relevant and useful as long as the document is needed. (Faircloth 2014, p. 356) In the end of documents lifecycle, when the need for the document has ceased, the document should be archived or disposed (Gough & Nettleton 2010).

Document lifecycle is usually connected to the business process the document is related to (Krishna et al. 2004). This mean that the creation, updating and disposal of document

are synched with the lifecycle of the business process. If the documentation is related to some project, the creation of documentation should be started during the project so that necessary information is not forgotten (Faircloth 2014, p. 356). Document management facilitating the whole document lifecycle helps to maintaining the documents in organizations (Garris 2007, p. 50).

## 3.3 Documentation management and process

Documentation management concentrates to manage and improve the documentation process and workflow instead of gathering and organizing documents as objects (Megill 2005, p. 34). Documentation management is required to have explicit procedures to maintain the activities related to documentation. These should include the document identification, controls, storage plan, security and protection methods, retrieval techniques, retention periods, and order arrangements and distribution methods. Also the definitions for documents and their requirements should be established. (Hernad & Gaya 2013, p. 30-31) Documentation management can be handled in a corporation by for example information manager (Megill 2005), corporate memory manager (Megill 2005), knowledge manager, librarian (Päivärinta & Munkvold 2005) or other knowledge service contributors (Debowski 2006, p. 227). When designing the strategy approach to documentation management, the whole system, the people, processes and technologies, should be considered and also the existing culture and external factors affecting the system (Hernad & Gaya 2013, p. 32).

As documents contain explicit knowledge, also documentation management process are designed to aid the management of explicit knowledge within organization. When designing documentation management processes and activities, they should be developed for both, structured and unstructured documents (Freeze & Kulkarni 2007, p. 98). From technological perspective, digital document management can be seen to be part of content management activities. Also content management activities are especially popular in companies where document management is important. Content management is an IT-system that is used to organize, store and manage different types of digital assets in unstructured form, like pictures or documents. Content management also means the process that these digital assets are managed with. (Krishna et al. 2004, p. 634).

To further explain documentation management, the theory of content management and knowledge management can be used as a basis to also explain documentation management process activities. The framework that connects these approaches together is presented in figure 10. (Dinh et al. 2014 p. 3549; Dinh et al. 2013 p. 102) This combination is possible, because content management can be seen as way to manage explicit knowledge repositories as it can be seen as a modern version of electronic document management in organization (Päivärinta & Munkvold 2005). By combining the knowledge management theory to content management theory, not only explicit

knowledge, but also the tacit knowledge can be considered as part of the documentation management framework (Dinh et al. 2014 p. 3545).

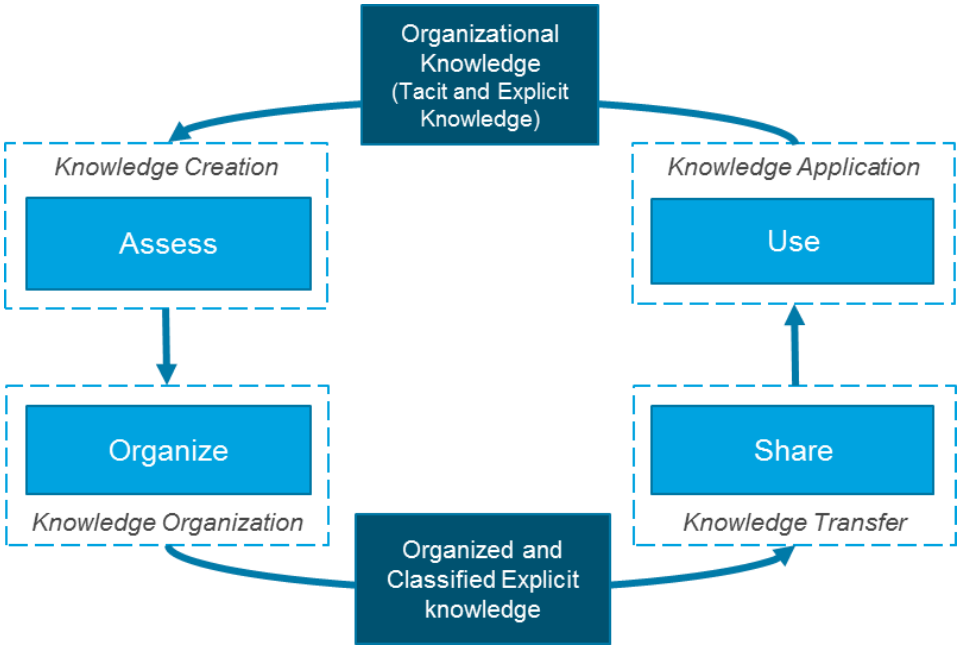


***Figure 10.*** *Documentation management related to Knowledge management activities (Adapted from Dinh et al. (2014 p. 3549) and Dinh et al. (2013 p. 102)).*

The documentation process starts from developing new or improving the existing documents, that is defined as the assess phase. New knowledge can be received from internally or externally and inserted to the system or used to rearrange old content. (Dinh et al. 2014 p. 3549) Because of the dynamic nature of knowledge, there is a continuous need to evaluate and improve the existing documentation, generate new content from organizational knowledge and adapt it for use (Haas & Hansen 2007, p. 1136; Debowski 2006). The document refinement should be done according to the gathered feedback by reproducing or repackaging knowledge in documents (Mayer 2007). A common problem related to documentation is not about the lack of understanding of the importance of documentation, but in actively committing people to document (Henry 2016, p. 182). Still it is seen that the problem is not always that people are lacking the ability to document, but instead there is no willingness to document (Renzl 2008). Another managerial problem is to gather all needed documents when there are some people that are not willing share their documents (Garris 2007). This willingness to share knowledge is also one of the most critical challenges in knowledge management (Aggestam et al. 2014, p. 566). This problem can be seen to be related to trust of management and fear of losing a unique value of one employee. Especially trust between individuals and its management has been seen to have a direct impact on efficiency of knowledge documentation in organizations. (Renzl 2008, p. 210) Other identified challenge is related to committing people to update the documents (Henry 2016, p. 182). One way to tackle these issues to improve documentation practices, is to apply documentation as a regular part of project workflows (Henry 2016, p. 181).

Then documentation is not seen as extra work that is done after the project has been finished, but as the part of the project. Still it should be understood that if knowledge is not constantly updated, continuously creating and capturing new knowledge will do more harm that it is useful (Aggestam et al. 2014, p. 3). This is because over time it will only result as an unreliable, out-of-date and irrelevant knowledge repository (Aggestam et al. 2014, p. 3).

The second action is to organize documentation. The purpose of organizing is to arrange the knowledge into objects in order to make them easier to manage (Dinh et al. 2014, p. 3549). In the case of documentation management, documents can be considered as containers that stores knowledge (Mayer 2007, p. 288). When these documents are organized in a documentation system, a document can be defined to be a composition of three different parts (Figure 11); a type, metadata and knowledge content. These three dimensions of documents define how the documents are approached. Therefore these dimensions should be aligned with each other. This means that document type defines what metadata is inserted to it, but also what content the document should have. On the other way around, the metadata is inserted according to the content of a document and the document type can be defined based on the document content. (Forbes-Pitt 2006, p. 15)

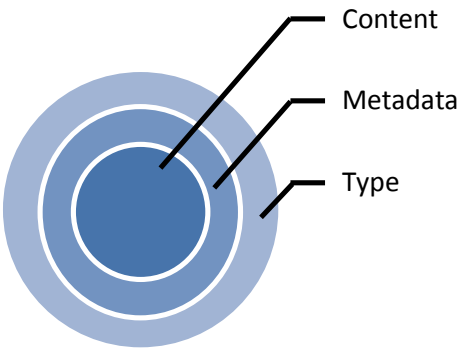


***Figure 11.*** *Three dimensions of documents (Adapted from Forbes-Pitt 2006 p. 15)*

A document type is defined as the understood role of the document (Forbes-Pitt 2006, p. 15). Document type defines the requirements for a document and it can be used to define and manage document lifecycle (Faircloth 2014, p. 360; Päivärinta & Munkvold 2005). Documents can be classified into different types depending on the approach to the categorization. They can be categorized for example according to their knowledge content, layout, or other features like related controls, security levels or time characteristics. (Mayer 2007, p. 288) A document type, in case of classifying document according to the content, can be for example project plan, SLA-document, roadmap or work instruction (Faircloth 2014, p. 360).

Metadata is the data describing a document (Forbes-Pitt 2006, p. 15). Metadata can be, for example the date of creation, type of a document or definition of the document owner.

Metadata is defined for each documents and it is used to identify documents. Therefore metadata can also be utilized by end users to search for documents. (Khan et al. 2015) To efficiently use metadata to organize and identify documents, the metadata utilization should be as atomized and standardized as possible. Still at the same time it should be possible to be produced dynamically. Also significance of metadata in document search and reuse should be understood by the ones that share documents. These requirements create clear challenges for metadata management that should be also understood in documentation management. (Päivärinta & Munkvold 2005) To aid document findability, documents should also have a describing, but still concise name. The possible naming practicalities might vary between different software because of different requirements. (Wiggins 2012, p. 94) Thus agreed naming and relevant metadata practices should be a part of organizations documentation management procedures and guidelines. (Dinh et al. 2014, p. 3549; Wiggins 2012, p. 94)

The content is the insides of the document (Forbes-Pitt 2006, p. 15). The content can include text, but also everything else that is inside document, such as hypertext and other multimedia content (Mayer 2007, p. 297). Because documents are an important way to share explicit knowledge, the organizations personnel should be able to understand and use the document content (Freeze & Kulkarni 2007, p. 94). One way to manage the document content is to create templates and style formats. Document styles formats are considered to aid documentation management, especially when documents are co-created with another stakeholders. As a guideline, documents that are created should have a structured template and layout regardless on their type. This way management can establish a base for an effective documentation management practices. Still it is important to remember that without adequate training, communication, policies, procedures, and documents for document template usage, even if the templates exist and are available, the benefit of them is cannot be exploited. (Wiggins 2012, p. 66)

The next phase of documentation process is to share documentation. To share electronic documents, there is a need for a medium, for example a web site, email or document repository (Dinh et al. 2014, p. 3549). Digital document management provides efficient ways to store and share documents. Search using keywords or documents content should provide fast accessibility and dynamic ways to arrange documents (Garris 2007, p. 50). Sharing does not mean that documents are made available for everyone, but sharing can occur inside teams or closed networks of experts (Deloule 2009, p. 78). Document management systems also provide security management functions, by granting view, editing and deleting rights to for predefined people or groups. This is essential when document management systems is used to communicate with documents to inside and outside of organization. (Garris 2007, p. 50)

Documentation management should not be seen only as act of storing and sharing knowledge, because as they consist dynamic knowledge also the documentations value is dynamic (Haas & Hansen 2007, p. 1136). Digitalization and the development of database

capacity has also made it too easy to store and share all the documents ever made. This might result that no documents are thrown away, even if they are not needed. (Garris 2007) Outdated and unnecessary documents will eventually effect on the usability and quality of documentation repositories. Thus it is important to consider the whole document lifecycle when designing documentation management practices.

Document repositories need to be easy to use and simple to make the documents accessible (Khan et al. 2015). To enable this, the organizations personnel should be informed about the location of documents (Freeze & Kulkarni 2007, p. 94). As the amount of shared knowledge increases, also the ways to find the needed knowledge gets more complicated. Therefore search engines can be seen as a crucial enabler of knowledge sharing with IT systems (Freeze & Kulkarni 2007, p. 94), as great search engine can help to ease document findability from complicated storage structures. If the accessibility to different documents are managed with links to the documents that can be found as search results, the documents do not have to be stored in the same place anymore (Megill 2005, p. 34). Still several different documentation management systems might lead to duplication of document, which leads to duplicated work in cases where documents are updated in different places (Garris 2007). Therefore the most efficient way to design a repository is to create a single point to find for all knowledge content (Debowski 2006, p. 145). In any case, it is important to understand how documents can be found with different search words. Thus when designing and managing the search words, it should be ensured that documents can be found with search words that are commonly understood and defined among all the document contributors and users. (Megill 2005, p. 34)

Use of documentation is the last phase of the documentation process. This phase means that documents are applied to certain use in practice. In this phase the context and situation of use, the users and other stakeholders and how it is used is clearer. (Dinh et al. 2014, p. 3549) In the end of each process cycle, the knowledge in document should be extended into tacit and explicit individual knowledge. When this individual knowledge is applied to different contexts, the experiences and continuous change will lead to creation of new knowledge and thus process will start again (Mayer 2007). Therefore the whole process should be considered as a continually iterating process (Aggestam et al. 2014, p. 566). The knowledge generated during document utilization should be used to assess and develop new documents. Therefore gathering and utilizing feedback is important. (Mayer 2007)

Document repositories are essential document management tools that technically aid with the facilitation of knowledge transfer from knowledge contributors to knowledge users (Freeze & Kulkarni 2007, p. 103; Awad & Ghaziri 2004, p. 73). According to Debowski (2006), in large companies, information and library services supported by IT are identified as one of the most important part of their knowledge management strategy. These services enable access, identification, and storage of information for individual users, but

also provide resources that support knowledge creation regardless of place and time. (Debowski 2006, p. 37) Also different IT-systems have been developed to manage documentation with various creation, searching, sharing, storing, application, and collaboration tools (Davis et al. 2005, p. 11). These document management systems (DMS) are used to help document management by providing ways to store, archive, and search and retrieve documents. A basic DMS has a workflows and access control to manage documents of different types and formats on a centralized location. (Khan et al. 2015, p. 402) DMS can also be used to aid the document management with monitoring documents during their lifecycle, have an automatic version management or even by making automatic changes to documents (Garris 2007, p. 50). Also when implementing such tools and processes, there also needs to be a role to upkeep the activities. These include for example maintenance of templates, metadata specification, and user support and training. (Päivärinta & Munkvold 2005, p. 6)

Documentation management can be seen as part of content management activities that also include, for example record management and web content management (Krishna et al. 2004, p. 634). Because of similarities between the functions and purposes, sometimes DMS's can even be defined as content management systems (Khan et al. 2015). For example commonly utilized content management tools are corporate intranets that can be used as a corporate wide knowledge repositories (Debowski 2006, p. 145). Enterprise content management (ECM) is a knowledge management tool (Khan et al. 2015) that provides processes, tools and strategies for information and knowledge management for producing, indexing, storing, organizing, publishing, and utilizing knowledge and metadata connected to it within organizations (Debowski 2006, p. 145; Päivärinta & Munkvold 2005). ECM is used to manage both structured and unstructured information and knowledge (Päivärinta & Munkvold 2005). Because there are different ways to approach documentation management problem from the IT perspective, it is important to understand and choose suitable software to the organizations document management needs (Garris 2007). As it important to have an organizational culture that understands the value of documentation, it is also important to understand the effect of document management tools to the efficiency of document management activities. Even if organizational culture supports and understands the value of documentation, inappropriate documentation management tools might still result cause ineffective knowledge management through documentation. (Henry 2016, p. 182) Therefore a holistic understanding of vital organizational knowledge needs and the different knowledge types is required when designing and maintaining knowledge repositories (Aggestam et al. 2014, p. 566). Also for DMS to be utilized, there needs to be user training of document maintenance and how the system should be used (Garris 2007).

# 4. QUALITY MANAGEMENT

## 4.1 Quality definition

The common goal of organizations is to create value for customers that are willing to invest more for the product than the cost of creation is (Lee & Yang 2000, p. 785). Value is the benefit that the service or good delivers and is defined by the beholder. Therefore perceived value can be defined as highly subjective. (Doyle 2011) Value has been closely connected to definitions of quality. For example ITIL v3 definition of quality is "*The ability of a product, service or process to provide the intended value"* (OGC 2007a, p. 141). Thus when pursuing to generate value for customers, it is essential to consider and manage the quality of the offering.

To manage and measure quality there is a need to define general definitions for quality in certain contexts (Hoyle 2009, p. 24). Hoyle (2009, pp. 25-27) defines four different attributes that have been connected the definition of quality; Freedom from defects or deficiencies, conformity to requirements or specifications, fitness for use and fitness for purpose. Quality as the "freedom from defects or deficiencies" means that that there are no differences between the specification and description of the product with the product that is offered to customers. (Hoyle 2009, p. 25) This description is mostly defined internally with quality standards (Chen & Sorenson 2007, p. 43). With this definition, a service or product that fulfills its purpose and is sufficient in technical use can defined to have a good quality (Baškarada 2009, p. 14). This requires good controls and can be used to decrease costs (Hoyle 2009, pp. 26-27). When defining quality with this definition, it is easier to manage and measure against the predefined criteria (Bhat 2010). Still, even thought there would be no defects on the product, but the products itself does not answer to customers' needs, the customers might not see it as a quality product (Hoyle 2009, p. 25).

