WORK INSTRUCTION CONCEPT FOR CUSTOM MANUFACTURING

Lappeenranta–Lahti University of Technology LUT

Master's Programme in Mechanical Engineering, Master’s thesis

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ABSTRACT

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Work instruction concept for custom manufacturing

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Keywords: Instructions, ISO, Installation, Manufacturing, Guide, Product documentation.

A company's documents are often used by various stakeholders to guide them through the phases of operations. Some of these documents include text, specifications, and computer-aided designs. The technical document can be seen as an asset that can be maintain.

The study's purpose is to create a model of a manufacturing and installation manual that can be used in custom manufacturing processes when developing documentation for production or installation from the standpoint of stakeholders. The study will also determine whether the model is appropriate for production by the organization doing the research.

The study makes use of a literature review as well as semi-structured interviews with the employees of the organization. Observation and participating is used to confirm other research methods. The purpose of analysis chapter was to expand on the thematic issue that the author found throughout the interviews. Following the analysis section, the most essential findings are discussed and there are some possible topics for further studies.

The theoretical portion of the research aims to underline the relevance of the documentation's meanings and provides approaches to analysing textual engineering documentation. It briefly discusses technical communication, product documentation, and how businesses may use standards and known information in their documentation.

The study produced a documentation management system with three basic elements: a tree-like structure, the use of main documents, and the use of symbols. The Proposal Chapter provides a framework for businesses to consider when preparing documents for existing or prospective initiatives.

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Yrityksen dokumentteja käytetään usein eri sidosryhmien ohjauksessa. Jotkut näistä asiakirjoista sisältävät tekstiä, teknisiä tietoja ja tietokonemalleja. Tekninen dokumentti voidaan nähdä myyntiä edistävänä dokumenttina, jota ylläpidetään tuotteiden kehittyessä.

Tutkimuksen tavoitteena oli kehittää valmistus- ja asennuskäsikirjamalli, jota voidaan hyödyntää räätälöidyissä valmistusprosesseissa, kun luodaan dokumentaatiota tuotantoa tai asennusta varten sidosryhmien näkökulmasta. Tutkimuksessa lisäksi selvitettiin, onko malli sopiva tutkimukseen osallistuvan organisaation ja mikä osa kuuluu ottaa käyttöön organisaatiossa. Tutkimuksessa hyödynnetään kirjallisuuskatsausta sekä organisaation työntekijöiden puolistrukturoituja haastatteluja. Analyysiluvun tarkoituksena oli laajentaa esiin tulleita teemoja, jotka kirjoittaja löysi haastattelujen aikana. Analyysiosion jälkeen käydään läpi tärkeimmät havainnot ja mahdollisia aiheita jatkotutkimuksille.

Tutkimuksen teoreettinen osa pyrkii korostamaan dokumentaation merkitystä ja tarjoaa pohjan tekniselle dokumentaatiolle. Siinä käsitellään lyhyesti teknistä viestintää, tuotedokumentaatiota ja sitä, kuinka yritykset voivat käyttää standardeja ja tunnettua tietoa dokumentaatiossaan. Keskustelukappale tarjoaa yrityksille ehdotuksen harkittavaksi, kun ne laativat dokumentaatiotaan nykyisissä tai tulevissa projekteissa.

Tutkimuksessa tuotettiin dokumentaationhallintajärjestelmä, jossa on kolme peruselementtiä: puumainen rakenne, pääasiakirjojen ja symbolien käyttö. Pohdinta kappale tarjoaa yrityksille ehdotuksen harkittavaksi laatiessaan dokumentaatiotaan nykyisissä tai tulevissa projekteissa.

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ABBREVIATIONS

3D	Three dimensional
B2B	Business to business
BOM	Bill Of Materials
CAD	computer aided design
IEEE	The Institute of Electrical and Electronics Engineers
ISO	The International Organization for Standardization
MM	Manufacturing manual
MS office	Microsoft office
SFS	The Finnish Standards Association
TDO	A technical documentation ontology

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1 Introduction

Product data management, or how the company's technical product documentation is organized, is something that organizations may want to consider. Organizing documentation and processes for a new product may improve communication and understanding among departments. These papers have an influence on production and sales, as well as inventory optimization and equipment procurement. When material or information is handled, all the essential stages to create the product are described as an operation. (MITRE 2014, 285.) The Institute of Electrical and Electronics Engineers (IEEE) standard describes a collection of these organization operations to be the outline of the business needs. A concept of operations is designed to display goals and objectives for the system. The term is used in information systems although it may simply refer to a sequence of operations. (ISO/IEC/ 29148 2011, 4.)

The purpose of this study was to create an installation and a production manual, both of which are narratives of the procedures connected to the company's goals and objectives. An overall operational notion that is suited to all cases, would be very complicated and difficult to use. For this reason, it’s best to limit the concept of operation’s method applicability to part of technical documentations and those users that are comparable enough to be addressed by the same methods. The chosen area of applicability includes a broad range of fundamental design of the system process outline.

Developing these manuals requires consideration of the nature of the product, such as selling, producing, manufacturing, and the supporting system as well as selecting the appropriate approach to technical documentation. If these manuals are developed successfully, they should be able to apply systems engineering approaches to future product families. The scope of manuals is applicable to the methods used in the manufacture of framed sliding door systems. It is an aluminium base sliding glass door system that moves on rails with framed glass panels.

1.1 Project background and motivation

The background of this project is a development project which aims to increase the variety of products. The project fits in with the rest of the company's products and has a natural continuity with the product family. This benefits the customers receiving the products by adding value for more choices and new functions of the system. The company's continual attempts to create long-term relationships with its clients is the most essential aspect (Lager & Storm 2013, 298.)

The company’s processes are captured in technical documents, models, and specifications. The type of the document helps group the documents into different categories. The documentation may take more structural form and people who benefits from the documents are called users. They can have limited access to certain documents, or they may have routinely needed the same type of information. (MITRE 2014, 293.)

However, when there is a need for documentation, it is usually developed naturally. In other words, manufacturing industry collects information and known models they use, and focuses to fill the information caps actively. This might end up for too limited scope for the manufacturing and in the future affect decisions concerning the state of the manufacturing. Predicting processes like behaviour of the installation phase will enable the exploration of future spaces, some of which are within the scope of current technology and others which have never been seen before. Databases and quality controls can be later improved by six sigma and other data-analysis concepts. (Kusiak 2018, 511.)

Reliably determining the technical documentation for production to begin requires information about technical product documentation types and its users. This is rather challenging task because of how many different factors can be considered. One possible approach is to always have access to all available information. That would mean that the presentation of routine information, sometimes on a regular basis, is included in several documents. Considering the complexity and cost of such system, a natural choice is

document planning. It is focused on determining what information pieces should be conveyed in a document and what expository structure should be used. (Rickheit & Strohner 2008, 26–30.)

1.2 Project scope and objective

The purpose of this study is to identify and prioritize those documents, processes, and supporting processes that are essential for a specific type of product manufacturing. Company has found the importance of product documentation that is systematically presented. Different forms of data are gathered effectively, but the difficulty is that the data is dispersed to more locations, resulting in inefficient and undesirable hasty action. The study's goal is to provide a system that facilitates continuity change management and execution. The study acts as a framework for the development of a new product. This makes answering the international production question quicker and more convenient, and all the data is collected in one spot. The company's demands for system manuals were investigated in this study.

The fact that the research is restricted to a single industry is one of the study's limitations. It's likely that the outcomes are influenced by the company and the product. In chapter 1.3 is a breakdown of the main research questions. Two questions were explored in the context of the technical product documentation to acquire a better understanding of production manufacturing. Through literature study, interviews, observation, and participation, the goal is to identify answers to research questions.

1.3 Research questions

The research began with an understanding of the overall level of technical documentation and system engineering. The study aims to answer two research questions.

The main research questions of the work are:

1. What are the components of the custom manufacturing concept (production and installation manual) and which, if any, will be excluded from the sliding glass system manufacturing process?

2. What to include in the manufacturing documentation and to the production documentation?

The theoretical portion of the research is used to find answers to the main problems. The theoretical part examines the factors for information sharing and selects factors relevant to this study that appear in the case organization with the help of the second question. The study is limited to include the production industry in such a way that some of the machining is done in the production line due to the nature of the custom sizes.

1.4 Case organization

Cover Global Ltd. is a Finnish company that specializes in balcony and terrace glazing. The cover glazing system is made up of an aluminium profile and glass, as well as accessories. The glazing system provides practical benefits such as wind and dust protection. A glass balcony may provide useful extra space for the home. Figure 1 is an illustration of a terrace glazing system.