Because the value is often described to be subjective, quality of a service or product can be defined according to what a customer is expecting of it. As an example customers might define value by comparing the pre-received expectation and previous experiences to the received experience. (Hoyle 2009, p. 24) Therefore quality product has also "conformity to requirements or specifications"-dimension, which relies on the fact that customers will provide a description of the product. The description can be gathered with, for example, a market research. (Hoyle 2009, p. 26) This is a common measure that can be used for varied kinds of offerings (Chen & Sorenson 2007, p. 43). It's also used by ITIL v3, which mentions conformation to specifications as one of quality perspectives (OGC 2007a, p. 118). By defining the product based on the customers perspective, does not still always help to create quality products, because customers might not know or are

not able to explain their needs or expectations and they do not consider the future needs for a product (Hoyle 2009, p. 26).

Because there might not always be requirements from users, there needs to be other ways to define quality from user's perspective. One definition is the "fitness for use" which means that the product will satisfy the need or serve the purpose that is bought for. Still also this definition will not provide guideline for product quality or a long-term perception for the product quality and customer needs. (Hoyle 2009, pp. 26-27) The last one of the definitions, fitness for purpose, has been defined in the UK Sales and Supply of Good Act 1994 and means that the product that quality product generally would be referred as a satisfactory product. When the quality exceeds the expectations it is considered as a competitive advantage. (Hoyle 2009, pp. 26-27)

From customer's perspective, quality definitions above are important to gain overall customer satisfaction (Hoyle 2009, p. 31). As quality is commonly defined by the expectation of customers, measuring and improving quality is hard (Bhat 2010). Therefore quality measurement should not be defined to be absolute but rather varying; the expectations and needs of customers continually evolve thus also the quality needs to adapt to the changing needs (Hoyle 2009, p. 29). Hoyle (2009, p. 29) and Smart (2002, p. 137) have both created graphical presentations of definition of quality over time. A compiled representation of both quality definition developments were gathered and presented in Figure 12.

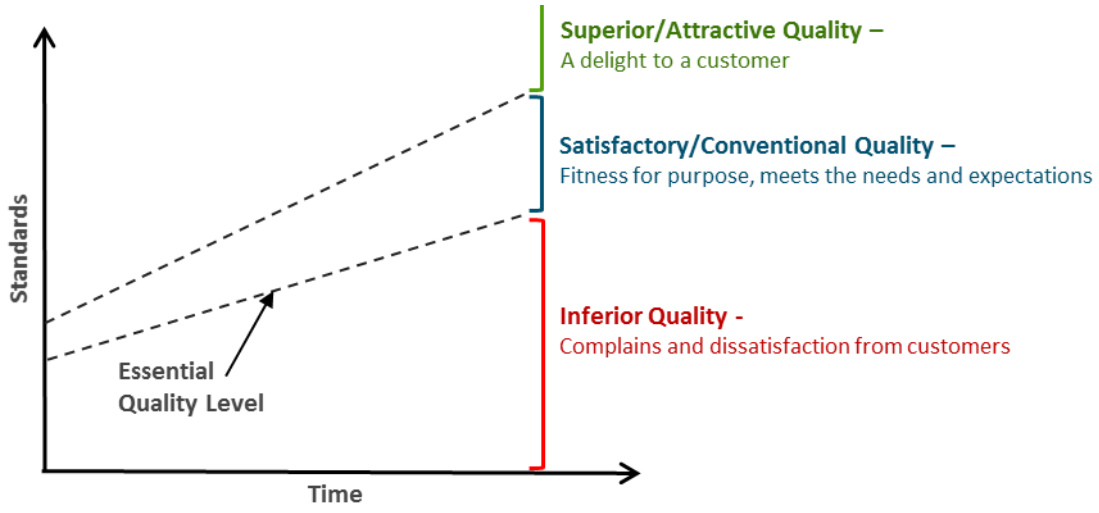


***Figure 12.*** *The definition of quality levels and standard (Adapted Hoyle (2009) figure 2-1, p. 29 and Smart (2002) figure 2 )*

Hoyle (2009, p. 29) defines quality to inferior, satisfactory and superior quality. When the required quality level of customers has not been reached, it can be said that the quality is on inferior level. After the quality has reached the defined quality standards and is acceptable, the quality can be said to be satisfactory. If aiming for superior quality level of an offering, the common quality levels needs to exceed the quality standards. (Hoyle

2009, p. 29) These quality levels are defined to be related on customer's reactions to the offering, in other words, how it meets the expectations. Similar categories for quality are presented by Smart (2002, p. 137) with three types of quality. Smart (2002) divided the quality categories to essential, conventional and attractive quality. The essential quality is the expected quality, the level that the quality is at least expected to be. It's a level of quality that is not even expected to be quality, but when it is missing, it causes dissatisfaction among the customers. (Smart 2002, p. 137) As reflecting it to Hoyle (2009, p. 29)'s definition of quality levels, the level under the essential quality level is called inferior quality. As an example, these quality levels can be reflected in a context of a restaurant. An essential quality in this context is that a restaurant is clean, because when it is clean, customers usually do not even notice it. Therefore the essential quality is needed to reach the minimum level of customer satisfaction. On the other hand, if the restaurant would not be clean, it would most likely cause dissatisfaction among the customers. (Smart 2002, p. 137) When defining quality of an offering, the actual quality is a combination of the quality of its different components, hence even if quality is superior in one area and inferior in another, it might still be seen to have an overall inferior quality (Hoyle 2009, p. 31). Thus when considering quality management practices, there is a need the support of all the different stakeholders of the value chain to be successful (Molina et al. 2007, p. 682).

## 4.2 Knowledge and information system quality

Quality of knowledge affects to the usefulness of knowledge, but also to the willingness to use knowledge (Rao & Osei-Bryson 2007). Therefore it is beneficial to consider the definition of knowledge quality. As digital documentation management is closely connected to and facilitated by IT, also the quality of a document management systems should be considered. When considering the success of information system, it relies on different quality factors that have an effect on the system usefulness and ultimately to user satisfaction (Aggestam et al. 2014, p. 1; Landrum & Prybutok 2004, p. 631). Landrum and Prybutok (2004) and Gorla et al. (2010) defines these quality factors to three different components: information quality, system quality, and service quality. Landrum and Prybutok (2004, p. 631) researched quality of a library system and found out that increasing these three variables affects positively to the usefulness and user satisfaction of the system. It is also seen that maintenance of quality level of knowledge repository is highly dependable of the quality of the knowledge in the repository (Aggestam et al. 2014, p. 1; Su & Jin 2007, p. 3243). Thus knowledge systems benefits can be seen to be especially closely related to the quality of stored knowledge (Awad & Ghaziri 2004, p. 219). Because of this, in this thesis quality is presented in more detail in the point of view of information and knowledge. As documentation management activities can be seen to be closely related to information systems, the influence of system and service quality are also considered.

When referring to data quality it is generally connected to some technical issues but information and knowledge quality is more related to non-technical issues. These non-technological issues are often related to the strategical issues, for example is the needed information on the right place, in a correct format, on right time and available for the right stakeholders (Madnick et al. 2009). Quality of the knowledge is more often defined on how well the expectations of the users are met. Perhaps user might appreciate more the availability and findability of the knowledge and knowledge contributors values more how properly the knowledge can be documented according to the expectations. With this approach quality of knowledge is subjective as it is dependents on beholder. (Awad & Ghaziri 2004, p. 219) When defining the quality as how well the knowledge can support the task completion (Haas & Hansen 2007, p. 1137), more objective approach can be adapted to evaluate the knowledge quality. As it can be beneficial to categorize quality of knowledge with some dimensions, it is useful to take a look into some defined quality measurements. In the table 1, there are presented different definitions identified in literature for knowledge and information quality. These quality categorization can be used as examples of different approaches how quality of knowledge can be defined.

***Table 1.*** *Information and knowledge quality categorizations*

| Name | Characteristics |
|---|---|
| **Information quality indicators** (Gorla et al. 2010, p.225). | ➢ **Information content is:** accurate, complete, concise, useful in daily jobs, relevant for decision making<br>➢ **Information format:** good appearance and format, consistent, easily to understand |
| **Knowledge item quality dimensions** (Rao & Osei-Bryson 2007, p. 373, table 2) | ➢ accuracy, consistency, currency, data interpretability, degree of context, degree of detail, degree of importance/relevance of the knowledge is the system/usage, sharing, usefulness, volatility |
| **Information quality dimensions** (Stvilia et al. 2007, p.1729, table 3). | ➢ **Intrinsic quality:** accuracy/validity, cohesiveness, complexity, sematic and structural consistency, currency, informativeness, redundancy, naturalness, precision<br>➢ **Contextual quality:** accuracy, complexity, naturalness, informativeness, relevance, precision, sematic and structural consistency, verifiability, volatility<br>➢ **Reputational quality:** authority |
| **Quality in documents** (Moyer 2005, p. 201) | ➢ Document is current, reliable, validated within context, relevant and searchable. |
| **Information quality dimension and definitions** (Nelson et al. 2005, p. 204) | ➢ **Accuracy :** The degree to which information is correct unambiguous, meaningful, believable, and consistent<br>➢ **Completeness:** The degree to which all possible states relevant to the user population are represented in the stored information<br>➢ **Currency:** The degree to which information is up-to-date, on the degree to which the information precisely reflects the current state of world that it represents<br>➢ **Format:** The degree to which information is presented in a manner that is understandable and interpretable to user and thus aids in the completion of a task |

Even if the quality of knowledge is evaluated as high in one perspective, some adaption of knowledge might be needed to fully utilize the knowledge in practice (Haas & Hansen 2007, p. 1137). Also as knowledge evolves over time, the importance of quality metrics varies depending of the context (Sabetzadeh & Tsui 2015, p. 362-363). Therefore measuring quality by using the different quality categories can be complicated. For example, in some situations the knowledge might not be current, but it is still useful and valuable for the purpose it is used for (Sabetzadeh & Tsui 2015, p. 362-363). Even if the quality of knowledge is evaluated as high used for one task, some adaption of knowledge might be needed to fully utilize the knowledge in other areas (Haas & Hansen 2007, p. 1137). Thus knowledge contextualization can help to evaluate knowledge quality criteria's more objectively (Stvilia et al. 2007, p. 1722). When taking this approach to quality definition, "fitness for use" could be seen as the most important quality measurement (Sabetzadeh & Tsui 2015, p. 362-363). "Fitness for purpose" quality metrics is also visible in the information and knowledge quality categories (table 1) as the format and the degree of context knowledge shared. Still to efficiently measure and manage quality, there should be some objective quality metrics. These can be defined for example based on what is the target of knowledge quality. If the aim is to solve problems quickly, the quality metric can be the time that is used to solve problems with the knowledge (Sabetzadeh et al. 2013, p. 947) or *"the time saved by using knowledge"* (Haas & Hansen 2007, p. 1137). On the other hand in knowledge intensive areas, *"the quality of the work output"* can be taken as a dimension to measure the quality of knowledge. The quality of work might be especially important in cases when the output is decision or proposal an issue. (Haas & Hansen 2007, p. 1137)

Knowledge quality ultimately depends on all stakeholders in the value chain (Sabetzadeh & Tsui 2015, p. 366). Still the quality should be understood and initially verified by the quality contributor (Deloule 2009, p. 79). Other way to ensure the quality of knowledge is to share and use it (Deloule 2009, p. 78). As explained in knowledge management process (section 2.4), the knowledge should be reviewed before share, but also in the use. As the result of the knowledge review also the quality of knowledge is assessed. In this case also knowledges subjective quality can be assessed and "meeting the customer expectations" can be used to evaluate quality of knowledge (Stvilia et al. 2007, p. 1722). Also the usefulness of knowledge can be assessed in the use (Sabetzadeh et al. 2013, p. 947).

Knowledge repository usability problems, such as findability issues, will affect to use of knowledge bases (Berztiss 2001, p. 439). Therefore the quality of systems will ultimately affect the benefits of information systems (Gorla et al. 2010, p. 210; Landrum & Prybutok 2004, p. 631). The quality of information systems is also closely related to the success of IT related knowledge management, like digital documentation management. In table 2 there are presented some system and service quality related quality categorizations to provide examples of the different quality dimensions.

***Table 2.*** *System and service quality categorizations*

| Name | Characteristics |
|---|---|
| **Knowledge management system quality dimensions** (Jabar & Alnatsha 2014, table 2; Owlia 2010, p. 1224, table 4) | ➢ functionality, completeness, reliability, usability, serviceability, access, flexibility, security |
| **Quality in service organization** (Wiggins 2012, p. 35) | ➢ reliability, access, communication, security, responsiveness, competence, courtesy, credibility, understanding |
| **Service quality indicators** (Gorla et al. 2010, p.225-226). | ➢ reliability, responsiveness, assurance, empathy |

When talking about system quality, it considers the technical side, the data and software, related to the information system (Gorla et al. 2010, p. 212). The quality metrics related to these can be for example the ease of use and system performance (Landrum & Prybutok 2004, p. 631). Usually challenges of quality are not related to knowledge accessibility, because of the amount of knowledge that is available for users. The bigger challenge is to make the available knowledge understood by or relevant for the receivers. (Deloule 2009, p. 78) Also the capturing needed knowledge with information systems can be seen as challenge in organizations (Aggestam et al. 2014, p. 1). When considering systems as services, some new quality measurements should be taken into account (Owlia 2010, p. 1219).

The definition and the measuring of quality of service is not as simple as in traditional manufacturing. When measuring service quality, the measuring is usually in more qualitative than quantitative way. (Wiggins 2012) Service quality is related the understanding of business but also the users, which can be achieved with a good communication and interaction different stakeholders. The ultimate purpose of this is to align services with the organizational goals and to provide quality information for decision making. (Gorla et al. 2010, pp. 225-226) For example understanding of users' needs as a service quality measurement is an important for gathering and providing relevant knowledge for use (Owlia 2010, p. 1220). The management of service quality can be done by managing the expectations and impressions, customer education, good support systems, gathering feedback and responding to it, and with guaranteeing the service (Wiggins 2012, p. 36).

## 4.3 Common quality management frameworks and standards

The efficiency of knowledge sharing activities are also seen to be affected by quality management activities (Molina et al. 2007). Quality management practices have been

closely connected to operations management as a factor to improve the efficiency of practices and performance. The performance improvement of quality management practices arise from the assumption that by managing the organizations knowledge and internal efficiency, it will affect to the overall performance of an organization. (Molina et al. 2007, pp. 682-683) There are several different quality management frameworks and standards presented for tangible traditional manufacturing companies and for more intangible IT and process centric fields (Bhat 2010, pp. 40-41). Generally presented terms related to quality management are quality control and quality assurance. Quality control stands for all the activities or functions needed to fulfil organizations quality requirements. This involves the establishment of quality requirements and methods of avoiding defects and controlling the measurement of processes. (Bhat 2010, pp. 40-41) As quality control is mostly concentrated on product quality, quality assurance additionally focuses on processes (Stewart & Waddell 2008, p. 989). Thus quality assurance is a process that guarantees the quality of a product, service or a process (OGC 2007b, p. 206). Both of these terms are included under quality management activities. Quality management can be defined as *"all activities that determine the quality policy, objectives, responsibilities, plans, actions, inspections, evaluations, and verifications across enterprises to fulfill customer satisfaction"* (Ansari et al. 2009, p. 78). A documentation created to support these activities is called a quality plan, that explains how and by who these different activities are applied and to which process, contract, product or project (ISO 2008). As the definition of quality is evolving continuously, also the quality management should support this through continuous service improvement (Ansari et al. 2009, p. 78). Also when designing quality management practices the social and technological factors needs to be considered (Molina et al. 2007).