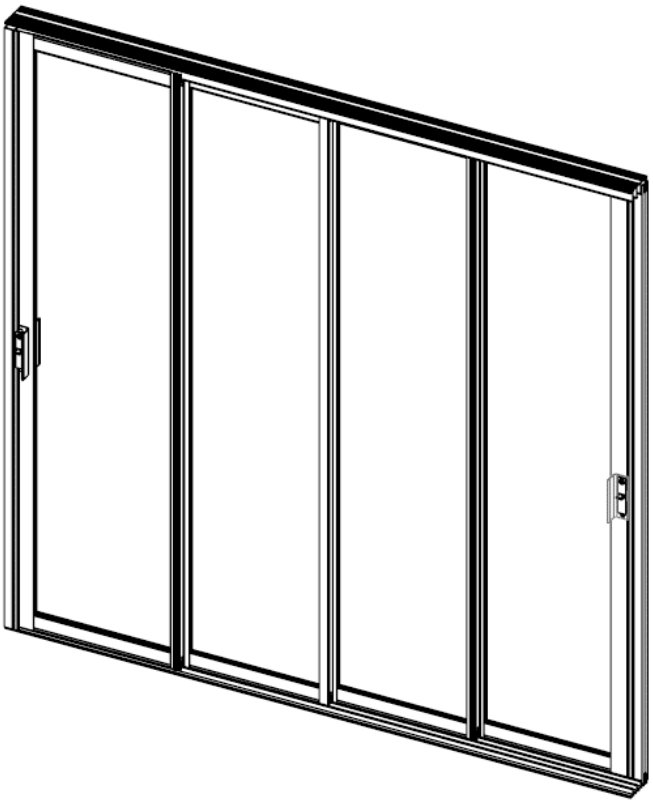

Figure 1. Terrace glazing system

2 Research methodology

Techniques for gather the qualitative research data are direct observation, interviews, involvement, and secondary data collection. Secondary data collection refers to research data that has previously been collected from another study (Eskelinen & Karsikas 2014, 77). The following were the research methodologies employed to reach the study's goal:

- Literature review
- Semi-structural interviews
- Observation
- Participation

The literature research was carried out to perform an initial assessment of technical communication and documentation to better understand the approach for this study. The context of qualitative research is crucial (Puusa & Juuti 2020, 98). Researchers can have a preconceived impression about the topic, which they further develop with the help of a literature research. After the literature research, they can re-evaluate previous assumptions or points of views. It is also common for the researcher to return to the data collecting phase to reassess the research aims and look at the preliminary questions with fresher eyes. The delimitation can also be determined by research. (Puusa & Juuti 2020, 98.)

Before making the interview questions, the researcher should become familiar with the theory and previous research knowledge of the chosen topic. With this familiarization, the researcher can define the theoretical frameworks and subject areas relevant to the research. Once the main themes are clear, they are further broken down into sub-concepts and categories that can be used to deepen the interview. As a result, semi-structured approaches are defined by the fact that certain aspects of the interview are locked in, but not all. (Hirsjärvi & Hurme 2018, 47 & 66.)

2.1 Research Approach and Design

Basic research aims to find general principles that apply to a variety of situations. It generates theories on various levels, which can be focused on a wide variety of issues. The designer is an analyst who specializes in solving difficulties and working with a set of instructions. He or she is a specialist who, by integrating multiple skills, aids in the development of solutions.

Design is a process where designers try to solve problems by coming up with new and improved solutions. This process involves knowing how and why certain things work. This process involves moving from tacit knowledge to explicit knowledge. It is time for designers to acknowledge that without a comprehensive body of theory-based knowledge, they will not be able to meet the challenges of today's complex world. A designer is someone who employs their knowledge to assist their clients in solving problems in a considerate and appropriate manner. They may also collaborate with the customer to test and develop their solutions in most circumstances. A designer must identify issues, choose acceptable objectives, and implement solutions. (Friedman 2003, 508.)

In research, questions are asked in an analytical manner. The core discoveries of basic research are applied to many groups of issues in this area. It also creates hypotheses on the same subject. (Friedman 2003, 510.) The distinction between a practice and a theory is acknowledged in literature. The practise, strictly speaking, is experimenting, and creating new ideas. (Friedman 2003, 512) Because knowledge is developed via practice, and research is focused on addressing issues that arise from experience, design and research are related. (Friedman 2003, 512.)

2.2 Literature review

The literature review was carried out utilizing the LUT Primo search engine and key terms. LUT Primo is a school’s library search for all students. The purpose of the literature review

was to understand what the researchers had discovered about the topic. LUT Primo search may be used to locate just peer-reviewed papers as well as schoolbooks with a LUT license.

At first, the search began with technical communication books and articles. Some of the search terms were:

- Standard Work Instructions
- Operational performance
- Observation
- Research approach and Design
- Installation Instruction
- Technical communication
- Visual work instruction

“Tekniikan taulukkokirja” book by Esko Valtanen introduces the technical drawing and gives guidelines for engineers to follow and it was inspiration to look for Finnish SFS ISO standard. The ISO 9001 quality handbook stimulated the search for structural technical documentation and instructions. Even if companies are not ISO certified, some businesses might benefit from the fundamental standards.

More information concerning symbols and textual evidence was required, and several books were discovered. To locate more literature on the subject, the author began browsing for non-engineering publications. For instance, marketing books, periodicals, and articles. With peer-review limitations, LUT primo searches provided more information.

For papers on this topic, Researchgate.net offers a search option. Most journals' peer-review status is explained in the "About this journal" section. It wasn't used as a source, but the same publications were discovered through a LUT primo search to confirm the status of peer review. The journals were published by Elsevier or Knovel, to name a few.

Following that, the author became acquainted with ISO standards. For SFS standard, there is an online store. There are more than 43 separate papers in the technical product documentation for SFS product group 01.110. Just a few examples include layout instructions, document management, and CAD drawings. With a LUT license, you could access them all. Interviews gave some reasons for performing a more in-depth literature research and added some context to the literature review.

2.3 Interview

In a research interview, the central task of the researcher is to convey the interviewee's thoughts, perceptions, experiences, and feelings in written form and as part of the research. Generally, the word interview means a survey data collection method in which a person is asked for opinions about the survey, and they respond in a spoken form. (Hirsjärvi & Hurme 2018, 40–43.)

When the goal is to comprehend the subject or phenomena being examined from the perspective of the persons participating in the study, qualitative research is frequently used. Qualitative research investigates people's experiences, ideas, and feelings, as well as what the phenomena or item being examined means to them. It is not a research method in and of itself, but rather a research trend comprised of several approaches, procedures, and methodologies. (Puusa & Juuti 2020, 10–17.)

There are different types of research interviews, a form interview, a thematic interview, a semi-structured interview, and an unstructured interview. The types differ from each other

mainly based on the degree of structuring. A form interview is the most structured type of interview, where the questions are written on a form and the interview proceeds according to this form. There are also ready-made answer options in the form interview. An unstructured interview is a form of interview where the questions are open, and the interview is conversational. In this type of interview, it is the interviewer's job to steer the discussion in the right direction and to deepen the interviewee's answers. (Hirsjärvi & Hurme 2018, 43–46.) A semi-structured interview is, as the name implies, an intermediate form between the other two types of interviews, although it is closer to an unstructured interview (Hirsjärvi & Hurme 2018, 48). This study examines and uses the semi-structured interview framework.

2.3.1 Semi-structured interview

A semi-structured interview is a conversational form of interview and gives the interviewee the right to speak more freely than in a structured interview. There are usually ready-made questions in a semi-structured interview, and the researcher may get the opinions of all respondents on significant subjects found in his research and established in advance by the topic. The Semi-structured interview proceeds in a certain order and one can move smoothly from one topic to another. However, the subjects are the same for all interviewees and the researcher must be familiar with both the topic and the interviewee's situation. (Puusa & Juuti 2020, 134.) When doing a semi-structured interview, planning plays a big role. Good planning guarantees clear guidelines for the research, but also allows for flexibility in the interview phase. (Hirsjärvi & Hurme 2018, 65.)

2.3.2 Design and preparation of the interview

Before making the interview questions, the researcher should become familiar with the theory and previous research knowledge of the chosen topic. With this familiarization, the researcher can define the theoretical frameworks and subject areas relevant to the research. Once the main themes are clear, they are further broken down into sub-concepts and categories that can be used to deepen the interview. As a result, semi-structured approaches

are defined by the fact that certain aspects of the interview are locked in, but not all. (Hirsjärvi & Hurme 2018, 47 & 66.)

The pre-made questions create the body of the interview. Those are a list of questions that are to be covered in the interview. In an interview situation, this created list serves as the basis for the interview questions and the interviewer's checklist. (Hirsjärvi & Hurme 2018, 66–67.) Although the interview method is not representative of any philosophy of science, it is still important that the researcher presents his own assumptions about the research topic. (Puusa & Juuti 2020, 140). However, the framework of the semi-structured interview should be open so that the interviewee's perspective, experience, and thoughts on the phenomenon under study are conveyed to the research material. (Hirsjärvi & Hurme 2018, 66–67.)

The individual reading the interview study is not able to read the interview and must instead depend on the researcher's interpretation. In qualitative research, the interpretation of the findings and interviews is done throughout the entire process. This process starts with an initial statement that makes sense of the observations and interviews, and then goes on to develop a comprehensive explanation for the phenomenon that the researcher is studying. (Hirsjärvi & Hurme 2018, 151.)

Because reality is formed by individuals and cultures from all over the world, it is doubtful that totally universal principles would be developed that would apply always and everywhere. That's why contextual aspects such as work history and culture must be included in study. (Hirsjärvi & Hurme 2018, 19.) Writing word by word is exhausting and time-consuming. The spelled text can be viewed from a variety of angles. The demands of objective and repetitious study often cause researchers to believe that they must "fade" themselves and put the reader into intimate touch with the content. (Hirsjärvi & Hurme 2018, 145.) It's also important to consider which components of the topic should be understood and how they should be read in a larger context. Interpretation is done throughout the study process in qualitative research. (Hirsjärvi & Hurme 2018, 151.)