These are several different approaches to quality management. For example COBIT 5 has defined manage quality -process as a part of the enabling processes (ISACA 2012). Still as quality management concerns all activities in organization, there has been a need to develop an extensive concept to manage different quality issues (Lal 2008, p. 109). Total Quality Management (later TQM) is an approach to quality management, which connects the whole organization to quality management activities (Stewart & Waddell 2008, pp. 989-990). TQM was firstly introduced in the 1950's and because of its partially abstract nature it is sometimes called as quality philosophy (Fotopoulos & Psomas 2009, p. 150). TQM is an approach to quality management that is based on an idea that quality should be considered in all organizational processes. As TQM defines quality from the perspective of the customers, the basic idea is that organizational success can be achieved through customer satisfaction. (OGC 2007b, p. 180) This counts on the assumption that everyone are responsible for the quality, in other words, a company should empower employees to be in charge of the quality of their work. In order to achieve this, there should be an organizational culture that understands what quality means. This organizational culture is called a "quality culture". (Stewart & Waddell 2008, p. 990)

The quality management activities can be seen as part of the TQM elements; leadership, employee management and involvement, and customer focus. Other elements of TQM presented in literature are strategic quality planning, supplier management, process management, information and analysis, knowledge and education, and continuous improvement. As there are several elements in TQM, there are no one single comprehensive model created for TQM several different approaches to the elements. (Fotopoulos & Psomas 2009, pp. 151-152) As an example, a continuous improvement model frequently used alongside TQM is a four step PDCA (Plan, Do, Check, and Act)-cycle presented in figure 13. The PDCA cycle can be used for example as a process tool to improve the quality of IT services. (Lal 2008, p.113; Chen & Sorenson 2007, p. 42; OGC 2007b, p. 180)

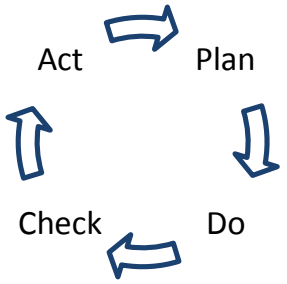


***Figure 13.*** *PDCA- cycle (Chen & Sorenson 2007, p. 42)*

In the PDCA-cycle, the idea is to continuously measure the IT services and then implement identified improvements to them. In "Plan" phase the idea is to identify and plan improvement possibilities and define objective for improvement and in "Do" phase to execute the corrective actions and gather data from the results. In "Check" phase the data gathered is analyzed and verified that were the expected improvements achieved. In the "Act" phase the target is to learn about the process and to include successful changes into organizations procedures. The cycle is repeated if the expected results are not achieved. (Chen & Sorenson 2007, p. 42; Lal 2008, pp. 113-114) PDCA improvement cycle can be used in any quality improvement activities and processes. As development idea created for the original model, the cycle can be seen to rotate on top of the quality standards level in a way that the "Plan" phase will always start from higher quality level than the previous one. (Lal 2008, p. 114) Other commonly utilized frameworks beside PDCA-cycle in TQM are for instance Ishikawa's fishbone diagram, which can be used to analyze cause-effect relationships, or Juran's Quality Trilogy, which consists of cycle of quality improvement, quality control and quality planning (Fotopoulos & Psomas 2009, pp. 151-152). These and also many other different frameworks can be utilized to improve TQM in organizations.

Other approach to quality management can be through standardization. The International Organization for Standardization (ISO) has developed a quality management standard series applicable for different organizations called ISO 9000 standard family (Lal 2008, p. 126). The main standard in the ISO 9000 family are ISO 9000, ISO 9001, ISO 9004 and ISO 90011. ISO 9000 introduces the basic description and terminology for quality

management, ISO 9001 has quality management system requirements, ISO 9004 advices for quality improvement with quality management systems and ISO 90011 provides guidance for quality management system audits (ISO 2015a) The standards are created for quality management systems, that can be defined as "*The set of processes responsible for ensuring that all work carried out by an organization is of a suitable quality to reliably meet business objectives or service levels"* (OGC 2007a). ISO 9000 and ISO 9001 but also other ISO quality management standards are influenced by different quality management principles. These principles can be combined into seven points (ISO 2015a; ISO 2015b):

1. **Customer focus** – Focusing on customer requirements and exceeding their expectations;
2. **Leadership** – Understanding purposes and goals, enabling of quality work;
3. **Engagement of people** – Empowering everyone in their own area to deliver value;
4. **Process approach** – Managing, aligning and understanding activities as a part of system;
5. **Improvement** – Focusing on continuous improvement;
6. **Evidence based decision making** – basing decisions on information and data;
7. **Relationship management** – Identify and manage important partners to optimize the organizations performance;

All of these points are explained in more detail in ISO 9000 standard. The idea behind these principles are that they are seen to affect the organizations quality and can be used as a base for organizations improvement and quality system development. (ISO 2015a) Emphasize of importance between these principles and how they should be approached depends on organization, but may also evolve over time (ISO 2015b). From the ISO standard family but also in general quality management, ISO 9001 is the most used standard for quality management. It provides a framework that is developed to improve quality and processes that ultimately leads to customer satisfaction. (ISO 2015a) The standard has been developed from process and system approaches to consider the viewpoints of both management and employees. It also states that quality should be measured and aligned with quality objectives. (Cianfrani & West 2010). Thus quality objectives, but also quality policies supporting these should be defined and documented as a basis for quality management. (ISO 2008)

From the knowledge management perspective, the quality processes can be used to ensure that beneficial knowledge is provided for decision making (Stewart & Waddell 2008, p. 991). Both quality management approaches, TQM and ISO 9000 standard family, can be used to improve knowledge management activities. For example in knowledge transfer, ISO 9000 can be utilized to improve knowledge transferability, by emphasizing the importance of documentation and TQM to improve knowledge transfer efficiency internally or with external stakeholders. (Molina et al. 2004, p. 1011) Aligning knowledge management and quality management can be seen to be beneficial also to other direction. Knowledge management as a strategy can be seen to facilitate for example a continual

quality improvement in services (Yang 2008, p. 110) and the development of quality culture (Stewart & Waddell 2008, p. 990). Therefore it can be said that knowledge management and quality management are closely associated with each other and this association should be acknowledged in organizations (Stewart & Waddell 2008, p. 995).

## 4.4 Documentation quality management

When the targets for documentation quality and developing the documentation management process are not clear, documentation is generally created in ad-hoc manner. In these cases the quality of documentation differentiates by the person and situation it is created and the quality is difficult to assess, but also the total value generated with documentation cannot be achieved. (Huang & Tilley 2003, p. 93) Quality improvement, when approaching quality definition from internally design-based perspective, should be started from defining processes and standards. This is because they can be used to generate a common understanding on what quality means. (Smart 2002, p. 134-135). Generally both, quality of documents that are created, but also the quality of processes should be managed (Huang & Tilley 2003). This means that quality management principles should be considered from in all phases of documentation lifecycle and documentation management practices. Still to fulfill the aim of satisfactory quality, the customer expectations and needs should not be forgotten when designing quality requirements (Smart 2002, p. 135).

When using IT systems to aid document management practices and almost anyone can share their own knowledge, the issues relate to content quality and their requirements needs to be noted. This means that the quality requirements should be defined for the content that is allowed to be shared or added to the system. (Awad & Ghaziri 2004, p. 377) To create value with documentation, it is important that it is usable in the context that it is created for, but also the context of document should be also informed for the users (Moyer 2005, p. 202-203). For example differences with vocabulary and needs to master concepts might be evident between an expert and user. Therefore the distributor should communicate the knowledge for the receiver based on the level that the receiver is expected to understand it. (Deloule 2009, p. 79) For organization to be able to create quality documentation, there should be commonly accepted definition and criteria of information and knowledge quality (Su & Jin 2007, p. 3244). This also helps to manage the value of shared knowledge (Awad & Ghaziri 2004, p. 377).

As defined earlier, it is difficult to create quality definitions for intangibles, like knowledge or documents, as it vary over time and case-by-case (Sabetzadeh & Tsui 2015; Huang & Tilley 2003, p. 95). To manage these different quality dimensions, still some measurements should be applied to maintain the quality. One factor that might affect the definition of quality is how much the organization is willing to invest to it, thus quality definition is affected by the aim to deliver quality with a reasonable price. Quality metrics can be subjective human centric measurements, such as from the feedback gathered from

users, but also more absolute objective measurements can be used. For example, the currency can be checked by verifying the creation or update date. Accuracy and consistency of a document can be measured by comparison of documentation and their ubiquity to one another. (Sabetzadeh & Tsui 2015) In documentation quality management perspective, there should be definition what documents should be created and what are expected from them. This means that different documentation requirements and the defining criteria for them are defined. (Hernad & Gaya 2013, p. 31)

Generally evaluating quality of a document that has been shared online is hard for users, because usually there are no quality checks when publishing information online. Thus individuals can just publish their documents without any checkups. In these cases readers has to evaluate the quality and reliability of the information themselves. (Rieh 2002, p. 146) This in not beneficial in situation where knowledge quality is critical. Still to create of a complete task list for content creators that guarantees the creation of quality documents is too complex to be achieved (Huang & Tilley 2003, p. 96; Smart 2002, p. 133). To avoid the sharing of unreliable information, but also to keep document up to date, it might be beneficial to define and create document approval practices (Hernad & Gaya 2013, p. 31). With a suitable review and approval process, document quality can be ensured before its publication (Faircloth 2014, p. 356). For document approval, there are some quality frameworks that aid the document evaluation. As an example, Smart (2002) proposes three quality criteria for technical documents that be used to evaluate and approve the quality of document (Smart 2002, p. 132-133). These quality dimensions are presented in table 3. The Smart (2002)'s quality dimensions have been refined from IBM's Producing Quality Technical Documentation-framework developed in 1983.

***Table 3.*** *Quality dimensions for technical information (Adapted from Smart 2002)*

| Target | Dimension | Description |
|---|---|---|
| **Easy To use** | Task Orientation | Using document helps to complete tasks it is made for |
| | Accuracy | There are no mistakes or errors and the information is factual |
| | Completeness | Document includes all and only essential parts |
| **Easy To Understand** | Clarity | There are no ambiguity or obscurity |
| | Concreteness | There are no abstractions and there are appropriate examples and scenarios |
| | Style | Correct and appropriate writing conventions and wordings are used |
| **Easy to Find** | Organization | Material is organized coherently that makes sense to users |
| | Retrievability | Information is presented in a way that is quick and easy to find |
| | Visual Effectiveness | Layouts, illustrations, colors, type, icons and other graphical devices are used to enhance the meaning and attractiveness |

The Smart (2002)'s framework can be used to considerer all the specified quality dimensions and answering then 'yes' or 'no' while evaluating documents. The approver should be able to answer to all descriptions 'yes' before approving the documentation. With a feedback from the review, the document creator can improve their documentation skills and create better documentation over time (Faircloth 2014, p. 356). Although this kind of approach is a good way to improve documentation quality, it does not consider the customers own opinion (Smart 2002, p. 137). Therefore collecting feedback and improving documentation according to also subjective aspects is important.

In practice, the initial responsibility of the quality of knowledge should be with the knowledge distributor, because there is no certainty how well the receiver is able to evaluate the quality of knowledge (Deloule 2009, p. 79). These contributors will act as subject matter experts, as they are provide the value by summarizing and sharing their knowledge (Sabetzadeh & Tsui 2015, p. 372). In training situations, the quality of knowledge is especially important to be ensured by the knowledge contributor, because the receiver uses it to create references to the subject. For instance the completeness and currency of knowledge might such quality metrics that are hard to evaluate by someone that has no previous experience of the subject. (Deloule 2009, p. 79) Thus to assure the document reliability, the responsibility to keep document up-to-date should be with somebody that can ensure and validate the quality periodically. Without this kind of arrangement, the document will become unusable over time. Therefore documents should always have an owner that is responsible for the reviews. Also the document owner should be someone that has the ability to identify outdated knowledge and has access to knowledge that is needed to update the documents. The document owner can be a person, like the subject matter expert, or a group of people or team that has the access to up-to-date knowledge. (Moyer 2005, p. 202-203)

To have documented knowledge efficiently used, in addition to the ease to use and understand, it should be accessible and available, preferably in a centrally managed repository. As documents usability is related to the context that is created for, it does not need to be usable for everyone. Different categorization and search functions help the users to find relevant documentation created for them. (Moyer 2005, pp. 201-203) The relevance of documentation will also affect document retrieval as "topical relevance", as the document content should reflect of the search words it can be found with. In other words, if a document cannot be found with search words that are equate to a topic and content of the document, it can be referred as a problem with the topical relevance. (Rieh 2002, p. 145) Thus as referring to document dimensions by Forbes-Pitt (2006, p. 15) presented in figure 11, the alignment of these dimensions, the document type, metadata and content, has an impact to identification and eventually to the findability of documentation. This should be noted especially in a knowledge critical situations as it is important that the needed documentation accurate but also is easy to access (Faircloth 2014, p. 356). If documents

are easy to use and understand, but not easy to find, they might still not fulfill their purpose (Moyer 2005, p. 202-203). Therefore all documents should be organized and controlled in a way that they are easily identifiable and the arrangement and distribution methods of documents should be considered to make the locating effortless. To achieve this, there is a need for a commonly utilized guidelines of how to store and secure all the generated documents. (Hernad & Gaya 2013, p. 31)

Franco and Mariano (2007) identified several challenges in the use of knowledge repositories. These were findability, complexity and user motivation. They found out that when there were several different places for knowledge, the needed knowledge was difficult to find. The complexity was related to naming and identifying knowledge, but also to knowledge fragmentation which made the search for useful knowledge difficult. Also there was a lack of motivation for updating and sharing knowledge was identified. (Franco & Mariano 2007, p.443) Thus it is important that the documents should are easily retrievable by users. In cases when document retrieval is complicated, it is recommended that some retrieval improvements are created. (Hernad & Gaya 2013, p. 31) The solution that was identified to improve the current situation was the development of rules and standards and ways for monitoring those (Franco & Mariano 2007, p.443). For instance the efficiency of document share can be managed by monitoring popularity of documents (Sabetzadeh & Tsui 2015). Also the developing the organizational culture was seen to be important factor for success of knowledge repository use (Franco & Mariano 2007, p.443). As the knowledge should be usable and relevant when it is shared, after a certain time knowledge loses its purpose. All documents should be defined a specific retention period that how long the document should be stored. When documents lifecycle comes to its end and the knowledge is not usable anymore, it should be disposed or archived (Hernad & Gaya 2013, p. 31).

# 5. DOCUMENTATION QUALITY MANAGEMENT IN THE ORGANIZATION

## 5.1 Description of the research context

There are four main topics that should be clarified when the goal is to improve the current situation; the scope of improvement, the current situation, what the target situation is and how it can be achieved (Wiggins 2012, p. 22). These four steps were used in this research to answer the research problem. The scope of improvement was the documentation quality management in the case organization, which has been included in the organization as a part of knowledge management process activities. The current and the target situation were concluded based on the Delphi method conducted with identified document management stakeholders.

As defined earlier, the scope of improvement was the case organization and specially the ITSM documents. The case organization was a large and international manufacturing company that operates around the world. The company operated on several different business areas and IT has been centralized to serve all of the business functions. Several supportive functions of IT has been outsourced to external vendors. To support these business areas in effective way, IT functions of the organizations were developed based on ITIL standards. Therefore IT processes and also the knowledge management process in IT has been developed based on ITIL's description of knowledge management. According to ITIL v3, knowledge management should be closely linked to other IT service management processes to be able to provide the needed knowledge at the right part of processes, for example Service Desk should be able to get knowledge from release management process. (OGC 2007a, p. 148). Thus knowledge management's purpose is to facilitate knowledge transfer as presented earlier (section 2.4) in knowledge management process.

In ITIL v3, ITSM is defined as "*The implementation and management of Quality IT Services that meet the needs of the Business. IT Service Management are performed by IT Service Providers through an appropriate mix of people, process and Information Technology."* (OGC 2007a). The ITSM documents are the documents related to services and created during service's lifecycle. According to ITIL v3, the service lifecycle consist of service strategy, design, transition, operation, and continual service improvement phases (OGC 2007a). The ITSM documents are for example instructions, specifications, operating procedures and troubleshooting documents. These include stable documentation that contain the knowledge needed in maintaining the services. Everyday working documents were not included into the scope. These documents were owned by the organization even in cases when a service has been outsourced to another service provider. Still, everyday

working documents, and legal, strictly defined, documents were out of the scope of this research.

Knowledge management activities should include all people that possibly contribute or use the knowledge from IT staff to users and vendors (OGC 2007a, p. 148). Knowledge management stakeholders were categorized to four different roles in the organization: contributors, builders/approvers, users and knowledge managers. These roles were identified in on the knowledge management process of the case organization. The contributors ware employees that provide knowledge for documents. The builders and approvers were experts of some subject matter and they were to make sure that the published knowledge was in appropriate form and had a relevant content. They approve the publication of knowledge. The users utilized documentation and gave feedback about content. Knowledge managers maintained this process and overall definitions for the process and actions. It was common that a stakeholder had more than one of these roles for example a contributor was also a user of knowledge.

## 5.2 Executing the Delphi method

The Delphi method was used to define the current and target situations in the case organization. The Delphi method was chosen for this, because the definition and need for change was wanted from the stakeholders, day-to-day users of the process that had the best knowledge of the strengths and weaknesses of the actions. The Delphi method with three rounds is the most common way to use the Delphi method in a thesis research (Skulmoski et al. 2007). Also in this research, the three iterative Delphi-rounds were chosen as the research approach.

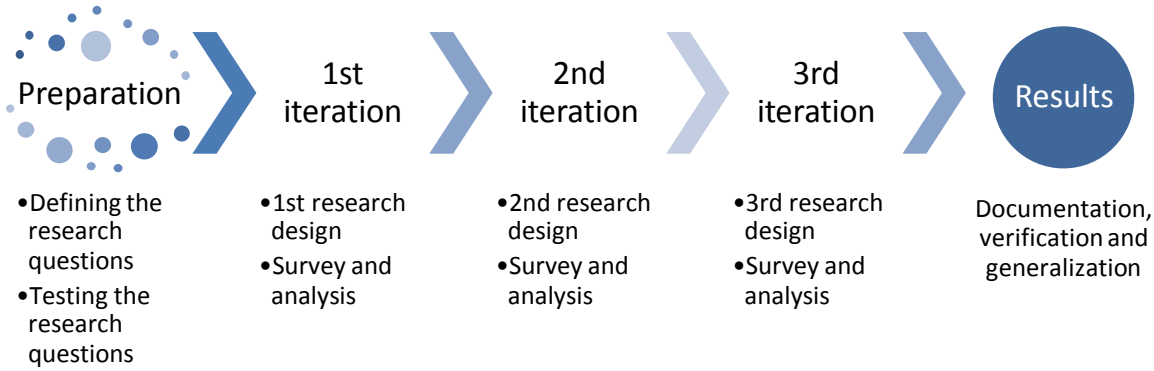


***Figure 14.*** *Three round Delphi process (Adapted from Skulmoski et al. 2007).*

The participants to the Delphi method were chosen by defining document management stakeholders from the case organization and partners according to the knowledge management roles: contributors, builders and approvers, users and knowledge managers. In the selection, the participants were chosen from different parts of the IT in case organization and partners. The aim in selection was to achieve diversity for gaining broad view

inside the scope of the document management quality management practices. The selection of contributors was done by analyzing the statistically biggest contributors of the ITSM documents in the last 12 months. The builders/approvers were selected among the people that had approved the most of these documents. The users and knowledge managers were selected according to their organizational roles. After this assessment, some additional participants were added by the representatives of case organization that were seen to provide useful insight to the research. Generally there are no defined amount of participants that should be taken into the Delphi method and the amount of the participants can vary from few to hundreds of participants (Skulmoski et al. 2007). In this research the aim was to gather enough participants for each roles from the case organization and partners. The aim for the research was to gather at least 30 participants to ensure the reliability of the research, which might have decreased during the research because of the loss of participants. As is was decided that there would be no questionnaire for invitees if they would like to participate for the research or not, the first iteration was also used to gather the Delphi participants. This method was chosen as it was seen to be more effective way to find participants for the research. Only the stakeholders that answered to the first round were included in the later iterations of the research. In the end 66 participants were invited for the first round of the research.

With the Delphi method, qualitative and quantitative information can be produced from each study iterations (Skulmoski et al. 2007). In this research, the qualitative data was gathered from the answers, explanations, themes and feedback gathered during the iterations. In Delphi studies, it is common that the quantitative data is gathered by clustering the answers according to different criteria (Tapio et al. 2011). Even though statistical methods are commonly used in quantitative research, it is not that usable during the Delphi method because statistical methods are used to create an average of the answers, but the Delphi methods purpose is to create mutual agreement. (Tapio et al. 2011) Still, statistical methods can be used to analyze the results from the last iterations (Skulmoski et al. 2007). In this study, clustering and statistical methods were chosen as quantitative analysis methods as they were suitable methods for the purposes of this research. The results from each iterations qualitative and qualitative analyses were used to define the approach and direction for the next iteration.

When designing the questions used in the research, it is critical to consider the precision, extend and openness of the questions according to the research needs (Skulmoski et al. 2007). Because the aim of the first round was to gather different views about the current situation and how to develop it, thus the questions were designed not to limit or guide the answers more than it was needed. The chosen themes for the research were the weaknesses and challenges, strengths and improvement needs off the organization.

In the second iteration, the gathered and categorized answers were send back to the respondents. In this round, the respondents were asked to choose five most relevant answers in their opinion, prioritize the answers and explain their opinion. The amount of ranked

answers were chosen after the categorization and was dependent of the amount of found categories. The aim of the iteration was to rank more answers that initially were required from the participants in the first round to require the participants to consider also other answers than they had initially thought of. When ranking too many items, it might affect to the motivation of attendees and precision of the received answers. (Saunders et al. 2009, p. 378) Thus the amount of ranked items were tried to retain to as few as possible. The answers from the second round were gathered and the average raking was counted from the answers. In this round also the answers were divided to two categories, the organizations employees and the vendors.

In the third round, the aggregated orders were sent to the responder groups and they are asked to defend or redefine their answer and give a short explanation for their answer. The answers are gathered back and a previous aggregate was refined according to the gathered answers. The third round's purpose was to create a consensus within the responders. In the end, the results of the Delphi method were created according to the last aggregate of the answers and the explanations for these answers from all rounds.

The Delphi method was conducted on the beginning of year 2016. The first round was started after common holiday season. The participants were given 7 days (5 work days) to answer the questions. The participants are reminded to answer the survey on the last day of the survey. The surveys were conducted from Wednesday to Tuesday to avoid long trips or holidays to affect the response rate. The analysis of each round answers was reserved two weeks. The detailed Delphi schedule is presented in table 4.

***Table 4.*** *The Delphi research schedule*

| Date | Time | Task |
|---|---|---|
| 1.12. - 12.1. | 1,5 months | Preparation for the survey |
| 13.1. - 19.1. | 1 week | 1nd survey response time |
| 20.1. - 2.2. | 2 weeks | Analysis and preparation for the next round |
| 3.2. - 9.2. | 1 week | 2nd survey response time |
| 10.2. - 23.2. | 2 weeks | Analysis and preparation for the next round |
| 24.2. - 2.3. | 1 week | 3rd survey response time |
| 3.3. - 15.3. | 2 week | Analysis of the results |

### 5.2.1 The first iteration

The purpose of the first round was to define and gather the challenges, weaknesses and improvement needs of the document quality and quality management in the organization. The questions of the Delphi method were designed to be open questions and developed based on predefined themes. These questions were:

1. What challenges or weaknesses have you noticed in documentation quality or quality management?

2. What you identify as the strengths of documentation quality or quality management?
3. How would you develop documentation quality or quality management?

The whole questionnaire send to the participants is attached in the appendix A. The participants were asked to send two to three answers with short explanations for their decisions. In the survey, the participants also defined their role or roles as document management stakeholder so that it could be assured that there was sufficient amount of participants from each document management stakeholder groups.

At first, 54 document management stakeholders were invited to the Delphi method and sent the first round answers. 21 of them were from the case organization and 34 from vendors. 12 of the invitees were invited after the first round response time, mostly of vendor participants, because of a need to gather more participants to the first round. From 66 invitees, 27 of them answered to the first round questions, hence the overall answer percent was 41%. Out of these, 16 were from the case organization and 11 from vendors. The survey participant roles as document management stakeholders are presented in table 5. All of the participants were asked to choose one or more roles what they see to suit them the best as document management stakeholder.

***Table 5.*** *Survey participants roles as document management stakeholders*

| | Contributors | Builders/ Approvers | Users | Knowledge Managers | Total |
|---|---|---|---|---|---|
| Organization + Vendors | 7 + 3 | 9+1 | 12+7 | 4+4 | 16+11 |

The first question was about the weaknesses and challenges of documentation quality and quality management. Totally there were 62 different answers for the question. The second questions was about the strengths of documentation quality and quality management. The second question was not as popular as the first one and some participants left it without answer or wanted to give only one answer for it. Totally there were 28 answers for the question. The third question was about the development ideas of documentation quality and quality management. Totally there were 73 answers for the question. The analyzing of answers was done by categorization and clustering of same themed answers together. The categories were not arranged by popularity to not guide the answers on the next round. The found themes from the all of the answers were clustered into categories and presented in tables 6-8.

***Table 6.*** *The categories of documentation quality and quality management weaknesses and challenges*

| Weaknesses and Challenges | Count. |
|---|---|
| 1.1 Documentation approval process is too slow or difficult | 2 |
| 1.2 Keeping documents up-to date, accurate and relevant | 14 |
| 1.3 Locations of documents are not clearly defined or not sufficiently communicated | 7 |
| 1.4 Nobody is clearly responsible for documentation quality management | 2 |
| 1.5 No common structure or templates for different documents | 4 |
| 1.6 No enough documents or knowledge in documents | 2 |
| 1.7 No quality criteria defined, communicated and managed for documents | 5 |
| 1.8 No scalable documentation requirements for different IT services | 1 |
| 1.9 Not enough resources for documentation management and/or its importance of is not realized | 3 |
| 1.10 Difficulties to use documentation tools or tool process, because of problems or limitations | 5 |
| 1.11 Responsibilities for documents and their quality are not clearly communicated | 3 |
| 1.12 Some documents are too cryptic and/or they are not written users in mind | 5 |
| 1.13 There are duplicated documents | 1 |
| 1.14 There are too many documents and they are not used | 2 |
| 1.15 Weak document search; Metadata or other document attributes are not required or summaries are not sufficient enough | 6 |

***Table 7.*** *The categories of documentation quality and quality management strengths*

| Strengths | Count |
|---|---|
| 2.1 Communication with/related to documents, Documents help or guide communication | 3 |
| 2.2 Document lifecycle control | 2 |
| 2.3 Document roles and responsibilities or ownership are defined | 3 |
| 2.4 Documents are easy to find | 3 |
| 2.5 Documents are usually up-to-date | 2 |
| 2.6 Documents created by some specified method have good quality | 2 |
| 2.7 Documents help troubleshooting and speed up recovery | 3 |
| 2.8 ITSM Document requirements have been defined | 1 |
| 2.9 Plenty of documents and information available | 2 |
| 2.10 Quality of information in documents | 2 |
| 2.11 Standard templates and article types | 2 |
| 2.12 There is intent and desire to improve documentation quality | 3 |

***Table 8.*** *The categories of documentation quality and quality management improvements and developments*

| Improvement Ideas | Count |
|---|---|
| 3.1 Clear definition and communication of documentation ownership, roles and responsibilities | 10 |
| 3.2 Clear definition and implementation of document management process and practices | 2 |
| 3.3 Clear strategy and governance for documentation management that supports overall IT strategy | 5 |
| 3.4 Clearly define and communicate locations for documents (Centralized documentation implementation) | 2 |
| 3.5 Definitions and measurements of quality criteria for documents and tools to maintain and monitor it | 1 |
| 3.6 Utilization of metadata and other document search improvements | 1 |
| 3.7 Establish document related SLA's | 1 |
| 3.8 Gather more feedback and analyze documentation needs to improve documents | 9 |
| 3.9 Improve and enhance documentation approval process | 6 |
| 3.10 Improve document updating practices, audit and targets | 4 |
| 3.11 Improve documentation and tool accessibility | 6 |
| 3.12 More effective versioning and documentation lifecycle management | 10 |
| 3.13 More efficient use of links to avoid information duplication | 7 |
| 3.14 Practical and commonly agreed document templates | 8 |
| 3.15 Threshold to create a new document should be decreased | 1 |

### 5.2.2 The second iteration

The categories clustered from the first round answers were used as a base for the second round questions. In this round the participants were asked to choose and rank five categories that they considered to be the most important answers for each question. The ranks for the answers were given from 1 to 5, where 1 was the most important answer from the group. The questionnaire is presented in Appendix B. Only the categories were presented for the participants in the second round to not aid in the ranking of the answers. The questions were sent to 27 participants, only for those who answered on the first iteration questions. In the second round analysis, the answers were gathered and analyzed with average by grading the answers. The scores for the categories were assigned according to the answers received from the participants. The ranked answers were given a score from 1 to 5, when a category ranked as 1st was given 5 points until to when 5th 1 point. The answers that were not chosen as a part of top 5 received 0 points. The average was calculated with weighed average (WA)-formula, as the weights of answers were the scores received from the participants.

Total of 20 of 27 participants answered to the second round questions. 13 of them was from the organization and 7 from the vendor side. The answers were divided between two different panels, the case organization and vendors groups, and the average score was

calculated for each category from the answers of each groups. The overall average ranking was calculated by placing the categories in order by the average score. In situations where the average score was the same between two or more categories, the category that was chosen more often was considered more important. When the average ranking and the amount of received mentions was equal, the answers were placed on shared ranking position. The answers from the iterations are presented in the tables 9-11.

***Table 9.*** *Initial average rankings of the weakness and challenge categories*

| Average Rank | | Category |
|---|---|---|
| Org. | Vendor | |
| 15 | 12-15 | 1.1 Documentation approval process is too slow or difficult |
| 1 | 1 | 1.2 Keeping documents up-to date, accurate and relevant |
| 2 | 11 | 1.3 Locations of documents are not clearly defined or not sufficiently communicated |
| 5 | 8 | 1.4 Nobody is clearly responsible for documentation quality management |
| 4 | 9 | 1.5 No common structure or templates for different documents |
| 12 | 12-15 | 1.6 No enough documents or knowledge in documents |
| 8 | 5 | 1.7 No quality criteria defined, communicated and managed for documents |
| 9 | 12-15 | 1.8 No scalable documentation requirements for different IT services |
| 7 | 10 | 1.9 Not enough resources for documentation management and/or its importance of is not realized |
| 10-11 | 12-15 | 1.10 Difficulties to use documentation tools or tool process, because of problems or limitations |
| 3 | 6 | 1.11 Responsibilities for documents and their quality are not clearly communicated |
| 13-14 | 4 | 1.12 Some documents are too cryptic and/or they are not written users in mind |
| 13-14 | 7 | 1.13 There are duplicated documents |
| 10-11 | 3 | 1.14 There are too many documents and they are not used |
| 6 | 2 | 1.15 Weak document search; Metadata or other document attributes are not required or summaries are not sufficient enough |

***Table 10.*** *Initial average rankings of the strength categories*

| Average Rank | | Category |
|---|---|---|
| Org. | Vendor | |
| 10 | 6-7 | 2.1 Communication with/related to documents, Documents help or guide communication |
| 8 | 10 | 2.2 Document lifecycle control |
| 12 | 6-7 | 2.3 Document roles and responsibilities or ownership are defined |
| 9 | 2 | 2.4 Documents are easy to find |
| 4 | 11-12 | 2.5 Documents are usually up-to-date |
| 5 | 11-12 | 2.6 Documents created by some specified method have good quality |
| 3 | 8 | 2.7 Documents help troubleshooting and speed up recovery |
| 7 | 9 | 2.8 ITSM Document requirements have been defined |
| 2 | 3 | 2.9 Plenty of documents and information available |
| 6 | 4 | 2.10 Quality of information in documents |
| 11 | 1 | 2.11 Standard templates and article types |
| 1 | 5 | 2.12 There is intent and desire to improve documentation quality |

***Table 11.*** *Initial average rankings of the improvement categories*

| Average Rank | | Category |
|---|---|---|
| Org. | Vendor | |
| 1 | 2 | 3.1 Clear definition and communication of documentation ownership, roles and responsibilities |
| 3 | 7 | 3.2 Clear definition and implementation of document management process and practices |
| 4 | 6 | 3.3 Clear strategy and governance for documentation management that supports overall IT strategy |
| 2 | 13-15 | 3.4 Clearly define and communicate locations for documents (Centralized documentation implementation) |
| 9 | 5 | 3.5 Definitions and measurements of quality criteria for documents and tools to maintain and monitor it |
| 7 | 3 | 3.6 Utilization of metadata and other document search improvements |
| 11 | 8 | 3.7 Establish document Related SLA's |
| 15 | 1 | 3.8 Gather more feedback and analyze documentation needs to improve documents |
| 12 | 12 | 3.9 Improve and enhance documentation approval process |
| 8 | 4 | 3.10 Improve document updating practices, audit and targets |
| 10 | 9-10 | 3.11 Improve documentation and tool accessibility |
| 13 | 12 | 3.12 More effective versioning and documentation lifecycle management |
| 6 | 11 | 3.13 More efficient use of links to avoid information duplication |
| 5 | 9-10 | 3.14 Practical and commonly agreed document templates |
| 14 | 13-15 | 3.15 Threshold to create a new document should be decreased |

### 5.2.3 The third iteration

In the third iteration, the aim was to pursue for deeper consensus of the ratings within the groups. To achieve this, the average answers of each groups and the previous answer received from the participants were sent back to the participants for the second review. The participants were asked to rethink their answers, they had a possibility to change their previous answer, and argument why they do or do not agree with the average ranking. The questionnaire sent to the participants was added as an attachment in Appendix C. The average answers of vendor group were presented for vendor participants and the organization group average answer were sent to the participants from the case organization.

All of the participants from the first round were invited to participate the third round. In the end, 18 of 27 participants answered to the third round, which all of them were also participants in the second round. 11 answers were from the organizations groups and all 7 vendor participants participated to the third round. The method of counting the weighted average score was also used to analyze the third round results. The new answers were used to refine the previous answers. In the end, a summary of the final round answers was made based on the all received rankings. The average rankings received from the analysis of the third round and the results of the method are presented in chapter 6.

## 5.3 The factors affecting the results

Overall the survey was successful and there were a good amount of participants during all research iterations. Also in all of the questions, there were clearly more popular and unpopular categories. As in all research, also in this one, there were some limitations affecting the results. During the research, there were some struggling in balancing between the accuracy of explanations, questions and instructions against the length of the surveys. The challenge was manifested as there were some misinterpretation of the second question. This resulted that some of the answers to the question were clearly improvement suggestions and thus they were analyzed as improvements in the first round.