2.3.3 Users of the documentation

The goal of the interviews for this study was to discover the true demands for product documentation from the perspective of the actual users of the documentation. The interviews also assisted with the research questions, which were assumed before to the interviews' implementation. To get the most out of the interviews in terms of completing the empirical part of this research, the interview questions were primarily written after the literature review. The required output for study and the interviews were considered, and questions were created based on this discourse to elicit the viewpoints of the interviewers on these most critical topics.

When deciding who to interview, the author looked at the flow of the information and identified a pattern. Production workers receive papers from management, which receives them from sales, and the first one comes from system development. Figure 2 presents the document flow.

Figure 2. Document flow

The information flow or in this case the document flow was recognized by doing overview of the production. The overview of the production is gathered from various sources, such as the company's internal documentation and visits to the production plant.

A semi-structural interview focuses on a specific topic, and one of the most common characteristics is that the interviewees have similar experiences. The goal of interviews is to discover who is utilizing the documentation and to get information about the production's tacit knowledge or know-how. It is critical to obtain as much information as possible on the intended topic and a diversified image of the phenomena of interest throughout the interview.

According to some academics, it would be appropriate to send interview subjects or ready-made interview questions to interviewees in advance to attain this purpose. (Puusa & Juuti 2020, 128.)

The interviews were spread out over a few weeks to ensure that the schedules matched as closely as feasible. Each individual interview lasted 10 to 15 minutes with the production employee, production manager, COO, and product development coordinator. Interviewees were sent the interview questions to generate more considered responses. Appendix 1 and 2 has the full list of the questions. For this study, the Finnish questions are translated into English.

2.3.4 Tools for recording and analysing interviews

In some way or another, the interview must be recorded. A portable tape reporter is one option, but smartphones are widely accessible in 2022. Interviews may be recorded and sent to computer, where they can be processed and studied, thanks to the phones' recording capabilities. To make audio recordings more accessible, the author can use word processing software on a computer to upload and transcribe them. The generated text recording is saved alongside the audio, and the text recording can be updated to correct text errors. The document and text may be saved in a variety of ways. (Hirsjärvi & Hurme 2018, 74.)

Easy Voice Recorder by Digipom, a free software from the Google Play store, was downloaded and installed on the phone. It uses high quality AAC format and recordings can be shared from the app. (Digipom 2002) The audio recordings were transferred to the school's cloud storage, and the transcript was edited in Microsoft Word, a word processing software. This raw text is converted into categories in Chapter 4 results of the interview.

2.3.5 Participants

Qualitative research often has a small number of participants, possibly as few as one. As the name implies, research focuses on the quality of the material, not its quantity. The deeper and richer the description of the phenomenon studied; the fewer participants are admitted. At the initial stage of the study, it may be difficult to determine the number of participants required because the saturation of the data cannot be estimated in advance. The saturation of the data means that new participants do not bring new things to the research. Only persons with experience in the subject of the study will be selected as participants. (Kylmä & Juvakka 2007, 26–27.)

Participants for this research were chosen from the case organization based on their prior experience with the subject matter. In total, four employees from various departments were interviewed. The interviewees were chosen so that each had at least a partially distinct perspective on the issue of production drawings. The author selected these people based on observation and an organizational chart. These individuals are required to have a thorough awareness of the case company's overall status. Table 1 contains a list of interviewees without names.

Table 1. List of interviewees

Interviewee	Job description	With own words	Experience in current position (Years)	Experience in company (Years)
1	Production Worker	- Assembly work - Driving forklift - Packing - And a lot more etc.	4	4
2	Production Manager	- Managing the production - Material procurement - Contacting customers	4,5	10

3	Chief operating officer	- B2B sales - Customer service - Taking care of production capacity - Different type of management tasks; budget, monitoring of funds and personnel	3	7,5
4	Product Development Coordinator	- Planning and execution product development activities - Assisting with projects, timelines, budgets - Reviewing product designs - Collaboration with customers and employers	3	4

The list includes job descriptions as well as a brief explanation of their work in their own words. Also, years of experience in the current position and with the company.

2.3.6 Interview questions

The questions were developed based on the findings in Chapter 3 Technical communication. To ensure that the backgrounds of all respondents were known before to the study, at the start they were all given the following questions:

1. How long have you been with the company? And how long have you been in your current position?

2. What responsibilities do you have as part of your job?

According to theoretical findings in Chapter 3, a well-designed documentation must meet at least the following requirements:

- It must include all necessary and appropriate production tasks.
- Standard work is straightforward.
- Each person is aware of their own schedule and responsibilities.

Four sets of question were made based on findings from the literature review. Questions are presented in appendix 1 and 2. The interviews began with the production worker. The first set of the question was designed to examine how people think about instruction and do they instruction coming from someone above of them. As can be seen from literature review, there are variety of uses for different elements and information forms.

The production manager was the subject of the second set of questions. It was primarily concerned with how the processes are perceived in the case company. They are likely to have a different perspective on the issues, therefore asking stakeholders about their connection to the documentation may be more useful than interviewing someone who does not utilize the content in this way.

With the question for the chief operating officer, the link between sales and production was evaluated. Most of the questions focused on what was on the papers and how it was applied to the paper. The present state of the company's development was queried with questions like “What is the significance and purpose of company’s work instructions in recent years?” and “What should be improved to make work easier?”

Because the respondents represent various positions within the case organization, they will most likely work on or with the manuals throughout a variety of time frames. Someone may use these documents on a regular basis, while another may only use them for projects and upgrades. All these questions provided as a platform for a more in-depth discussion on document usage. The fourth set of questions was for the product coordinator and was more focused on system development.

2.4 Observation and participating

A good starting point is to identify the organization. Once this is done, it is time to start focusing on the items that are most likely to catch the attention of the targeted audience. The advantages of observation are that it saves time and allows the researcher to get on the field

and collect data without being tied to a particular institution. Getting on the field and obtaining a key person can help gather important details and avoid wasting time and money. When it comes to the participation of the organization, it is best for the researcher to be patient and not to rush into conclusions that are already organized by the members of the organization. (Puusa & Juuti 2020, 160–162.)

Observation can be utilized as a primary approach or as a supplement to other data collecting methods. Conducting interviews and, if feasible, spending time on the scene watching the participants and settings is perhaps the most popular method. Then observations are discussed as a secondary source of information. The capacity of an observer to notice the aspects of a new item or processes in a fresh light without prior assumptions is extremely important for research. This advantage might be used for a single event or a series of occurrences. Observing is not the same as unfettered observation. While it's vital to make a list of everything that interests you, it's equally crucial to maintain track of the specifics so you can refer to them later. (Puusa & Juuti 2020, 162.)

The most typical method of observation is a participating researcher who works in the organization or in they otherwise actively participate and in which he has a certain permanent task (other than the researcher). On the other hand, in participatory observation, the researcher clearly has the role of an external researcher, although his presence and activities also influence the course of the observed phenomenon. External observation means that even if the researcher is present when the phenomenon under study occurs, he tries to stay out of it and not to influence the course of events. Then the interest of research is completely focused on the phenomenon as it would be without observation. (Puusa & Juuti 2020, 161.)

In his paper “Theory construction in design research: criteria: approaches, and methods “, Ken Friedman stated that design will never achieve its aim unless it is founded on the three pillars of science: observation, theorizing, and testing the valuable theories from the rest. Some designers argue that theory-based design robs of its artistic depth. Friedman believe that it can still achieve great heights by studying the world beyond the self-generated artist. It is not experienced that leads to knowledge, but our understanding of it. Knowledge comes

from theories that allow us to ask and learn from the world around us. (Friedman 2003, 521–522.)

Several visits to the production facility were made. Those facilities are close to the company office, and entry is simple. The focus of the observation was on paperwork discovered on the manufacturing site. Observational visits are not scheduled in any manner, but they do take place over a lengthy period. The use of the installation and production manuals was observed. The method can be used to identify behaviours that the individuals do not want to talk about. The observation is about the present moment, although it can be carried out over an extended period. Observation is particularly well suited for the analysis of interactions. (Hirsjärvi & Hurme 2018, 38.) The observation is on the colleagues and how they use papers on a regular basis.

The study focuses on installation and manual instructions, with no mention of company layout, warehouse management, or subjects relevant to other items. Observing such matters was not part of the study's objectives. The discussion chapter contains the author's personal professional expertise. It includes tacit knowledge and a comparison of the author's personal experience and the personnel of the organization. (Eskelinen et al. 2014, 78–79.)

The most typical method of observation is a participating researcher who works in the organization or in the otherwise actively participates and in which he has a certain permanent task (other than the researcher). On the other hand, in participatory observation, the researcher clearly has the role of an external researcher, although his presence and activities also influence the course of the observed phenomenon. External observation means that even if the researcher is present when the phenomenon under study occurs, he tries to stay out of it and not to influence the course of events. Then the interest of research is completely focused on the phenomenon as it would be without observation. (Puusa & Juuti 2020, 161.)

3 Technical communication

The structure of documents is an essential aspect that has a direct influence on how well their material is received by their readers (technical documentation users). The division of complex knowledge into hierarchically arranged parts is essential not only to guide users to cut the subject smaller step to be archived, but also to allow readers to rapidly locate valuable parts of documents when seeking information. Authors frequently gets assistance in integrating and arranging existing writings from multiple sources. They want the message to be as obvious as possible to the audience. (Mehler & Romary 2012, 317–319.)

Technical documentation can have several roles. It can be used as a communication tool between seller and customer. The system's developer can offer their own viewpoint on the system's goals and expectations. This provides a technique of producing as well as a means of communicating with ideas and product names. It also can provide common understanding among multiple developers, assembly workers and installers. Documentation can also be a place where users can place their visions and best practices. Users can validate their knowledge and some concerns about solutions by providing a method of documentation. (Fairley, Thayer & Bjorke 1994, 43–44.)

A study commissioned by VTT in 2011 examined the current situation of work instructions for Finnish companies that manufacture their own products. The study revealed that many of the companies' work instructions are not clearly explained in their documents. Most of the time, work instructions come in the form of part lists and drawings. They are presented in A4 format and are usually kept in the folder next to the working area. (Haag, Salonen, Siltanen, Sääski & Järvinen, 2011, 16–17.)

The Finnish Standards Association (SFS) and the International Organization for Standardization (ISO) are used in this chapter. These organizations develop standards documents and further information may be obtained from SFS or ISO.

3.1 Production operation

Looking around is a great method to begin understanding the nature of operations. Everything you see around you is the result of an operation. Every service you used today (radio station, transport, lecture, etc.) was made possible by an operation. Everything you purchase, sit on, wear, consume, and trash away is designed by operations managers. These operations are everywhere. (Slack, Brandon-Jones & Johnston. 2013, 6–9.)

Quality can mean that all parts are manufactured and assembled as instructed, the result is reliable, and the product is appealing and devoid of flaws. (Slack et al. 2013, 52-53) For excellent quality, a lot of planning is necessary. Plan is a format of what is intended to happen, at some time in the future. It does not ensure that an event will occur. “It is a statement of intention. Although plans are based on expectations, during their implementation things do not always happen as expected” (Slack et al. 2013, 290).

Computer aided design (CAD) systems allow you to develop and edit product designs with help of computer. Points, lines, arcs, circles, and text can be incorporated to a computer-based designs. These things may be duplicated, moved, rotated, enlarged, or removed once they have been included into the design, The design made in this way can be preserved and retrieved later. Visuals can be added to text documents and help in the explanation of instructions. (Slack et al. 2013, 140.)

3.2 Product documentation approach

Understanding the meanings behind the purpose is critical while reading technical product manuals. In other words, context is import when connection relationship between concept, word, and object. Semiotics studies these relationships. According to Mehler and Romany (2012, 317–319), semiotic triangle depicts the link between words and objects, both real and abstract. In Figure 3, three vertices of the semiotic triangle relate to the word, its concept or meaning, and the abstract object to which it refers. Dotted line means link is not there, but

connection is more indirect. The term might be a single word, or a phrase made up of several words.

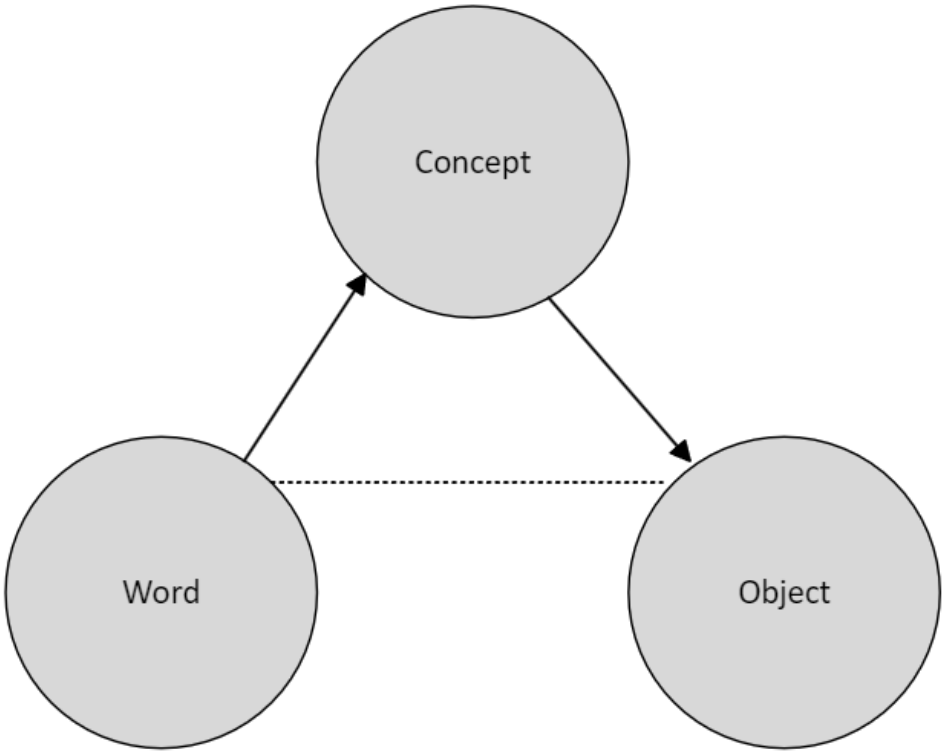

Figure 3. Semiotic triangle (in accordance with Mehler and Romany 2012, 317–319.)

Authors of dictionary are interested in general knowledge rather than specialized areas of knowledge thus they practice the study of the meanings of words and phrases in language. The need to satisfy the assumptions and limits of different audiences is one part of conveying the complicated link between thoughts and language. Even though definitions from words are meant to identify the same referent, the wordings and contents can be different. (Mehler et al. 2012, 317–319.)

How to represent a statement with a few words or symbols, is the most difficult parts of presenting the subject matter of documents. First the topic is defined and described. After that, material must be indexed. According to Jens-Erik Mai (2001, 592–593.) indexing is a representation of an interpretation of a text for future use, rather than a neutral and objective representation of the subject content of a document. This indexing process can be combined with semiotic framework. The process goes through steps and the creation of the subject matter is based on the authors cultural environment. The number of steps depends on complexity of the subject. The indexing process is frequently depicted as having two, three, or even four steps. These four steps are:

1. Determine the document's subject matter.

2. Reconstruct the subject in a natural-language expression.

3. Rephrase the sentence in the indexing language's vocabulary.

4. The subject matter is put into the indexing language.

The two-step approach uses the first and fourth of these four steps and the three-step approach adds the usage of the second step, and the four-step uses them all. The steps indicate the indexing process' logic rather than the physical activities. The indexing procedure would be completed by an expert indexer in a single complicated activity.

The subject matter of the document is explicitly specified in the first step. The author then summarizes the document's subject content, frequently using his or her own language and in the form of a shorter sentences. In a third step, the author converts the sentences into the indexing language's vocabulary. Finally, the author creates one or more topic entries in the indexing language in a fourth stage.

In three-step approach there is no need for rephrasing the sentences to indexing language’s which would add complexity to indexing process with usage of the terminology of an indexing language. The essential process of adding the subject to the paper is already included in the final stage. (Mai 2001, 592-593)

3.3 Product construction

Assembly is the stage of the manufacturing process where suppliers' produced parts and other components are put together. The assembly takes place in the production plant. The process of assembling a product at the customer's location is referred to as installation. Typically, these goods are broken into smaller portions to ensure safe shipping. As far as feasible, the task is completed in an assembly facility under regulated conditions using proper tools by assembly workers. Traditionally, assembly workers have done a lot of manual labour. This is changing, and employees are becoming more reliant on automation. (Ihalainen, Aaltonen, Aromäki & Sihvonen 2011, 478.)

How the product is constructed has a significant impact on the product's processes, which affects production times and quantities. It specifies the number of components and assemblies in the structure. Using standard components and breaking down manufacturing into manageable portions makes it easier to achieve efficient production. With the use of partial assemblies or machining, final assembly may be completed more quickly. Manufacturing portions or sub-assemblies with supplier, offers the advantage of simplifying component buying procedures. Traditionally experience gained from product assembly and installation is a useful resource for product design planning. As a result, coordination between the designer and the manufacturing team is essential while organization is developing manufacturing work. Improvements in installation and development of the assembly on production are ongoing. (Ihalainen et al. 2011, 485-487.)

Figure 4 shows how processes establish connections and a network of shared knowledge. Everything related to the product development department is on the left, while everything related to the production department is on the right. Lines depict the movement of information. Smaller boxes include information.