After the research, feedback about the surveys for being too long was received from the participants. As the survey was conducted in the case organization, some participants explained that they were too busy to answer the survey, even thought they might have wanted to. Also even though in the beginning the participants on vendor side were chosen to represent all stakeholder groups equally, in the end the participants from the vendor side were mainly document users. Therefore the vendor participants that participated to the survey might be a bit too homogenous to present all whole vendor segment. This might have affected the research results. The reason for some differences between the answers between the groups could be because of the fact that the participants from the vendor side were primary using IT ERP-tool and their own specific sites for work related activities. This is also realized as that vendor participant were more concentrated to use IT ERP as a document repository as the other repositories. Still this grouping provided

interesting results that are also valid for the development of knowledge management activities.

As mentioned earlier, the second question got the least answers the first round, but also in the ranking rounds. In the second and third iterations some participants wanted to rank overall only two, not five strength categories. This might have affected to the last rankings as the answers were quite scattered between the categories. As an example, one participant explained this in the following way:

*"I'm not able to identify strengths. That been said, I'm optimistic that the content quality, and documents in general are in very good level – in spite of the process and management of documentation. I just see too much lost potential to be able to pick up strengths."*

# 6. ANALYSIS OF THE CURRENT STATE

## 6.1 Presenting the results from the Delphi method

The answers and explanations gathered from the Delphi method were used to clarify the current state of documentation quality management in the organization. This was done by categorizing answers from three different questions: what are the weaknesses, the strengths and the most important improvements needed for documentation quality management. The results were presented by introducing the average scores of both groups gathered from the respondents. Also the final rankings of categories were calculated according to these average scores. The analysis method was explained in more detail in section 5.2.

In the analysis of the current state, the main focus was on the categories that were rated as the top five of the most important ones by each of the groups. The same amount of the most important categories was chosen also in the Delphi method by the participants. As these categories were rated as the most important by the stakeholder groups in the Delphi method, they were also identified as the main targets of the improvement presented as the conclusions of the study (chapter 7). Still the other categories should not be dismissed when designing document quality management improvements, because of possible connections or shared root causes between different categories.

The figures present the weighted average score of the categories rated by the groups. Based on the answers gathered and analyzed in the Delphi method, the average ratings were grouped in figures 15-17. In the figures the category that received the highest average score was chosen as the most important category. Therefore according to these scores, the average rankings were calculated for all categories. The average rankings were presented in tables 12-14. The most important categories were highlighted with colors in the figures and tables.

## 6.2 Identified weaknesses

The first question was used to determine the current weaknesses and challenges in the organization. From the answers there could be identified more popular categories than the others. There was a clear agreement among the both groups of the most important challenge or weakness category, but after the first weakness there was no visible agreement between the groups. The results from the third iteration were presented in the figure 15 and table 12.

***Figure 15.*** *Average scores for the weaknesses and challenges*

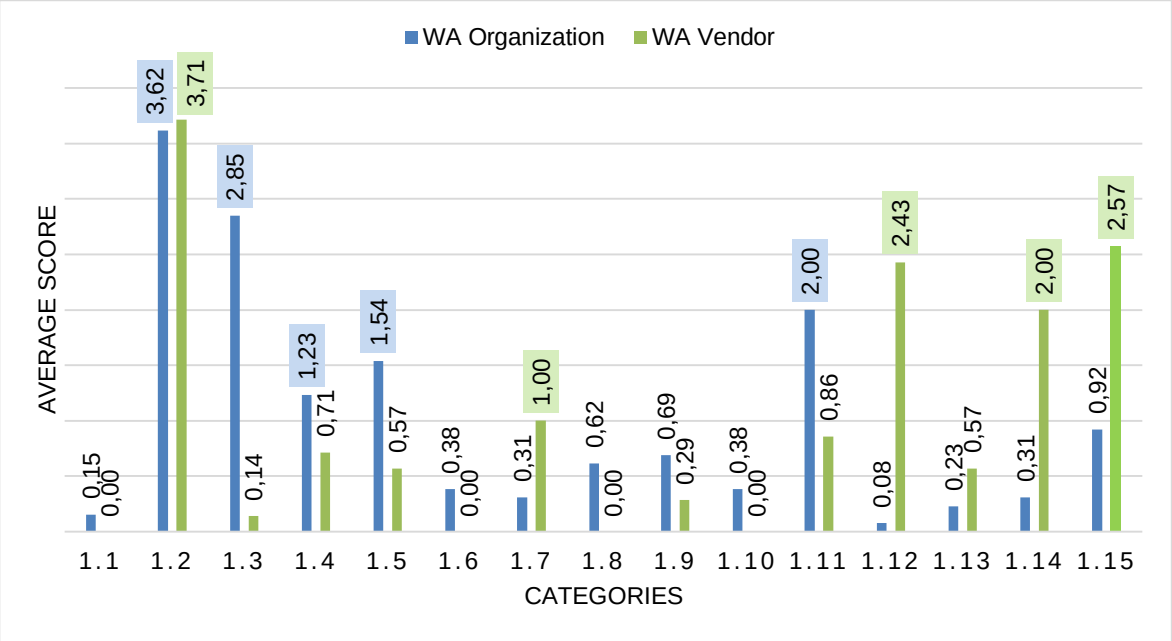


***Table 12.*** *Average rankings of the weakness and challenge categories*

| Average Rank | | Category |
|---|---|---|
| Org. | Vendor | |
| 14 | 12-15 | 1.1 Documentation approval process is too slow or difficult |
| **1** | **1** | 1.2 Keeping documents up-to date, accurate and relevant |
| **2** | 11 | 1.3 Locations of documents are not clearly defined or not sufficiently communicated |
| **5** | 7 | 1.4 Nobody is clearly responsible for documentation quality management |
| **4** | 9 | 1.5 No common structure or templates for different documents |
| 9-10 | 12-15 | 1.6 No enough documents or knowledge in documents |
| 11 | **5** | 1.7 No quality criteria defined, communicated and managed for documents |
| 8 | 12-15 | 1.8 No scalable documentation requirements for different IT services |
| 7 | 10 | 1.9 Not enough resources for documentation management and/or its importance of is not realized |
| 9-10 | 12-15 | 1.10 Difficulties to use documentation tools or tool process, because of problems or limitations |
| **3** | 6 | 1.11 Responsibilities for documents and their quality are not clearly communicated |
| 15 | **3** | 1.12 Some documents are too cryptic and/or they are not written users in mind |
| 13 | 8 | 1.13 There are duplicated documents |
| 12 | **4** | 1.14 There are too many documents and they are not used |
| 6 | **2** | 1.15 Weak document search; Metadata or other document attributes are not required or summaries are not sufficient enough |

The category that was the most important one within both groups had retained its popularity the whole research was: **1.2 keeping documents up-to date, accurate and relevant.** The participants stated that there were challenges in updating related documents

whenever changes occurred. This caused confusion among the users and affected to the reliability of the documents:

*"Not hundred percent sure that what is the relevant and accurate document"*

*"Documents are usually created during IT service implementation time. But during the IT service life cycle we don't actively update documents."*

*"Computer systems & processes are constantly being updated but documents are neglected."*

*"I'm thinking that documents are not up-to-date always. I have noticed in my work that there's a lot out dated information - contact information, hardware information, etc. in the documentation."*

The category that was rated as the second most important one within the organization, but not seen as such a weakness within the vendors was: **1.3 Locations of documents are not clearly defined or not sufficiently communicated.** The confusion was related to the fact that there are several places of where documentation are stored, from official repositories to personal directories. The problem seemed to be more apparent from the organizational level than within the teams.

*"We lack commonly agreed and usable locations where documentation would be stored and accessed"*

*"Although we now have a common location for all ITSM related documentation, it has not been implemented properly"*

*"It is a big challenge to locate documents, or locate the latest versions of them."*

*"If I only look at the de facto situation where everyone is using their own document repositories there might not be issue. If I look at the generic, organization wide topics or availability of places for e.g. vendor documentation I see a lot of issues. If you would provide 5 concrete documents and ask organization where they should be located, I assume you would receive rather heterogenous answers."*

The second most important weakness for vendors was **1.15 Weak document search; Metadata or other document attributes are not required or summaries are not sufficient enough**. The problem was mainly related to the search functionalities of IT ERP, but also to the identification of individual documents:

*"Documents are not easily found by any search engine."*

*"Summary or document statement of knowledge articles uploaded in IT ERP is not appropriate"*

*"The document search related issue is an eternal one, what's the point of having documents if you cannot find them when you want to use them."*

The category that was rated as the third important one within the vendors **1.12 Some documents are too cryptic and/or they are not written users in mind**. The category scored quite close to the second most important category. The challenge was related to the amount of context, detail and relevance of documented knowledge.

*"Sometimes the documents are too cryptic & require extensive pre-existing knowledge on the subject."*

*"Information in the Articles is not structured and sometimes is not clear for whom it was prepared (SD, OSS, MDS, etc.) Because of this support Teams waste time."*

*"I was shortly involved in a case and based on that! ...documents was written from expert perspective and not that "user minded"."*

The third important weakness in the organization's perspective, but also fairly highly rated within the vendor participants was **1.11 Responsibilities for documents and their quality are not clearly communicated.** The responsibilities related to creation of documents and ensuring that documents are accurate and relevant during their whole lifecycle seemed not to be clearly understood:

*"Service owners should approve that documents are correct. They just print YES and not even check the content."*

*"It is not clear in many cases who is responsible for documenting something."*

*"We have issues at the very basic level, meaning definition of roles and responsibilities, clarifying of which should improve the situation largely. I think we are creating documents on many levels and partly they are overlapping. Clear ownership is missing..."*

*"… Service/Process Owners are not updating the Article when it is required. In the past we had situations where Service Owners even did not know that such Article even exist."*

All of the next categories were rated among top five in either of the groups. The category that was graded as the fourth in organization was **1.5 No common structure or templates for different documents**. The participants saw that there was a lack of common guidelines, templates or even definition for IT documentation. This can be seen to be affected by the issue that the documentation requirement were not completely evident.

*"We lack completely the commonly shared definition of "Service Documentation" it is not clear what documentation we should have (both content wise and structurally)"*

*"We lack any practical guidelines/support for documentation management (e.g. templates, best practices, guidelines, etc.)"*

The category rated as the fifth in the case organization was **1.4 Nobody is clearly responsible for documentation quality management**, as it was seen that there was absence of common document quality management in the organization.

*"Quality management has been missing or it's been done by not qualified persons"*

Rated as the fourth of the most important categories by vendors, but was not seen as important in the organizations side was **1.14 There are too many documents and they are not used**. It was seen that the outdated and unusable documents were affecting the document findability.

*"Old worthless docs clutter the search."*

The category **1.7 No quality criteria defined, communicated and managed for documents** received the fifth place in vendor's ranking list, but still received significantly

smaller average score than the previous category. The category was related to the identified issue that it was hard to define documentations quality as there were no predefined definition for documentation quality.

*"No commonly applied definition of what is considered adequate documentation quality. Due to this what quality means is quite arbitrary and will largely vary in different areas."*

## 6.3 Identified strengths

The second Delphi question was related to the strengths of documentation quality and quality management. In the end, among the rankings there were disagreements between the organization and vendor, but also the answers were quite scattered inside the groups. Thus the marginal between the average scores of categories were smaller than in the identified weaknesses. The answers were presented in the figure 16 and table 13.

***Figure 16.*** *Average scores for the strengths*

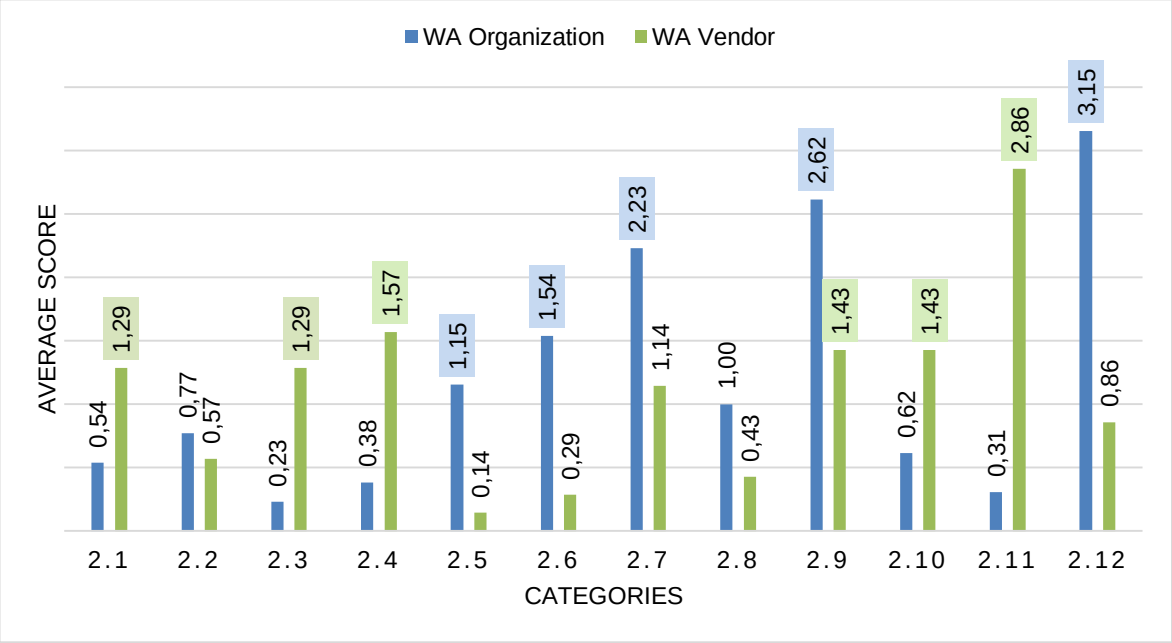

***Table 13.*** *Average rankings of the strength categories*

| Average Rank | | Category |
|---|---|---|
| **Org.** | **Vendor** | |
| 9 | **5-6** | 2.1 Communication with/related to documents, Documents help or guide communication |
| 7 | 9 | 2.2 Document lifecycle control |
| 12 | **5-6** | 2.3 Document roles and responsibilities or ownership are defined |
| 10 | **2** | 2.4 Documents are easy to find |
| **5** | 12 | 2.5 Documents are usually up-to-date |
| **4** | 11 | 2.6 Documents created by some specified method have good quality |
| **3** | 7 | 2.7 Documents help troubleshooting and speed up recovery |
| 6 | 10 | 2.8 ITSM Document requirements have been defined |
| **2** | **3** | 2.9 Plenty of documents and information available |
| 8 | **4** | 2.10 Quality of information in documents |
| 11 | **1** | 2.11 Standard templates and article types |
| **1** | 8 | 2.12 There is intent and desire to improve documentation quality |

The organizations most important strength, which was rated as the third one in vendor side, was identified as **2.12 There is intent and desire to improve documentation quality.** It was seen by the participants that the quality of documentation had been improving during few last years and there was still intent to improve further.

*"The direction of the documentation quality has been going up."*

*"The main positive is that it seems there is "awakening" towards the importance of document management and intent to improve."*

*"I think we have all the tools available and there is a clear vision to improve."*

The most popular strength in the vendor group was **1.11 Standard templates and article types in IT ERP.** The existing templates were seen to aid the document creation by providing requirements for knowledge documentation. This was seen as one factor which led to the situation that documents in general have a good quality.

*"Multiple article types, languages and templates available for document presentation thereby making it more flexible."*

*"Also in IT ERP, some articles types have standardized templates which will control the minimum/structure information that must be in them."*

The second most important strength was chosen by organizations category as **2.9 Plenty of documents and information available**. This category was also chosen as the third best rated one by the vendor group. It was seen that there is a good amount of information already available in the organization.

*"Documents contain fair amount of valid information."*

*"Document creation and number of documents which are available covering almost all the domains"*

*"It is true that we have a lot of information and documents available."*

As the first strength rated by the vendor participants received was the category that the vendor participants agreed the most, the ratings for the next ones were clearly more scattered. Still there appeared some more popular categories than the others. The second most important strength from the vendor's point of view, with a small margin (0.15) to the next two most important strengths, was **2.4 Documents are easy to find**, which was rated as one of the least popular ones in the organization. As the findability of the documents was rated also as one of the biggest weaknesses, it seemed that the usefulness of IT ERP as document management tool was also seen as a positive thing:

*"The strength of the documentation is we can find the documentation for all supported application and other supported environment easily."*

*"via IT ERP the documents are well sorted and easy to find."*

The category rated as the third one by the organization was **2.7 Documents help troubleshooting and speed up recovery.** The benefits of already existing good quality documentation was seen in the day-to-day service operations and this category can be defined as one example of this.

*"Usually when people read the articles with care, many problems can be fixed."*

*"In some areas we already noticed good quality like SD instructions in IT ERP which helps a lot during our daily operation"*

The category that was rated as fourth by the vendors, **2.10 Quality of information in documents**, received the same average score as the third one, but was assessed as less important one. This was because of the lesser amount of people that ranked the category into their personal top five. Even though the updating of documents were seen as the biggest weakness, there were satisfaction for the general quality of documentation. Documentation was seen to be useful, especially those documents that are used in day-to-day practices. Also on the organization's side, there were satisfaction to the general documentation quality.