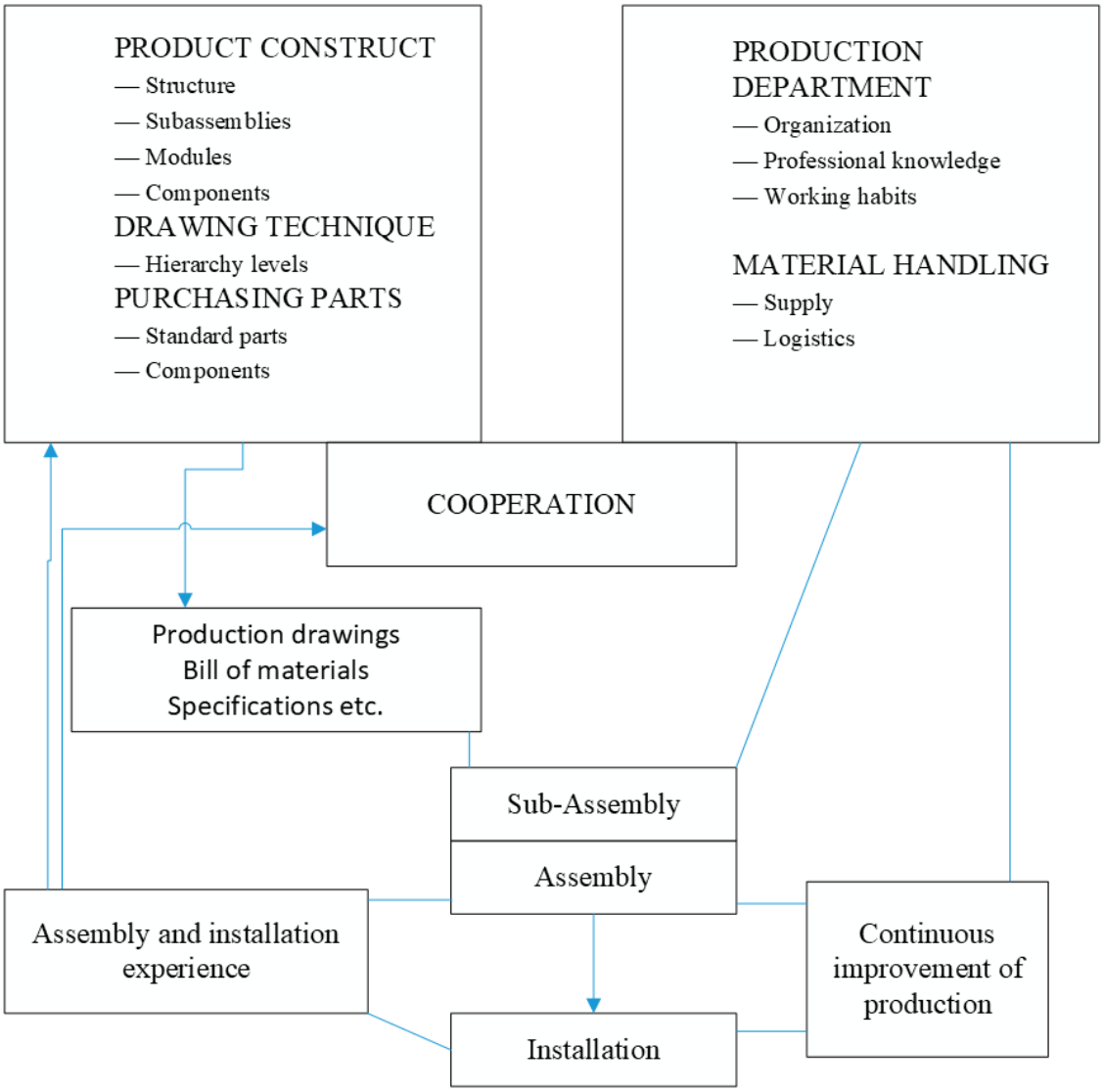

Figure 4. Cooperation of Product data management and Production is important (in accordance with Ihalainen et al., 2011, 485-487.)

For example, purchasing and logistics should collaborate to get everything ready for manufacture. This cooperation enables that the right goods can be supplied at the right time to the right location. Expecting quality should be the norm. That's why in manufacturing, the term just-in-time inventory is used, and it is referred to as a "pull" strategy. This pull is started by assembly, and information is passed down the stream to direction of where the needed components come. It is crucial information in material handling. Only necessary components are loaded on sets or pallets and transferred to the appropriate location like

assembly line. Nothing should be too much or too little. For better flow a buffer inventory should be reduced, with the possibility of getting rid of them. (Ihalainen et al. 2011, 489.)

Manufacturing should be supported by layout design and working techniques. The importance of cleanliness and order cannot be overstated. When materials are where they should be, it can have a favourable impact on lead times. The best potential lead time is obtained by carefully planning the assembling process. Stacking materials incorrectly might mean lost manufacturing time. Also, any correction or rework is a waste. If the components are dimensionally exact, there are no corrections. The organization may achieve better outcome through rationalizing working habits and locations, as well as getting the best possible tools. The goal of production should be to achieve the same level of quality all around and remove bottlenecks. (Ihalainen, 2011, 489.)

Even if automation is not the initial move, the product's structure should be prepared for it. In other words, the number of components should be kept low, and just one assembly orientation should be used. This is preferable in manual assembly since it becomes easier and more straightforward. In a manufacturing facility, assemblies can be split down into sub-assemblies and given their own section, referred to as a module. Modules are customized for individual needs and have a quick turnaround time. (Ihalainen, 2011, 489.)

3.4 Product documentation

Workflow is often defined as the act of coordinating and managing multiple tasks and procedures to achieve a certain goal, such as document or information transmission. Although it is possible to control workflow manually, most of the time it is done through an IT system. It may be argued that the procedural methods, that guides the flow of data and documents through a process, is concerned to be workflow. (Slack et al. 2013, 117.) Some of the technology platforms requires a minimal human intervention. Generally, high-volume processes tend to use higher automation technology while those with low volume typically use lower degrees of automation. Much of this work is usually done using various general-purpose technology platforms such as spreadsheets. Those can calculate the required measurements. (Slack et al. 2013, 238.)

A study commissioned by VTT in 2011 examined the current situation of work instructions for Finnish companies that manufacture their own products. The study revealed that many of the companies' work instructions are not clearly explained in their documents. Most of the time, work instructions come in the form of part lists and drawings. They are presented in A4 format and are usually kept in the folder next to the working area. (Haag et al. 2011, 16–17.) Technical product documentation methods come in a variety of forms. The International Organization for Standardization (ISO) establishes guidelines for using a single document to collect all product-specific information for a particular part or assembly.

3.4.1 Graphical and textual documentation

The ISO 29845 standard specifies the categories of technical product documentation. Engineering documents are usually created by means of text- and image-based processing. They should use a title block that is in accordance with the latest version of the International Organization for Standardization. A standard is a set of rules and guidelines that are used for the development and execution of engineering projects. It is usually established by a recognized organization or body. Technical specifications are one type of standard paperwork that is used to declare needs and gather information. Some of these document types interested in this study are found in this standard. Standard describes calculation sheet, process specification and assembly instructions. (ISO 29845 2011, 48.)

The size of the presentation form or paper is crucial for readability. The original drawing should be done on the smallest sheet possible to get the required clarity and resolution according to SFS-EN ISO 5457 standard. The ISO-A series sizes are utilized and in accordance with ISO 7200, the title block in drawings should be placed in the bottom right corner of the drawing space to the A0 to A4 sizes. It should be vertically oriented to the maximum extent possible. (SFS-EN ISO 5457 1999, 8.)

The international standard SFS-EN ISO 5457, establishes the data fields used in the headers and title blocks of technical product documents. It is intended to facilitate the exchange of such documents and ensure compatibility. SFS-EN ISO 7200 standard provides predefined data fields for document management-relevant data. It supports the cross-use and re-use of documents. To suit an A4 sheet, the entire width is 180 mm, with a 20 mm left margin and a 10 mm right margin. For all paper sizes, the same title block is utilized. (SFS-EN ISO 5457) Documents should be supplied in single-language versions wherever possible. The language codes must, however, be separated by an appropriate symbol in a multilingual document. (SFS-EN ISO 7200 2004, 13.)

3.4.2 Symbols

A symbol can have multiple meanings depending on its type. For instance, a circle can be used to represent a shape or the moon on the sky. It is very important that you understand the context of a symbol to understand its meaning. There are a variety of lists that provide a good idea of the type and domain of a symbol including, but not limited to basic communication symbols, engineering drawing symbols, consumer symbols, hazard symbols and technology symbols. Basic communication symbols are used to represent various emotions and status. Engineering and scientific symbols are used to represent rules and concepts in the scientific and engineering context. (Khan, Naveed, Ur Rehman & Khan 2020, 8696.)

Recognition is mainly focused on recognizing graphic symbols. Most of the time, the recognition of graphic symbols occurs in different domains such as engineering, music, and electronics. An engineering drawing system uses an interactive approach to represent graphical objects. A logo is good example. Logo or trademark classification is a process that involves identifying the various features of an image. This recognition is usually carried out by extracting text and graphics from the image. (Khan et al. 2020, 8703.)

Although the domain of symbol recognition is becoming more sophisticated, the main challenges that researchers still face are finding suitable symbols for feature extraction and overcoming the challenges of scalability and efficiency. The complexity of the task of recognizing graphical symbols is vast. It can be utilized in other applications such as pattern matching and image processing. (Khan et al. 2020, 8696-9703.)

3.4.3 Installation and production instruction

An installation drawing depicts the general design of an item as well as the information needed to install it in relation to its matching structure or other components. (ISO 29845 2011, 13.) An assembly or production instruction is a document that explains how and in what order certain parts should be combined to produce a specified result. Assembling sections are referred to as jobs or work. Work instruction is a process that involves creating a set of instructions that are specific to a certain task. It should be formatted in a way that explains its purpose and should include all the necessary details. Work instructions should be well-written and should flow smoothly. They should also be clear and memorable. To test the effectiveness of the instructions, introduce an inexperienced individual to complete the task. (Beluško, Hegedüš & Fedorko 2016, 692.)

People have a predisposition to take shortcuts, regardless of the quality of their environment's representation. The ability to perform a shortcut strategy does not always reflect differences in performance. The significance of the task doesn’t not affect the strategy's performance. the environment's quality was not affected by the instructions. The usage of a shortcut approach is influenced not only by the quality of one's representation of the environment, but also by the specific work instructions. (Boone, Bryan & Hegart 2019, 1412.)

The reliability and effectiveness of production lines are critically important to achieving a high-quality product. It is also important to create work instructions that mirror the procedures and processes of a standard operating procedure. This means that the person who

is responsible for the production must fully understand the various steps involved in the process. There are various ways to achieve this goal, some of which involve developing a set of work instructions that are only suitable for one company. (Beluško et al. 2016, 698.)

3.4.4 Technical documentation and information structure

The launch of new products and major improvements are a top priority for any company. The Engineering Procedures Handbook by Phillip A. Cloud explains several sequences of actions that must be carried out in a specific order. Employees will benefit from this technique since it will help them prevent delays and increase the efficiency of the product development process. It's also utilized to keep track of all the tasks and activities involved in the product development process. (Cloud 1997, 2.)

Systems and products can be organized based on hierarchies and sub-units. Figure 5 illustrates the main assembly tree structure. The tree is used to depict the link between the subassemblies and assemblies (SFS-EN 62027:2012, 11). This will help visualize the finished product's whole structure. The main assembly tree simply illustrates why you see certain features in an assembly's feature tree. It's well-organized, and a fast scan offers a lot of information. This may be highly valuable for project management and providing project or program visibility to your business if done appropriately. (Cloud 1997, 63.)

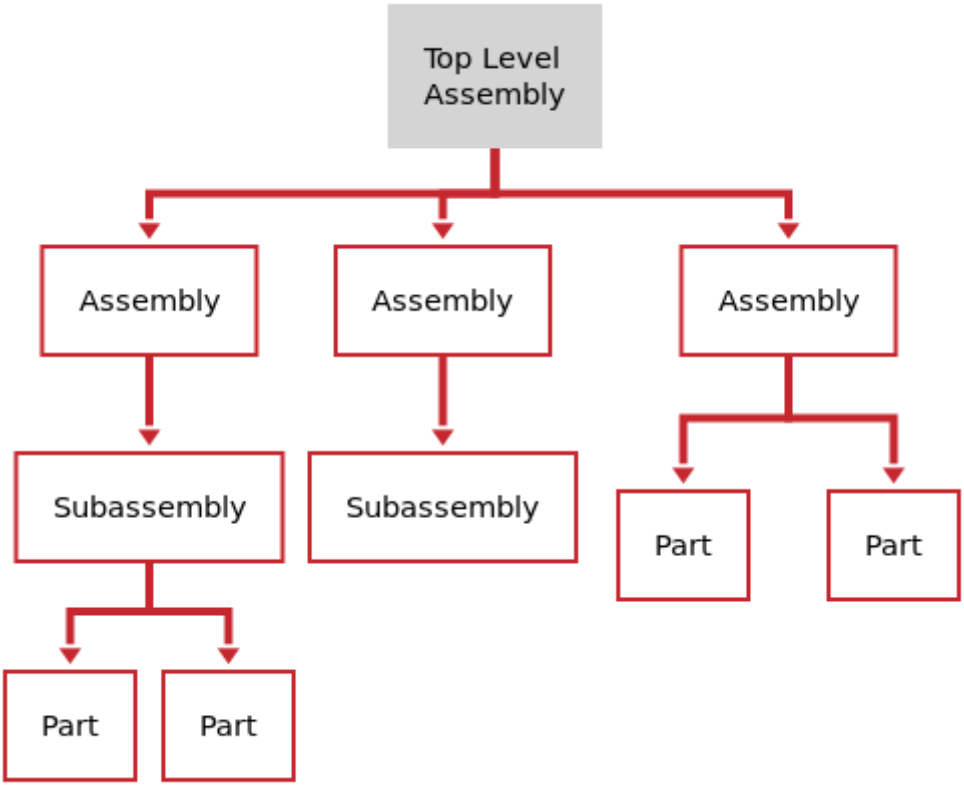

Figure 5. Assembly structure tree (in accordance with SFS-EN 62027 2012, 12.)

Main assembly tree is an example which includes assemblies, subassemblies, and parts. A components list is a list of items that are necessary for the assembly and manufacture of a product. This list usually only includes one assembly level per item. (SFS-EN 62027 2012, 12.) For each of the documents mentioned above, examples of document numbering methods are provided. New document numbers are obtained by signing out of a logbook kept in document control. (Cloud 1997, 68.) Figure 6 depicts an example of a manual numbering process. A company may have several manuals.

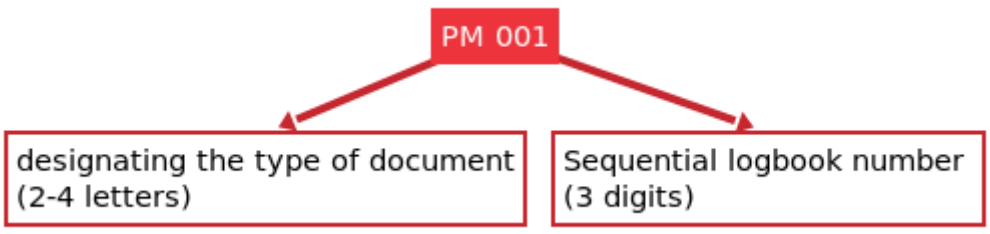

Figure 6. Numbering system for manuals

The initial letters in a numbering system indicate the document type. These includes but doesn't limit to, MM for manufacturing, QM for Quality Manual and SA for safety manuals. Subsections can also be found in manuals, and the numbering scheme can be controlled. (Cloud 1997, 72.) Figure 7 depicts a department identification, section number, and document number example. The department designation is indicated by two letters, one digit for section, and one digit for document number in the manual's subsections. This number should be written down in the logbook.

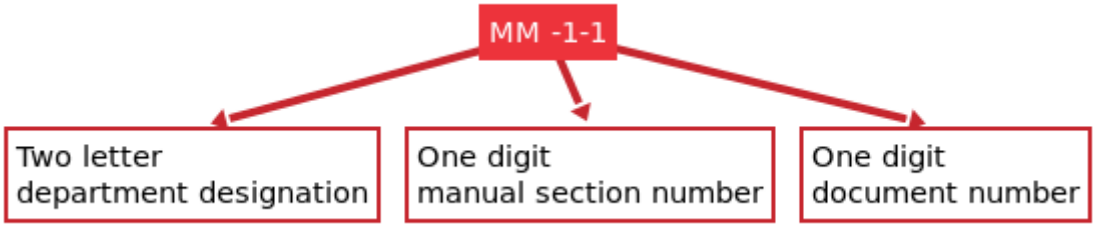

Figure 7. Numbering system for manuals subsections

Document numbers are signed out using the document control logbook. From the document number assignment logbook, all end users will obtain a document master list of all numbers assigned. (Cloud 1997, 74.) The number of documents involved in the development of a product increases as it goes through the various stages. These are then presented to the various departments of the company for their approval. (Cloud 1997, 369.)

3.5 Production information integration

Due to the complexity of product configurations and the varying productivity requirements, manufacturing companies have started to look for ways to improve their efficiency. This has led to the need for employees to be adaptable and skilled in handling different tasks. Unfortunately, this requires a skilled workforce that can meet the demands of complex

products. The lack of skilled personnel has become an issue for many engineering companies. (Haag et al. 2011, 6–9.)

The process of merging numerous components and pieces into a working product is known as assembly. The elements are brought together in the final assembly to make a completed product. Having a comprehensive list of all the parts and specifications that are involved in the assembly process is very helpful if the company uses a product lifecycle management system or Enterprise resource planning. (Haag et al. 2011, 16–19.) Aside from Office tools, there are also various software packages that can be used for creating workbooks. Some of these are integrated into your existing product information management system. CAD software can be used to created work instructions. They often offer support for a variety of 3D formats as well as system independence. If this isn't appropriate for all procedures, Adobe software can be used to produce certain types of instructions. (Haag et al. 2011, 16–19.)

3.6 Ontology-based framework

The technical documentation is a collection of documents presented with text or visual aids. These information sources can be difficult to understand, out of date, or unavailable. This might affect users and how well they learn. Information doesn’t reach its audience as tented and according to Koukias, Nadoveza, and Kiritsis (2015), there can be a gap between the technical documentation and practical operations. The research they presented offered an ontology-based approach for modelling technical documentation. the Ontology is described to be a study of essential captures of the content. Meaning that technical document is an asset and can be updated. The documentation should only contain the necessary information. The approach's goal is to guarantee that the asset is managed optimally in accordance with the manufacturer's instructions. Important thing is that ontology model provides meaning to the concepts. (Koukias, Nadoveza & Kiritsis 2015, 31.)

A technical documentation ontology (TDO) model is created to describe all the relevant information in the documentation on how the asset should be handled. Model can be used to

populate missing documents and other information sources. An ontology model that represents documentation instructions might be used by industrial information systems or applications to ensure a shared understanding of words and information structure for both humans and computers. (Koukias et al. 2015, 26.)