*"Documents in general are also done with good quality."*

Rated as the fourth by organization was **2.6 Documents created by some specified method have good quality** as it was seen that there were some documentation methods already adapted in some practices that aided documentation quality

*"Step-by-step instructions are the most valued documents for our ITSD agents, a good percentage of the instructions are following this method"*

Category rated as the fifth by organization was **2.5 Documents are usually up-to-date** as it was seen that the persons responsible of the documents usually keep documents up-to-date.

*"On service level I believe we have pretty good overall level of documentation, in other words, most persons responsible have taken good care of documentation in spite of the conditions"*

The next categories that were ranked to a shared fifth place in vendor group with equal amount of rankings and score; **2.1 Communication with/related to documents, Documents help or guide communication** and **2.3 Document roles and responsibilities or ownership are defined**. These categories average score was only 0.14 points margin less than the third and fourth received from the vendor participants. It was seen that the documentation could be used to facilitate and aid communication and in cases when the documentation needed more clarification, the document ownership helped to guide document users to the persons that had the needed information. Also it was seen that overall perception of document ownerships was clear.

*"We can communicate effectively with others teams referring the documentation"*

*"..also the document ownership seems to be quite clear in most of the cases."*

## 6.4 Identified needs for improvement

The third question of the Delphi method was related to the future vision and development of the documentation quality management. Also this question got clear favorites among the answer groups. Still the averagely the most important categories between to the two study groups were quite different. The answers are visible in the figure 17 and table 14.

***Figure 17.*** *Average scores for the improvements*

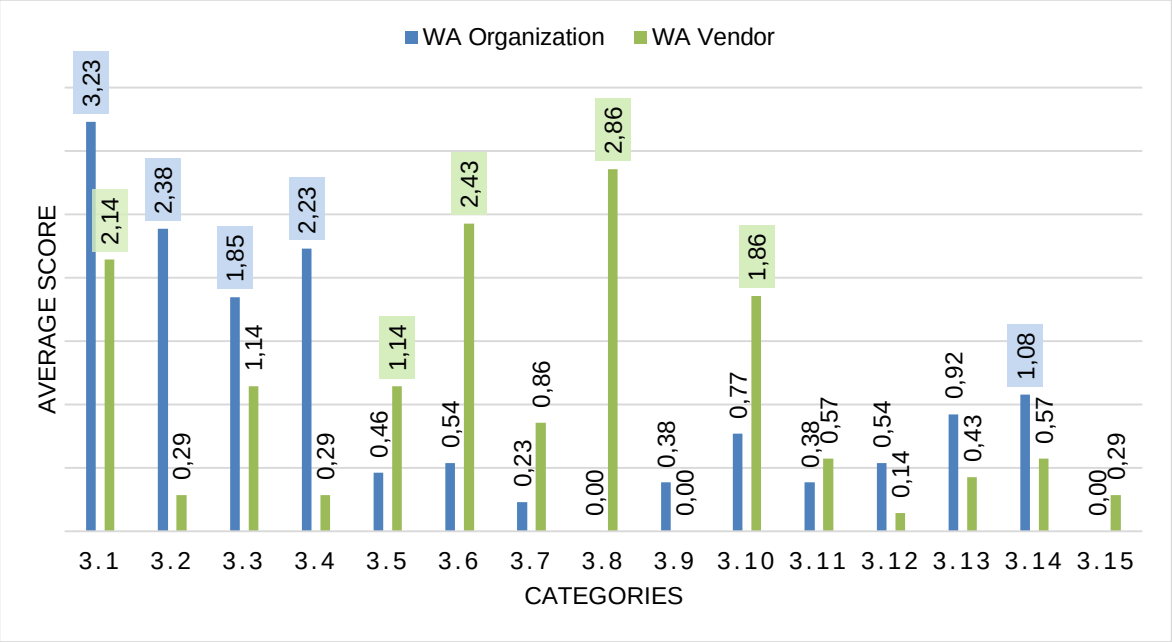

***Table 14.*** *Average rankings of the improvement categories*

| Average Rank | | Category |
|---|---|---|
| **Org.** | **Vendor** | |
| **1** | **3** | 3.1 Clear definition and communication of documentation ownership, roles and responsibilities |
| **2** | 11 | 3.2 Clear definition and implementation of document management process and practices |
| **4** | 6 | 3.3 Clear strategy and governance for documentation management that supports overall IT strategy |
| **3** | 12-13 | 3.4 Clearly define and communicate locations for documents (Centralized documentation/Document Repository Concept implementation) |
| 10 | **5** | 3.5 Definitions and measurements of quality criteria for documents and tools to maintain and monitor it |
| 8 | **2** | 3.6 Utilization of metadata and other document search improvements |
| 13 | 7 | 3.7 Establish document related SLA's |
| 14-15 | **1** | 3.8 Gather more feedback and analyze documentation needs to improve documents |
| 12 | 15 | 3.9 Improve and enhance documentation approval process |
| 7 | **4** | 3.10 Improve document updating practices, audit and targets |
| 11 | 8-9 | 3.11 Improve documentation and tool accessibility |
| 8 | 14 | 3.12 More effective versioning and documentation lifecycle management |
| 6 | 10 | 3.13 More efficient use of links to avoid information duplication |
| **5** | 8-9 | 3.14 Practical and commonly agreed document templates |
| 14-15 | 12-13 | 3.15 Threshold to create a new document should be decreased |

Rated as one of the most important weaknesses identified by the organizations participants, ranked as the most important improvement by the organization, but also as the third one by the vendors group category was **3.1 Clear definition and communication of documentation ownership, roles and responsibilities**. It was seen that an improvement should be started by defining and communicating the roles and responsibilities. This was seen to simultaneously aid the improvement of weaknesses in the documentation quality area. These could be for example in document updating and creation and improvement of quality documentation.

*"Ensure IT leads know their role in IT projects – related to ITSM requirements and document creation. Not necessarily creating the documents themselves but contacting service managers etc. relevant people."*

*"As per the current scenario, I believe defining roles and responsibilities and communication ownership can be the most crucial developments as it requires multi-vendor agreement and this requirement will be based on more awareness which can vary time to time."*

*"Ownership for KB articles is lacking in IT ERP and it's the key location for ITSD documents, multiple documents might be deleted (retired) accidentally since no one is responsible for them"*

*"Quality of document probably will be better if someone really feels owning it."*

The second most popular category by organization was **3.2 Clear definition and implementation of document management process and practices**. The category was not seen

as important by vendors and was rated into the last third of the improvement categories. This was related the previous improvement factor, but also there was a need for a general document management definition in practical level; of how documents should be managed, where and by who.

*"We need to work out fundamental document management practices and ensure implementation over all IT/Business areas."*

*"Where do I find the document I need? This document seems old, who should I contact to update? I have some article need to share where do I put it, how do I communicate it?' those are questions we often seem in daily work, all I think is related to 'Clear definition and implementation of document management process and practices'."*

The category that was rated as the most important by the vendor participants, but did not receive a single point from the organization was **3.8 Gather more feedback and analyse documentation needs to improve documents**. The vendor participants saw that there would be a need for more customer centric approach for documentation management, but also to quality management, by gathering the more feedback from the document users. This should be done before the beginning of the process by gathering the needs, but also by continuously refining knowledge according to feedback. There already are way to provide feedback, but they were not seen to be used for quality improvement.

*"Giving Actual feedback should be encouraged because that way problems are noticed faster."*

*"Ask the people who use the documentation, what the documentation is lacking (like this survey) and actually work on the improvements needed"*

*"Need and usage of the documentation should be well analyzed."*

Ranked as the third category by organization group, which average score's margin was quite close to the second one (0.15), was **3.4 Clearly define and communicate locations for documents (Centralized documentation/Document Repository Concept implementation).** The category was rated in the last third of the categories by the vendor group.

*"Improved findability for users of documentation in Organization and vendor partners"*

*"One common repository for the documentation with a proper interface, structure and search engine. It would be easy to find the knowledge, but also to know if there are multiple documents describing the same topic (so we could have only 1 version)."*

*"Implement and root the concept of common document management platform"*

The vendor group's second most important category was **3.6 Utilization of metadata and other document search improvements.** The category was ranked in the middle of the organizations list. It was seen that improving the search and also other factors that helped to identifying documents were important functions that needed improving. The problem was related on the fact that documents are stored on differed repositories with different organizing practices. The utilization of common metadata or only one interface to locate documents could improve the findability of documents.

*".. without proper metadata, indexing and search functionalities you cannot fully utilize documentation even if its quality is excellent. And if we have different document repositories, e.g. documents are located in different places it would be great to have one search to search everything in one go."*

*"Search keywords should be generic and precise in IT ERP for referring any knowledge base."*

*"It would be great to have one place or at least one search engine to search all the IT related documentation."*

Ranked as the fourth one by organization, **3.3 Clear strategy and governance for documentation management that supports overall IT strategy,** was relatively popular in the both groups. The category was also rated as the sixth one by the vendor group with same average score as the category ranked as the fifth. It was seen that a clear vision and strategy was missing or not communicated related to documentation management in the organization. There was also a need for a flexible approach for documentation management requirements.

*"Build information management strategy for IT service documentation"*

*"I would be extremely careful around "mandatory" (control level) requirements in documentation, because creation will take time. Especially any new documentation needs to be approached carefully"*

From the fifth one **3.14 Practical and commonly agreed document templates** and forward, there was not such notable agreement between the organization's participants as there was in the vendor's group, but the points were more scattered. The templates were seen to be important for document quality management improvement also from the organization point of view, but not as an essential improvement.

*"And the structure of the documents have some room for improvements. They are structured…but not easy to read."*

*"First of all I would make more logical chain of data which is stored in documentation. So in case of the need, user can easily and quickly check what should be done or what should be performed."*

The fourth important development need in the vendor's list was **3.10 Improve document updating practices, audit and targets.** There were similar arguments for the category that was rated as the fifth, **3.5 Definitions and measurements of quality criteria for documents and tools to maintain and monitor it.** The ultimate aim of these categories was to solve the challenge of keeping the documents up-to-date and relevant. It was seen that by creating practices, official SLA's or other encouragements, and measurements for them, and monitoring these the quality management could be improved.

*"Create a monthly goal for updating documents, i.e. 20 actions per month. The department / person receives some kind of bonus from achieving the goal. Helps to keep documents up to date"*

*"There should be SLA measurement to documentation updates. It ensures measurement and reports to know where it stands. "*

*"Document maintenance should be linked to IT processes and required controls should be created. This way we could ensure timely updates."*

## 6.5 The observations made from the present state

In the overall results, there were some agreement within the groups, but mostly the rankings were quite different. There was a clear agreement that the document updating and keeping them relevant is one of the biggest weaknesses documentation quality management (category 1.2). The document updating practices were also listed as part of important improvement suggestions (category 3.10). Outdated documentation can be seen to affect the documentation and knowledge quality, as it affects for example to the currency of knowledge (see quality categorizations in table 1). As the document responsibility was seen as one of the weaknesses (category 1.11), but as the most important improvement target as well (category 3.1), it can be assumed that the unclear responsibilities related to documentation management in organization might be related to challenges of the maintenance of documentation. The unclearness of locations related to documents (category 1.3) might be in relation with challenge of updating documents (category 1.2), as it was mentioned that in some cases the document owner might not be aware of the existence of some documentation that they have responsibility of.

These challenges related to responsibilities and locating documents (categories 1.11 & 1.3) were not as visible on the vendor side (category 2.3). This might be because the group was more concentrated to use one document management tool, the IT ERP, to manage and locate documentation. Instead of challenges of knowing the document locations (category 2.4) the challenges related to the organization of documentation and to the search (category 1.15) were more visible. As the vendor participants were more focused to use the documentation as to manage it (see table 5), the usability issues of the documents were more distinct (categories 1.2, 1.12 & 1.14). The amount of documentation was seen as a challenge, as some documents were not up-to-date, but also as a strength (categories 1.14 & 2.9). There were generally not many issues in the creation of documentation and the quality of documentation was in a good condition (categories 2.5, 2.7 & 2.10). This was seen to be related to the existing practices related to documentation as it seemed that there were some practices adapted for how some quality documents should be created. An example of these were the step-by-step instructions. (category 2.6) Also the existing templates in the IT ERP were seen to aid the documentation quality (category 2.11), even thought it was commented that there are also some quality challenges related to them. Still the lack of common structures or templates was seen as an important weakness in the organizations side (category 1.5), as there were no common definitions or guidelines for ITSM documents. Also the development of common templates (category 3.14) and development of some common criteria or requirements (category 3.5) were seen as suitable tools to manage and improve the quality of documentation. It was also commented that in creation of the documentation, the needs and context of the document usage should be considered even more. (category 3.8) This was identified by the vendors that explained that as some document were seen too complex to be used (category 1.12). This could be

related to missing quality criteria (category 1.7), as it might result that it might not be clear that what the expectations from documentation quality were.

There were mixed opinions of the document repositories used for documentation management. Especially the definitions for document locations were required in the organizations side (category 3.4), but also the findability and the identification of documents inside the repositories were mentioned in the weaknesses especially by the vendors (category 1.15). The document search improvement was also rated as important improvements (category 3.6). The new document repository was seen as an opportunity to improve the current situation (category 3.4), as there were also comments of the limitations in the current tools in cases of organizing the documents (category 1.10). For example there were several mentions for a need to use metadata or similar methods to unambiguously identify documents inside the tools (category 3.6), which were not fully utilized based on the participants opinions.

In the end, it seems that there was a general will to improve documentation quality management (category 2.12) and, even though some development has already happened, it is still seen as an important subject for improvement. This was also visible in the vendors answers, as they would like that feedback would be utilized more to improve and evaluate the documents and documentation needs (category 3.8). The participants identified that there was a lack of a clear responsibility of overall document management (category 1.4), and a need for the definition and implementation of the document management process and related practices (category 3.2). Also communication of the strategy and guidance related to the area was requested (category 3.3). Still some benefits were already realized from the good quality documents (category 2.7). The documentation was seen to aid knowledge transfer also by guiding communication (category 2.1) and by helping in completing tasks (category 2.7). As the will to improve is an important enabler for development, the current state of the organization can be seen as a good base for improvements.

# 7. DOCUMENT QUALITY MANAGEMENT IMPROVEMENTS

## 7.1 The solution approach

As the current situation and possible target situation has been investigated with the theoretical and empirical parts of the thesis, the improvements can be suggested for the defined scope (Wiggins 2012, p. 22). The goal of the thesis was to suggest improvements for the current situation of documentation quality management in the organization. The improvements were gathered by examining the most important categories found in the empirical research and by presenting materials to support the approach from the theoretical material presented in the thesis.

The improvement suggestions are presented to provide a holistic approach for improving the documentation quality management. With these improvement suggestions, the organization can approach the identified challenges related to documentation quality management, but also utilize the current strengths more broadly. The improvement suggestions were grouped into three improvement goals; enabling documentation quality management, facilitating the share of quality knowledge, and assisting the maintenance and use of documentation.

As there were lack of definition and communication related to documentation quality management (e.g. categories 1.4, 1.7, 3.1), to enable the documentation quality management, these issues should be tackled. With process improvement, also improving the quality of the products is possible (Huang & Tilley 2003). Therefore to manage and improve the quality of documentation, it is also required to improve the activities related to documentation process. The challenges identified were closely related to how the documentation is shared (e.g. categories 3.2 & 3.6) and already existing documentation maintained and used (e.g. category 1.2 & 1.12). Thus the improvements related these process activities are considered in more detail.

## 7.2 Enabling documentation quality management

**Define and communicate documentation and quality objectives.** Even though quality objectives were not explicitly defined as challenge or improvement need in the empirical research, they can be seen as fundament for quality management and improvement (Ansari et al. 2009, p. 78; Huang & Tilley 2003, p. 93). Documented, implemented and maintained quality objectives are also general requirement of ISO 9001 standard (ISO 2008). Defining objectives can be seen as the beginning of improvement also in PDCA-cycle, as

it is a part of the first step of quality improvement (OGC 2007b, p. 180). Thus the definition of quality objectives are presented as the first quality improvement step for the organization. The need for quality objectives can be seen to be visible in the next categories of the empirical research results:

- 1.7 No quality criteria defined, communicated and managed for documents
- 3.3 Clear strategy and governance for documentation management that supports overall IT strategy
- 3.5 Definitions and measurements of quality criteria for documents and tools to maintain and monitor it.

As documentation should be created for some defined purpose or need, the purpose should be known and defined: What is the purpose of documentation? Why and what should be documented? Who and how it should be documented? There were similar needs for definition also from quality management perspective (category 1.7). To answer to these questions there should be defined quality objectives and goals in the documentation management strategy. The objective should be considered from the perspective of all stakeholders to reach to a common understanding (Smart 2002, p. 134-135). Also other factors affecting the system, the internal and external factors, should be considered in the strategy design (Hernad & Gaya 2013, p. 32). As there was a need for documentation management strategy to support the overall the IT strategy and the strategical needs of organization (category 3.3), the documentation and its quality objectives and requirements should be reflected from the different stakeholder needs (ISACA 2012, p. 102). For example requirements for quality objectives are defined in ISO 9001 standard. These quality objectives should be documented together with quality policies. (ISO 2008) The communication of the approach should be done with proper training (ISACA 2012, p. 102).