The information about an asset, frequently summarized in written documentation, provides users with the knowledge they need to make educated decisions regarding the asset's maintenance. Users are also in charge of monitoring and managing this data. Instead of manually checking the data about an asset, a TDO can perform an analysis of the documentation to determine the appropriate usage and maintenance of the asset. This approach is also applicable to the various safety and environmental requirements that are included in the documentation of an asset. These requirements help prevent injuries and minimize potential risks. This method is equally applicable to the maintenance of a hydraulic drill, for example. This maintenance activity should be carried out only when a component is detached it from the power pack. (Koukias et al. 2015, 36.)

3.7 Document types and format

There are 48 distinct categories of documentation included in the international standard ISO 29845. They provide presentation for drawings, plans, models, and diagrams. For example, an assembly instruction is a document that details how and in what order certain parts should be combined to produce a specified result. Characters are used in a textual presentation form, such as in written instructions and descriptions. (ISO 29845 2011)

In terms of processing time, picture-based work instructions are about as effective as video-based instructions. Written instructions were also considered to be just as straightforward to deliver as video-based tutorials. The most important information is placed on the top of the page, while the other information is placed at the bottom. This layout works best when the worker is focused on the first thing he or she reads. Each part, product, and tool are labelled with its name so the worker can easily identify which one is the right one for him or her. The

arrows are added to emphasize the section's message. This template shows the various parts and their order in relation to a specific fixture. It is very easy to use and update. (Beluško et al. 2016, 696–699.)

4 Results of the interview

The purpose of the interviews for this study was to find out what stakeholders really want in terms of product documentation. Focus was on the installation and production manuals. The interviews also assisted with the research questions, which were assumed before to the interviews' implementation. During the interviews, a total of 38 questions were asked, eight of which were concerning the interviewee's background.

The initial step in analysis is to seek for statements that are significant to theoretical thinking and study from a theoretical standpoint (Puusa & Juuti 2020, 198). The interpretation of the key event, the meaning or solution crystallized in it, can then be tested by reading the story forwards and backwards. In Table 2, key statements of the interviewees on work instructions and their application are compiled. The expressions that seem important from the point of view of the problem under study have been shaded and the generalizations made based on them are written in the column "to be included in the analysis".

Table 2. interview results

the interviewee's attitude toward work instructions		**to be included in the analysis**
Production Worker	Right now, I only **need to know** the names of the customers to see what's done next. For those gigs but in what order nothing else. Practically **almost independent.**	– Correct information – Can help themselves
	Well, if **there's a problem** about that, just ask your supervisor.	– Correct information
	In fact, these gig papers **have improved** over time. These have **clearly stated** whether the glasses have come here or whether they have gone to the customer and those YF lists and everything else that belongs to it? Well, it's clear in that document.	– Continuous improvement – Importance of visual guides

Production Manager	Even when we don't have virtually identical delivery entities for each retailer, we deliver customized Entities for them. Creating detailed work instructions makes no sense. Yes, the **work instructions are used in production**. And, of course, as upgrades to **improvement** ideas occur, things will change. Let us even change the way we work.	– Correct information – Continuous improvement
	Materials are used in the product's production. For the workstation, they are explicitly documented**. Work stages** indicate the sequence in which we will build the assignment. They must be always on show. The video content is gathered as needed from the labor processes and **used as a memory aid**. But we also have that on paperwork. On the paper, there are bot**h measurements and lines. Th**e division of a **highly personalized produc**t is a problem. While doing the same thing again and over may appear to be effective, this is not the case. There isn't a single truth to tell. This problem may no longer apply to the full following delivery.	– Help themselves – Presentation – Importance of visual guides
	Issues with assembly and installation, for example, can be solved with in the form **of a video**. I see the work on paper as well, but that is **precisely** the difficulty when we view our delivery entities and the product repertoire is broad, so those **booklets are so thick** that getting the proper **information** from there is unnecessarily arduous.	– Importance of visual guides – Help themselves – Mistake removal – Correct information – Presentation
	When new workers are assigned a task, they must be tutored through **work instructions** as an order of action. Which each employee may **then rely on** their own as necessary.	– Correct information

	When we are always working on the processes we build in production, we have time to free up everyone who works here to grow as well. Not only do they have their own workplace and working environment, but they also have **their own working practices**. After all, we are spinning or rolling here as if continually around that we, whether in this day by day or truly like a month as it is said that month and year. Of course, the experiments are not yet fully implemented, but they are **continually evolving**, either at the initiative of management or solely at the initiative of the employee, in a better direction than the working ways.	– Help themselves – Continuous improvement
Chief Operating Officer	We make 5 different products. Everyone has a little customized **work guide** for the production on which the job is done, and they really generate this **classic or almost traditional style of drawing** and participate. The work instructions based on th**e photographs** were only partially used. We usually make work instructions for an aluminum frame, which in other goods is like a top view where you can see the manuals locks some facts about the product and then make just like Excel's built-in counters which count what length profiles, how to produce and what are profile lengths.	– Correct information – Presentation – Importance of visual guides
	[Documents should be] **Simple** and **describe** the production only one way. When ordering project-related live glasses and profiles, th**e same format is utilized**. For projects that mostly include incremental changes and continuing work on the instructions, which may be **automated** using work instructions issued from sales orders onwards.	– Presentation – Mistake removal – Continuous improvement
	There are Excel customizations, where is a very **simple top view** of the product that you then practically like is used. In such circumstances if our consumer wants to purchase something totally different, **we must use it in some way**. Hand-drawn is the most common method. There are pictures of what is being done, but there are also those hand-drawn drawings produced by the client or myself.	– Presentation – Importance of visual guides – Mistake removal

	the **customers themselves take care** of the offer calculation and produce the order confirmation. With this program, you get from there pricing, get a 3D image of the items, if necessary, for your own use to the end consumer and that's what we really aim for that we get.	– Help themselves
	Typically, manual work instructions are only created for very special cases like this, which are not in this as **standard format.** Otherwise, you may go look at the **photographs or use the**m, but that's only a small portion of it.	– Presentation – Importance of visual guides
	There were **errors t**hat then went into production, and production is kind of unable to question that if it is a sensible-looking item that can be done and the gear has been ordered for it, production will not be able to question. This is not correct, because it leaves the consumer as he or she is.	– Mistake removal
Product Development Coordinator	Yeah, I think it's very important and any projects that we start here we start with them mapping them stakeholders so user. Our needs and there's connection to this project. This is so called like **user centered design** and the customer needs is a priority and **understanding** what kind of problems cost customer a mask have is to start any product development and with **each solution accordingly**.	– Correct information – Help themselves – Presentation
	Products that we're developing as not always possible to create like a real model, so we use quite a lot of mockups of design concept, and we present those visuals. **To customers thus trying to involve customers as early as possible into development and get feedback and insights from them.**	– Continuous improvement
	Early in the development process is important. Changing design later is costly and time consuming.	–Mistake removal
	Very few resources used, and we take it up to the field we show to the customers. We get insights. We ge**t validation or feedback** or in validation and depending on the feedback that we received, we either continue to with the development or we get back to ideational brainstorming sessions.	–Continuous improvement – Mistake removal – Presentation

It's a part of **customer package,** but of course here we're talking that manual and technical. And documentation must be intuitive and clear and logical. The possible questions or installations, issues and production moments must be tackled there, and **this does save time spend on customer support** and leads to customer satisfaction. And moreover, them providing materials or such **technical documentations** to customers. It helps with the customer image and is a part of customer service. As I mentioned. This also supports brand image of the company and supports the quality of the product, diminishing the custom insecurity about a new product.	– Help themselves – Importance of visual guides – Presentation
On the market just by providing the product, we need to provide something bigger like value to the customer and in this sense **the technical materials** and manuals I see that is raising the customer.	– Correct information

4.1 Observation

Employees in smaller organizations are more inclined to share tasks in general. The best practices are discussed at orientation, and everyone prefer to have work order system. This came up as part of the batch preparation for the manufacturing. Someone could want to do the tasks in smaller junctions. Everyone should understand the overall procedure. The most important finding was that everyone made care to do everything right the first time, avoiding the need for rework.

When reading the paperwork, it became clear that the earlier installation and production guidelines were designed as part of a sales branding strategy. The company considers the target audience in this way. As part of a client's package, the company provides new business with installation and production manuals. They're sales tools that show potential customers installation and production alternatives.

The order of manufacturing varies from one partner to the next. This might be due to the layout, machinery, or a specific product line. There were benefits of brand focused documents. The stakeholder’s interest is addressed and personal relationships with partners are kept. It leaves room for partners to figure out what are the best practices for their production. More details are not given in business meetings but can be given via different format.

5 Analysis

When the entire interview is not analysed word for word, the best follow-up is done by the researcher who conducted the work. They know the material well enough to easily identify key thematic areas. (Hirsjärvi 2018, 148.) Some areas are highlighted more when all opinions are combined.

Correct information

The chief operating officer mentioned that custom manufacturing needs generated bill of materials (BoM) and cutting lists. Standardized work reduces the amount of time spent on tasks and increases the speed with which they are completed. The relevant information had to be in the proper location for the production worker. Even the highest level of skill cannot prevent blunders when it comes to customized production and a wide range of products. New workers must have trust in the documentation because it is their first source of information. Sometimes we can prevent bigger issues with correct information. Ergonomics, for example, is critical, because it protects our health.