When the documentation and quality objectives and policies have been defined, they can be used to aid in documentation quality management (Cianfrani & West 2010; ISO 2008). For example, they can be used to aid in creation of quality measurements and definitions (category 3.5). The quality measurements will help to manage quality and its improvement (Sabetzadeh & Tsui 2015). They will also support in designing documentation quality management activities and to reach the main improvement goals. For example different quality dimensions and definitions (section 4.2) could be used to aid in planning task.

**Define, communicate and implement documentation quality plan.** After the quality objectives have been defined, the improvement of quality management process can be started. The process improvement could be initiated by defining the gap between the existing situation and the objectives (Hernad & Gaya 2013, p. 31). In the empirical research, some areas for improvement could already be identified, as several categories that are closely related to the process management. These categories were:

- 1.3 Locations of documents are not clearly defined or not sufficiently communicated
- 1.4 Nobody is clearly responsible for documentation quality management
- 1.7 No quality criteria defined, communicated and managed for documents
- 1.11 Responsibilities for documents and their quality are not clearly communicated
- 2.3 Document roles and responsibilities or ownership are defined
- 2.4 Documents are easy to find
- 2.6 Documents created by some specified method have good quality
- 2.12 There is intent and desire to improve documentation quality
- 3.1 Clear definition and communication of documentation ownership, roles and responsibilities
- 3.2 Clear definition and implementation of document management process and practices
- 3.4 Clearly define and communicate locations for documents (Centralized documentation/Document Repository Concept implementation)
- 3.10 Improve document updating practices, audit and targets

Also possible relation to the categories:

- 1.9 Not enough resources for documentation management and/or its importance of is not realized
- 1.13 There are duplicated documents
- 1.14 There are too many documents and they are not used

To manage documentation quality, there was an identified need for common practices and practicalities for documentation process (category 3.2). Thus there seems to be a need for improvement of quality plan for documentation. For this generally defined best practices and standards can be utilized (such as ISO 9000), but also it can be beneficial to investigate already adapted practices in organization (category 2.6). The issue with the lack of common guidance was seen to be reflected also as other categories which were not rated to be as part of the most important categories. This was because these challenges, like document duplicates or amount of documents, were seen more as a result from other challenges:

*"'Duplicate documents' or 'There are too many documents' as a big problem' – why this problem is existing? We don't have any governance/rules/templates/instructions available."*

For instance ISO 9001 standard requires documented procedures and other supportive documentation to maintain quality management and continuous improvement (ISO 2008). The improvements to documentation process practices should be resulted from the gathered requirements and the feedback from users to satisfy the overall needs (Hernad & Gaya 2013, p. 32). This should also include guidelines of what are the definition for documentation, but also how documentation is created, retreated and maintained (Hernad & Gaya 2013, p. 30-31). To aid the process improvement, for example different documentation maturity models (like presented by Huang & Tilley 2003) could be used to improve the maturity of documentation process. To manage these activities, there is a

need for someone to take a responsibility for documentation quality management (category 1.4). The definition of document locations, but also roles and responsibilities related to them seems to be challenging or unclear in the organization (Categories 1.3, 1.11, 3.1 & 3.4). As these were considered to be challenging in the organization, especially these should be taken into consideration in the designing and implementing documentation management guidelines and procedures.

To manage quality of individual documents before their sharing but also during ongoing reviews, there should be somebody responsible for the document quality (Moyer 2005, p. 202-203). These responsibilities should be defined to specific processes or documents and documented for example in quality plan (ISO 2008). Even though in some areas in the organization, the roles, responsibilities and ownerships related to documentation were clear (category 2.3), there still seemed to be challenges and needs for improvement related to them (categories 1.11 & 3.1). According to some document management stakeholders, improvement of the area was also seen as precondition for the whole process improvement.

*"I still think having clear responsibilities defined is the basis of having efficient document management, even the best of tools and processes cannot work if nobody takes responsibility."*

Therefore roles and responsibilities should be taken as improvement action related to documentation management as they should be even more clearly communicated and documented to ensure common understanding (categories 1.11 & 3.1). On the other hand, it was sometimes disagreed that responsibilities ware not clearly communicated, but the actual problem was seen to be with understanding what the responsibility meant or with lack of resources for documentation (category 1.9):

*"A bit disagree with the item ranked as 3: "Responsibilities for documents and their quality are not clearly communicated" – from my point of view it's a question of responsibility, not communication."*

*"Quite often there's not enough time reserved for documentation or documentation management. It is not realized how much time it requires to create a good, understandable document."*

Thus there might be some other challenges related to the responsibilities (e.g. category 1.9) which need more investigation of the subject. As it seems from the results that the organizational culture would not be too resistant for improvement actions on the documentation quality management (category 2.12), still it should be noted that there might be a need for developing the quality culture in the organization (as defined in TQM). For quality culture it is important that the employees are empowered to be in charge of quality in their own area (Stewart & Waddell 2008, p. 990) and the quality objectives and the reasons for them are also clearly communicated.

The challenges with document locations were explained as issues related to common definition and communication of the subject (categories 1.3 & 3.4). The documentation management process did not seem to have clear and explicit guidelines for documentation

locations, which can be seen to result as uncertainty of document locating (category 1.3). The issue was seen as an important challenge and target for improvement, as it was also seen to cause other challenges related to documentation quality management:

*"Not sure if this is area specific but I feel that in my responsibility area duplicates are really an issue. Might have something to do with the unclarity related to the place we need to store the documents. In order to overcome this challenge, documents are often duplicated in many places thus causing challenges on keeping all up-to-date."*

The definition of locations can be seen especially important in situations where there are several different document repositories (Freeze & Kulkarni 2007, p. 94), like in the case organization. The issue could be solved with one commonly used document repository, clearly defined document locations or by establishing common search for all repositories (As defined by Debowski 2006, p. 145; Megill 2005, p. 34; Moyer 2005, p. 201). On the vendor side, in practice, there was only one primary document repository in use, which most likely resulted more certainty in document locating (categories 2.4 and 1.3). Still challenges on the document findability that were search related issues were identified on the vendor side (categories 1.15 & 3.4). Thus the identification of documentation should also be considered when defining documentation guidelines and procedures.

## 7.3 Facilitating the share of quality documentation

**Support the sharing of quality documentation with best practices.** Even though willingness to share knowledge has been identified as common issue related to documentation management in theory (Renzl 2008) it seemed that willingness to share information was not identified to be a major challenge in the organization (categories, 1.6, 1.14, 2.9 & 3.15). Therefore as the definitions for documents and their quality targets are identified, they can be used in the process to aid the maintaining knowledge sharing activities (Awad & Ghaziri 2004, p. 377). The categories that can be identified to be related to knowledge share are the following:

- 1.12 Some documents are too cryptic and/or they are not written users in mind
- 2.6 Documents created by some specified method have good quality
- 2.9 Plenty of documents and information available
- 3.2 Clear definition and implementation of document management process and practices
- 3.8 Gather more feedback and analyze documentation needs to improve documents

When defining and implementing knowledge management process and practices (category 3.2), the practices related to managing the quality of documentation during the process should be considered. One way to assure the knowledge quality with the process is with initial quality checks and approvals before knowledge publication (Faircloth 2014, p. 356; Hernad & Gaya 2013, p. 31; Gough & Nettleton 2010). Different quality criteria could be used to support this phase to assure that the definition for quality is understood.

For example approval criteria for documentation (category 2.6) and guidelines such as Smart (2002)'s quality dimensions for technical information presented in table 3, could be used to aid documentation evaluation in document approval. Also practical examples of well created documentation can be used to encourage the creation of good quality documentation (ICASA 2012, p. 105). Feedback should be gathered and utilized even more to evaluate documentation needs (category 3.8). The relevancy of documentation should be improved (category 1.12) by understanding the target audiences of documentation and documenting according to these knowledge needs and level of understanding (Deloule 2009, p. 79). As all documents are not meant to or even cannot be relevant for everyone, the communication of the documentation target audiences and the context of use should be communicated for users (Moyer 2005, p. 202-203).

**Create common templates and requirements for documents.** Common templates will help the users to utilize and understand the documents (Freeze & Kulkarni 2007, p. 94). Also similar way they will help the document contributors to understand the expectations for specific document types. The categories related to this improvement are:

- 1.5 No common structure or templates for different documents
- 2.11 Standard templates and article types
- 3.14 Practical and commonly agreed document templates

Document templates can be used to unify the form of knowledge or how certain document types are created. This was also seen as a benefit in the organization as in the IT ERP, the standard templated were utilized for some types of documents (category 2.11). Still as document templated were seen as a strength in documentation management, there were need for further document template improvement and development (category 3.14). Also there are areas that did not have these kinds of standard templates in use (category 1.5). The benefits of the common templates can be seen especially in situations like the case organization, where there are different stakeholders that are generating the documents (Wiggins 2012, p. 66). Common templates can be used to help in document creation to communicate the knowledge needs for specific type of document. Also unified forms can be used to aid in document identification and to aid to find the knowledge inside documents. It should be noted that the use of templates should be trained, because without it, the benefits of them cannot be fully achieved (Wiggins 2012, p. 66).

**Communicate the value of quality documentation.** When taking a look at the definition of quality, quality improvement means that the ability to provide value is increased (OGC 2007a, p. 141). Even though the process improvement should simultaneously improve the quality of products, there is still a need to be able to determine and improve quality of individual documents (Huang & Tilley 2003). Thus to create quality documents, there should be an understanding of the purpose and needs for documentation. In other words how documentation creates value for the organization. The categories that were identified to be related to this improvement suggestion are the following:

- 1.12 Some documents are too cryptic and/or they are not written users in mind
- 2.1 Communication with/related to documents, Documents help or guide communication
- 2.7 Documents help troubleshooting and speed up recovery
- 2.10 Quality of information in documents
- 2.12 There is intent and desire to improve documentation quality
- 3.8 Gather more feedback and analyze documentation needs to improve documents

As explained earlier, documents need to be created for some purpose (Wiggins 2012, p. 66). If there is no purpose for documentation, unused and irrelevant documentation will do only harm to other documents (Aggestam et al. 2014, p. 3) by affecting for example the reliability and findability of relevant documents. In the empirical research, some value was already created and identified as the results of documentation (categories 2.1 & 2.7). As one value of documentation, but also knowledge share, is to aid to perform tasks (Haas & Hansen 2007), the value of quality documentation was realized in documentation use. Even though the general quality of documentation was seen to be in a good level (category 2.10), there were still some challenges and needs for improvement in the area, especially in understanding the users' needs in documentation (categories 1.12 & 3.8). The resources lost to document knowledge, should be won in the use of documentation (Haas & Hansen 2007). Thus it is important for the document contributors to know what and how value is realized with the documentation. One essential part of quality improvement is the use of feedback (Mayer 2007). Therefore the importance of feedback should not be communicated only to document contributors, but also to the document users to gather and utilize more feedback in documentation quality improvement (category 3.8). As there is a will to improve the quality of documentation even further (category 2.12) and the importance of feedback is also seen in the organization (category 3.8), the encouragement to provide and utilize more feedback should not be hard to achieve.

## 7.4 Assisting the maintenance and use of documentation

**Improve documentation maintenance practices.** As category *1.2 Keeping documents up-to-date, accurate and relevant* was seen as the most important challenge in the both participant groups in the Delphi method, there is definitely a need to improve the practices related to the ongoing reviews of documentation. As explained by one participant:

*"There are too many documents that are outdated because maintenance of them is not controlled or document maintenance work is too complicated"*

The responsibilities and location definitions for documentation can be seen to affect this challenge (Freeze & Kulkarni 2007, p. 94; Moyer 2005, p. 202-203), but as these were addressed in the previous section, this improvement covers the challenge in more practical level. The categories related to the improvement are:

- 1.2 Keeping documents up-to-date, accurate and relevant

- 1.7 No quality criteria defined, communicated and managed for documents
- 1.14 There are too many documents and they are not used
- 2.5 Documents are usually up-to-date
- 3.2 Clear definition and implementation of document management process and practices
- 3.5 Definitions and measurements of quality criteria for documents and tools to maintain and monitor it
- 3.8 Gather more feedback and analyze documentation needs to improve documents
- 3.10 Improve document updating practices, audit and targets

To improve the documentation maintenance practices, the management of the whole document lifecycle should be understood and defined (Garris 2007, p. 50). This means that the target of documentation management in not only to assist with creation and sharing new documents (Faircloth 2014, p. 356). It should also facilitate the ongoing reviews and, at the end of the document lifecycle, the archival and disposal of documents (Faircloth 2014; Gough & Nettleton 2010). One way to improve the management of documents during their whole lifecycle is to synch the lifecycle of documents into the lifecycle of the service or project it is related to (Faircloth 2014, p. 356). As documentation creation can be taken as part of project workflows (Henry 2016, p. 181), the updating documentation could be taken as part of change tasks in services. This could be used to aid documentation updating after changes are implemented. The same idea was also suggested by participants:

*"Document maintenance should be linked to IT processes and required controls should be created. This way we could ensure timely updates."*

As new knowledge is created when the documentation is used in practice, this knowledge should be used to improve and review the existing documentation (Mayer 2007). Therefore additionally to the cases when changes occur, documents should also be continuously evaluated and improved by utilizing the feedback gathered and knowledge created from the document usage (category 3.8). As an addition to these, there should be some objective quality metrics based on the quality objectives (Sabetzadeh et al. 2013, p. 947). These kind of metrics could also be used more efficiently to evaluate documentation quality and perhaps even use them to create automatic document review reminders.

Implementing common best practices related to document maintenance, for example, from standards and already successful areas of document management in the organization (category 2.5), could help to improve the practices. For quality control also different document update and audit targets (category 3.10) could be applied. The development of frequent reminders or personal targets for document updating were suggested by the documentation stakeholders.

**Improve documentation findability.** There were few references related to document findability issues. As issue related to the definition and management of document locations were addressed previously, this improvement is considered more with document identification and findability inside a repository. With this improvement, the value can be utilized more efficiently from the amount of knowledge available (category 2.9). Also as the amount of knowledge is also seen as one of the challenges faced in the organization (category 1.14) search improvements could be used to improve the documentation findability further.

- 1.15 Weak document search; Metadata or other document attributes are not required or summaries are not sufficient enough
- 2.4 Documents are easy to find
- 2.9 Plenty of documents and information available
- 3.6 Utilization of metadata and other document search improvements

The problem with search was related to identification issues (Category 1.15). One solution to improve the situation is to create commonly understood taxonomy and search words. The definition for these should also be communicated to ensure the common understanding and utilization of these (Hernad & Gaya 2013, p. 31). This also requires improve for document identification. As a digital document can be understood according to their dimensions; document type, metadata, and content (Forbes-Pitt 2006, p. 15), all of these should be utilized and aligned for proper document identification. Also the management of documentation is easier when considering them as complete objects (Dinh et al. 2014, p. 3549).

In some cases, there were some contradictions between the identified challenges and improvements needs (categories 1.15 & 3.6) with the strengths (category 2.4), the issue might also be with proper training of how to use the document search functions. As documentation management is managed with IT systems, there is a need for proper user training of the system use to ensure efficient utilization (Garris 2007).

# 8. CONCLUSIONS

## 8.1 Summary and findings of the study

Information and knowledge can be seen as important resources that enable organizations operations. As the amount of information and knowledge grows (Eppler 2015), also the importance to manage it efficiently to create value is emphasized. This creates a need to manage the quality of the knowledge. To react this issue, the goal chosen for this thesis was to propose improvements to the current state of documentation quality management in the organization. Documentation management was considered as a part of knowledge management activities in the case organization. The thesis concentrated to improve documentation quality management from the process perspective. To understand the area of improvement, the basic theory and terminology of knowledge, documentation and quality management were presented.

To manage documentation, also the basics of knowledge and knowledge management theory should be understood. The knowledge in organization exists as individual and corporate knowledge and the knowledge can be found in personal, tacit, and formal, explicit, form (figure 6; Debowski 2006, p. 19). The purpose of knowledge management is to utilize the knowledge more efficiently, by facilitating knowledge creation, organization, transfer, and application (figure 8; Dinh et al. 2013 p. 103), to provide knowledge for decisions making and decreasing the need for knowledge rediscovering (OGC 2007a). Documentation can be seen as a medium to aid these knowledge management activities as documentation is basically a way for aiding the management of explicit knowledge.