Help themselves

Employees learn by doing in a hands-on educational process. The manufacturing process is walked through by the instructor. Written instructions are available to the employee for later usage. They can ask if anything is unclear and repeat the directions. When necessary, production employees can refresh their memories. Customers might have questions about installation, issues or certain production moments which must be tackled there and right away. Having instructions on hand can save time spend on customer support and leads to customer satisfaction according to the product development coordinator. One could wonder why. Because it can raise the customer service value according to COO. Business customers begins to take care of the offer calculations and produce order confirmation for their clients. With an application, they can get pricing, 3D drawing of the items for their own use and for the end consumer. *"That is now really the effort that we get."* Said the COO.

Mistake removal

There were mistake which went through the production and the production team was unable to dispute it the project might be completed with parts ordered. This isn't right, and it irritates customers, who, understandably, aren't pleased. The production manager mentioned a production base-frame on which employees may rely. Employees are free to work in whichever sequence they like if the outcome is the equal. No one benefits from forcing employees to take a specific form. Even though each order is unique, the company follows a consistent work schedule.

During the development process, early mistakes might be detected. Feedback should be included into the development process as quickly as possible, although not all assumptions are valid. Changing the design later is both costly and time consuming.

Continuous improvement

In manufacturing, new working methods are always being developed and then they can be implemented when there is spare time. Production manager also said that they also have free hands for everyone to improve the working environment. Employees and management can both provide ideas. As the product development coordinator noted, planning comes first. Pilot projects might be used to test assumptions on occasion. Planning is particularly critical for the COO, who desired that everything be automatically created, eliminating any typing mistakes and other concerns.

Importance of visual guides

Guideline from the product development coordinator was, *"If at all possible, present the information in a visual way"*. Stakeholders should be involved in the development process as early as feasible so that they may provide useful comments and ideas. Ideas may be exhibited using 3D drawings, tested with mock-ups, and recorded for subsequent usage,

according to both development and production. Videos are used to share information to customers, employees, and management.

Presentation

Traditional assembly and installation drawings, as well as bill of materials (BOMs), are the most basic forms of information. Certain principles and assumptions can be used to simplify special cases. Always using the same format, so the documentation can be intuitive, clear, and logical. All the interviewees agreed that documentation usability was important.

Simple and the one you explain I made for the preparation and produce the same work instructions. The same format is used when ordering project-bound glasses and profiles. Documents may, for example, depict the product's handedness, and if this is not obvious, mistakes may occur. Some customers or employees choose to perform things in a different sequence, and if it doesn't have a significant impact on the overall process, they may as well do as they please.

6 Discussion

The stakeholder should be able to access a certain level of information, but the material should only contain the essential information. For instance, the information necessary in production should be available in the production. Capability to make documentation should match to the requirements for the documentation. It is likely that a smaller company does not have the operational capacity to go back and correct or alter the documents. Market trends can sometimes help a company to focus its operational capabilities, but they can also put a company at danger. (Slack, Nigel, Lewis, Michael, Bates & Hilary 2004, 381–382.) The only reliable method for transferring information is documentation. Not only does it help avoid mistakes, but it also helps keep track of all the details that are important to employee. It makes no difference whether the company is large or small; a certain level of consistency is required.

The chosen interview method provided the ideal framework to conclude this study. The respondents' responses varied significantly depending on their perspective. The questions they answered mirrored the literature review but added some extra information. The direction and flow of information are discussed in Chapter 2.3.3 Users of the documentation. It was mentioned in that chapter that the papers are distributed to production employees by management, which receives them from sales, and the first one is from system development. During the interviews, this was proven in the case company.

Based on interviews, technical know-how is an asset, which means that identifying structures and documentation material should be planned. Unmanaged asset can be lost or be on the wrong place. The pull method for documents and information from Chapter 3.3 Product construction isn't the complete solution because someone could not know what to ask. Looking information in the several places has proven to be extremely difficult, if not impossible, because the information has dropped out when the instructions were replaced with new ones.

According to the findings of this study, the engineering drawings for everyday use may be too complicated. Perspective of the stakeholder might help when making the documents for them. It's clear that those who choose to follow the instructions learn from it. In Alexander p. Boone's article "Instructions matter", has an experience about individual differences in navigation strategy. In the dual-solution paradigm, individual variations in navigation strategy reveal that some people prefer to travel the known routes while others prefer to seek shortcuts. (Boone et al. 2019, 1401–1414.) Documentation was described as the backbone of operations in interviews.

Employees are the type of people that would benefit most from the revised product instructions. Definitions are helpful in reviewing the working environment and conditions of employees to ensure that the production is used to its full potential. One of the most important goals of a process design project is to establish a uniform approach to designing and implementing various process activities and methods. This concept is very important in large organizations because, typically, different ways of carrying out the same task can emerge over time. Doing so would allow employees to exercise their own discretion. (Slack et al. 2013, 100.)

The product's assembly is the result of the design process. The goal is to describe the product's characteristics as well as how it interacts with other elements. The connections between the various elements influence how a product is put together. If there is no specified configuration framework, the individual elements may not perform the desired role.

6.1 Answers to the research questions

The goal of this study was to create a work instruction concept for installation and production manuals, primarily from the user's point of view. The first research question," *What are the things that belong to the manufacturing concept (production and installation manual) and which of those, if any, will be left out in sliding glass system production?"* was created to address the issue. The literature review laid the groundwork for obtaining information and

publications. The work instructions itself has been developed to enhance user-centricity and user experiences (Beluško et al. 2016, 698). While the literature review provided the basis for technical communication and documentation, it did not provide guidance on how to utilize general knowledge in the organisation's needs in custom manufacturing. Based on the interviews, one of the most difficult aspects is that there may not be a suitable method to capture everything. Yet, the technical documentation was recognized as the primary source of all product-related information, such as how to install, maintain, operate, manage, and dispose of the product. It is also the initial point of contact for users who require assistance with a product-related issue. (Koukias et al. 2015, 26.)

According to an interview with a manufacturing worker, accurate information is sometimes difficult to come by, which might annoy the individual. If employees base their work on poor quality instructions, they tend to make more errors and have a lower job satisfaction. This is a serious issue for companies as it can affect their bottom line. Although literature has been devoted to this topic, it is not clear what types of information quality measurements are involved in assembly work instructions.

The most crucial part of the creation is to keep in mind that the documentation is built for stakeholders and their demands. Stakeholders must be included in development and their feedback should always be gathered later to guide the development in the right direction. As a result, when the organization is establishing manufacturing work, cooperation between the designer and the production team is critical. Installation and assembly development on the manufacturing line are always being improved. (Ihalainen et al. 2011, 485–487.)

The study's second research question was: *"What to include in the manufacturing documentation and to the production documentation?",* but it should be answered from the perspective of the organization. Without the involvement of the organization, the documents could be held as general documentation. The literature review provides the directions for document management. However, the company may have its own ideas about how marketing and look of the document should be done. This is to be expected.

To respond to this question, a proposal was created. It responds to the question by recommending that a base is established from which all necessary information may be gathered. With the proposal one can answer the second question that documents should,

- include company's layout and format

- should be based on the engineering drawings

- should be simple and easy to approach

One of the features of the proposal is its flexibility to the growth of production as well as its logical structure. The base is built to define all the pertinent information in the paperwork regarding how the asset should be handled. In three-step approach

6.2 Reliability of the study

The interviewers were selected based on their knowledge of the company's operations and the situation in the industry. Since the answers to these types of questions are not related to the respondents' personal life, they tend to provide better reliability. However, it is important to note that some of the topics were only presented by one interviewee. Due to their professional background, the participants can easily interpret the concepts presented to them. This advantage can be maintained since they do not have incentive to twist their responses.

The findings and conclusions of the study were derived using scientific methods. Questions were sent in advance, and these were then recorded and analysed later. Another advantage of this method is that it allows the participants to discuss all the topics. The study's scale also affects the potential impact on the participants. Small businesses, on the other hand, follow the same fundamental processes as larger businesses, therefore when assessing interviews from a small group, one may conclude that the research approach performed as well as it would if the firm were larger. It may be argued that quantity isn't as important as quality.

6.3 Comparison with previous research

In his paper "Work Teaching Quality in Industrial Management," Haug Anders discusses how the quality of instruction affects employees. There are some similarities to this study. Thematic elements in this study's analysis chapter were correct information, help themself, mistake removal, continues improvement and importance of visual guides. The article focuses on 15 different quality problems which some of them are “difficult to understand”, “poor reputation”, “unneeded”, “untimely”, and “too complex content” (Haug 2015, 175). Even though the study analysis offered positive statements about how documentation should be, they reflected the article's poor-quality issues. It is acknowledged that reaching a consensus on the quality of some instructional content can be difficult at times. (Haug 2015, 175.)

Literature review revealed that while numerous studies give general guidelines, they lack specifics in the overall picture. The company addresses its lack of interest in the quality of work instruction. In the VTT report “Työohjeiden laadinta menetelmiä kappaletavaratuotannossa”, the researchers discussed about the feedback collected from various industry sources, which indicated that in Finland’s manufacturing industry is not at the level that it would be desired. The importance of work instructions is often