Using documentation to aid knowledge management has several advantages. Documentation can be used to share knowledge in any time and place, but also to store knowledge for later use (Faircloth 2014, pp. 355-356; Deloule 2009, p. 79; ISO 2008). To ensure that the goal of documentation is achieved, they should be managed during their whole lifecycle. The process of documentation management (figure 10) was approached from the combination of knowledge management and content management process. The approach was chosen as documentation management in the organization is aided with IT systems, and thus documents can also be seen as content, managed with content management systems (Dinh et al. 2014 p. 3549; Dinh et al. 2013 p. 102). To manage the process of documentation, activities related to the assessment, organizing, sharing, and using of documentation (figure 10) ought to be facilitated by the organization.

As the target of quality is to provide value (OGC 2007a, p. 141), the quality of knowledge should be managed also in documentation management. When defining quality, the approach can be quite objective as “meeting the requirements” or subjective “meeting the expectations”. Still the definition of quality develops as the expectations and needs evolve

over time (figure 12). Different quality categorization (tables 1 & 2) can be used as the quality requirements to create common understanding of what does quality mean in a certain context. Additionally to the quality of information, as documentation management is aided with information systems also the quality of system and service should be considered (Gorla et al. 2010; Landrum & Prybutok 2004). Different quality management approaches, like TQM and ISO 9000, can be used to aid in the designing of quality management approach and goals (section 4.4).

To be able to propose improvements, the current state of documentation quality management in the organization was studied by utilizing the Delphi method (chapter 5). This was done by gathering the current weaknesses, strengths, and development needs. The research scope agreed to be improved in the organization was the ITSM documentation. The current state was derived from the results gathered with the Delphi method and the documentation management stakeholders. The stakeholders were chosen from the organization, but also from vendors to gain a broad approach to the research subject. In the Delphi method, three rounds were used to gather and iteratively refine challenges, strengths, and development needs for documentation quality management. As the result of the empirical research, the ranked lists of the most important categories were identified (chapter 6). The biggest weakness identified were related to the relevancy and findability of documentation. The strengths were found in the amount of information, the existing practices related to document creation, and the willingness to improve. Most important improvements needs were related to definition and communication of documentation roles and responsibilities, but also to the broader utilization of feedback.

As the solution, seven different improvement suggestions divided to three different areas were identified based on theory and the ranked categories (chapter 7). These were summarized in the table 15.

***Table 15.*** *Documentation quality management improvement suggestions*

| Improvement goals | Improvement Suggestions |
|---|---|
| **Enabling documentation quality management (section 7.2)** | ➢ Define and communicate documentation and quality objectives<br>➢ Define, communicate, and implement documentation quality plan |
| **Facilitating the share of quality documentation (section 7.3)** | ➢ Support the sharing of quality documentation with best practices<br>➢ Communicate the value of quality documentation<br>➢ Create common templates and requirements for documents |
| **Assisting the maintenance and use of documentation (section 7.4)** | ➢ Improve documentation maintenance practices<br>➢ Improve documentation findability |

The improvement suggestions were grouped according to three targets: enabling documentation quality management, facilitating the share of quality knowledge, and assisting the maintenance and use of documentation. The first goal, enabling documentation quality management, included two improvement suggestions. According to the empirical research, the criteria, roles, responsibilities and locations for documents seemed to be unclear. Thus there seemed to be a lack of definition, communication and/or implementation of quality objectives and plans. Still to maintain, measure and improve the quality of documentation, these should be explicitly defined. (Section 7.2)

The next introduced goal of improvement was facilitating the share of quality documentation. As there were some stakeholders that were satisfied in the general quality of documents and also some benefits of documentation were already identified in the organization. Therefore some good practices of documentation were already applied. Still as there were need for further improvement, these existing practices could be more extensively utilized. In addition some other good practices could be applied and implement to aid the share of quality documentation. Because the purpose of documentation is to create value in use, this value creation should be understood in the document creation. Common templates and document requirements should be utilized to aid the quality documentation creation. (Section 7.3)

The last improvement goal was assisting the maintenance and utilization of documentation. The last two improvements tackled the challenges of maintaining the quality of documentation, but also improve the documentation findability and usability. The documentation quality management should aid the ongoing reviews and the maintenance of documentation in case of changes. Therefore documents should be updated or disposed to not complicate the findability of relevant documents. Documentation findability can be aided by organizing and improving documentation identification. This requires the alignment of the document type, metadata, and document content. It should also be noted that user training is important enabler of success of this improvement. (Section 7.4)

## 8.2 Implication for practice and theory

This thesis provided the case organization an overview of the current state of their documentation quality management and improvement suggestions based on the previous research and empirical findings on the study. These can be used to guide the development actions, but also to justify developments needed for the area of documentation quality management. Still these improvements should be noted and considered by the organization. For example the enabling of the quality management is important for quality development and measurement, as there were multiple weaknesses and development needs related to this area. After the definition and communication of practices has been done, it will also create a good foundation for the other the quality improvement areas. Even though the improvements would not be further investigated, the challenges related to the

area are good to understand. As both knowledge and quality are hard to define and measure, the value creation based on these might be difficult to realize in practice. Still knowledge is an important enabler for organizations operation and thus it should not be taken as a granted.

Willingness to share knowledge is a common problem identified by academic literature (e.g. Aggestam et al. 2014, p. 566; Renzl 2008). However, this study did not identify that problem. Instead the availability of information was one of the biggest strengths (category 2.9) while keeping existing documentation up-to-date was one of the weaknesses (category 1.2) Instead of availability of information, the biggest issues seemed to be on other quality related aspects, such as the relevancy (category 1.2) and findability (categories 1.3 & 1.15). These findings imply that, since we are increasingly facing an information overload in our everyday work, there might be a shift from unwillingness of sharing knowledge to problems of maintaining it. This is an interesting finding and adds an example to the academic discussion.

Similar studies with the same scope and for similar organizations could not be found. Therefore this thesis provides a new case study related to the topic. This thesis also provides a study case that utilized the Delphi method for research. Delphi method is occasionally used, for instance in information system research in the forecasting and issue identification, and concept and framework development (Okoli & Pawlowski 2004, p. 17). It is apparent from the results of the thesis that the Delphi method is suitable approach also for current state analysis.

## 8.3 Limitations of the study

Overall the study was successful. The research problem "How ITSM documentation quality management can be improved in the case organization?" was answered with seven different improvement suggestions that were summarized to three quality goals. The improvements were supported by the findings in theory and empirical research. The research approach chosen to address the research problem was suitable for the purposes of the thesis, as it could be approached broadly, but still in a controlled way. The same approach could be recommended also other similar studies.

The theory was based on identified literature of the knowledge management, documentation management and quality management areas. As the scope of the research was limited to the process perspective of the study area, the other parts of the system, people and technologies, were not considered in depth. These areas were mostly limited out of the research scope, thus there could be factors in these areas that are also affecting the improvement of the documentation quality management. This is the case for example with the quality of the documentation management tools. In addition the study concentrated to the management of explicit knowledge, which mostly limited out of the tacit knowledge, the choice might have affected to the study results.

The research approach had some identifiable limitation. With the Delphi method, a broad approach to the research problem could be achieved, but detailed causes for specific categories could not be received. Alternative options for the Delphi method could have been interviews or a survey. With interviews more in depth answers could have been received (Saunders et al. 2009), but it might have limited the amount of participants for the study. If the study would have been conducted with a survey, more participants could have been taken to participate into the study. Still with one survey, the benefits of the Delphi iterations could not have been achieved. This is visible when comparing the distribution of answers from the first round to the rankings of the last round. For example improvement category 3.12 was popular in the first round, but it was not rated highly in the last round by either of the groups. More practical limitations were previously presented in the section 5.3.

This study was conducted in a limited time frame and had a limited sample size. The time frame of the study limited how many persons could be taken into the Delphi method. More variety in participants could have resulted additional depth in the analysis. Still participants chosen as the participants were suitable for the research. According to the feedback received after the study, the strict timeline for the empirical research eliminated of participants as they were too busy to answer the survey. The schedule limited the amount of iterations that could be taken as part of the research. Also as the thesis was done only by one person with a limited timeline, it affected to how in depth the analysis could be done.

Even though the goal of the research was to be as objective as possible, the researcher might have affected the research results. The interpretation of categories was done by the researcher, another researcher could have interpreted them differently. As the research philosophy was critical realism, this possibility was taken into consideration during the research. Thus it was beneficial to also use the ratings in the evaluation of the importance of answers. Also there is a possibility that the participants have interpreted the categories differently, which might affect the reliability of the answers. Additionally different interests of the participants might affect the results of the study, as they might have answered more positively or negatively than the real situation actually is.

The chosen research strategy for the research problem was a case study, the solution was only considered from the perspective of the case organization and the scope of the study. The thesis provided the organization an insight to the current state of the documentation quality management, which is presented in the chapter 6. If similar study was conducted in another organization or even for other types of documents, the results could be different. Therefore with this study, the results cannot be generalized without further research. Still similar results can be found from other scopes as well, and this case can be used as an example of one of these cases.

## 8.4 Suggestions for future research

As the thesis was a case study, the future research related to the subject should be considered by the organization and improvement presented by the thesis should be evaluated by the organization. The results of the current state analysis can be used to create further research on the subject. The improvements cannot be implemented without adaption as they were presented from general perspective and the benefits related to the development costs were not studied. If there is need to further investigate the possibilities related to the improvements or reasons behind some categories, this thesis could be used to aid in the design of research scope.

The impacts of found weaknesses, strengths and the improvement needs could be further investigated to evaluate the importance of the improvements from the organizational perspective. Additionally, other documentation areas could be studied to gain broader view to the overall situation and improvement needs in documentation quality management in the case organization. As the quality improvements were considered in the thesis mainly from the process perspective, the improvement related to other components of knowledge management, the people and technologies, should be evaluated. When improving knowledge management activities from more broad perspective, also the management of tacit knowledge should be considered.

This thesis presents one more case study of IT related documentation quality management that could be used in the further evaluation of the study area. Similar studies could be done also in other organizations, for example research the area on small and medium organizations, to investigate if similar results could be found. As the thesis did not aim to create common documentation quality management improvement solutions, a broader approach to the area could be done to evaluate the general state of the actions. Additionally improvements that could be applied to these general problems could be suggested in more detail. This could be beneficial for organizations that are struggling with the documentation quality management.

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# APPENDIX A: THE FIRST ITERATION QUESTIONS

Choose the best fitting role(s) for yourself:

- Document contributor
- Document builder/approver
- Document user
- Knowledge manager

Give 2-3 examples in each of the questions and explain your answers shortly:

1. What challenges or weaknesses have you noticed in documentation quality or quality management?
2. What you identify as the strengths of documentation quality or quality management?
3. How would you develop documentation quality or quality management?

# APPENDIX B: THE SECOND ITERATION QUESTIONS

Please choose from each table exactly five (5) categories you consider the most important ones and rank them in prioritized order from 1-5, where 1 is the most important and 5 is the least important of the group. On the left side of the tables is a designated space where the order number can be placed. Please also explain your answer shortly.

1. Choose and rank five (5) *Organization's* most crucial challenges or weaknesses in documentation quality or quality management:

| No. | Category |
|---|---|
| | Documentation approval process is too slow or difficult |
| | Keeping documents up-to date, accurate and relevant |
| | Locations of documents are not clearly defined or not sufficiently communicated |
| | Nobody is clearly responsible for documentation quality management |
| | No common structure or templates for different documents |
| | No enough documents or knowledge in documents |
| | No quality criteria defined, communicated and managed for documents |
| | No scalable documentation requirements for different IT services |
| | Not enough resources for documentation management and/or its importance of is not realized |
| | Difficulties to use documentation tools or tool process, because of problems or limitations |
| | Responsibilities for documents and their quality are not clearly communicated |
| | Some documents are too cryptic and/or they are not written users in mind |
| | There are duplicated documents |
| | There are too many documents and they are not used |
| | Weak document search; Metadata or other document attributes are not required or summaries are not sufficient enough |

Short explanation:

2. Choose and rank five (5) *Organization's* most crucial strengths in documentation quality or quality management:

| No. | Category |
|---|---|
| | Communication with/related to documents, Documents help or guide communication |
| | Document lifecycle control |
| | Document roles and responsibilities or ownership are defined |
| | Documents are easy to find |
| | Documents are usually up-to-date |
| | Documents created by some specified method have good quality |
| | Documents help troubleshooting and speed up recovery |
| | ITSM document requirements have been defined |
| | Plenty of documents and information available |
| | Quality of information in documents |
| | Standard templates and article types |
| | There is intent and desire to improve documentation quality |

Short explanation:

3. Choose and rank five (5) most crucial developments or improvements that should be done for *Organization's* documentation quality or quality management:

| No. | Category |
|---|---|
| | Clear definition and communication of documentation ownership, roles and responsibilities |
| | Clear definition and implementation of document management process and practices |
| | Clear strategy and governance for documentation management that supports overall IT strategy |
| | Clearly define and communicate locations for documents (Centralized documentation/Document Repository Concept implementation) |
| | Definitions and measurements of quality criteria for documents and tools to maintain and monitor it |
| | Utilization of metadata and other document search improvements |
| | Establish document related SLA's |
| | Gather more feedback and analyse documentation needs to improve documents |
| | Improve and enhance documentation approval process |
| | Improve document updating practices, audit and targets |
| | Improve documentation and tool accessibility |
| | More effective versioning and documentation lifecycle management |
| | More efficient use of links to avoid information duplication |
| | Practical and commonly agreed document templates |
| | Threshold to create a new document should be decreased |

Short explanation:

# APPENDIX C: THE THIRD ITERATION QUESTIONS

In the tables below are presented your last answer to the survey and the average of the answers in your group. In this round, you are still able to rethink and change your previous answers. Please choose from each table exactly five (5) categories you consider the most important ones and rank them in prioritized order from 1-5, where 1 is the most important and 5 is the least important of the group. Please place your answers once more in the table's first row and shortly explain why do you agree or disagree with the average answers. If you make any changes to your previous answers or you don't want to make any changes, please also give a short explanation for your decision.

1. Rank Five (5) most crucial existing challenges or weaknesses in documentation quality or quality management:

| Your Top 5 Answers Now | Your Previous Top 5 Answers | Average Rank (Top 15) | Category |
|---|---|---|---|
| | | | Documentation approval process is too slow or difficult |
| | | | Keeping documents up-to date, accurate and relevant |
| | | | Locations of documents are not clearly defined or not sufficiently communicated |
| | | | Nobody is clearly responsible for documentation quality management |
| | | | No common structure or templates for different documents |
| | | | No enough documents or knowledge in documents |
| | | | No quality criteria defined, communicated and managed for documents |
| | | | No scalable documentation requirements for different IT services |
| | | | Not enough resources for documentation management and/or its importance of is not realized |
| | | | Difficulties to use documentation tools or tool process, because of problems or limitations |
| | | | Responsibilities for documents and their quality are not clearly communicated |
| | | | Some documents are too cryptic and/or they are not written users in mind |
| | | | There are duplicated documents |
| | | | There are too many documents and they are not used |
| | | | Weak document search; Metadata or other document attributes are not required or summaries are not sufficient enough |

Short explanation of the agreement or disagreement with the average and changes:

2. Rank Five (5) most crucial existing strengths in documentation quality or quality management:

| Your Top 5 Answers Now | Your Previous Top 5 Answers | Average Rank (Top 12) | Category |
|---|---|---|---|
| | | | Communication with/related to documents, documents help or guide communication |
| | | | Document lifecycle control |
| | | | Document roles and responsibilities or ownership are defined |
| | | | Documents are easy to find |
| | | | Documents are usually up-to-date |
| | | | Documents created by some specified method have good quality |
| | | | Documents help troubleshooting and speed up recovery |
| | | | ITSM document requirements have been defined |
| | | | Plenty of documents and information available |
| | | | Quality of information in documents |
| | | | Standard templates and article types |
| | | | There is intent and desire to improve documentation quality |

Short explanation of the agreement or disagreement with the average and changes:

3. Rank Five (5) most crucial developments or improvements that should be done for *organization's* documentation quality or quality management:

| Your Top 5 Answers Now | Your Previous Top 5 Answers | Average Rank (Top 15) | Category |
|---|---|---|---|
| | | | Clear definition and communication of documentation ownership, roles and responsibilities |
| | | | Clear definition and implementation of document management process and practices |
| | | | Clear strategy and governance for documentation management that supports overall IT strategy |
| | | | Clearly define and communicate locations for documents (Centralized documentation/Document Repository Concept implementation) |
| | | | Definitions and measurements of quality criteria for documents and tools to maintain and monitor it |
| | | | Utilization of metadata and other document search improvements |
| | | | Establish document related SLA's |
| | | | Gather more feedback and analyse documentation needs to improve documents |
| | | | Improve and enhance documentation approval process |
| | | | Improve document updating practices, audit and targets |
| | | | Improve documentation and tool accessibility |
| | | | More effective versioning and documentation lifecycle management |
| | | | More efficient use of links to avoid information duplication |
| | | | Practical and commonly agreed document templates |
| | | | Threshold to create a new document should be decreased |

Short explanation of the agreement or disagreement with the average and changes: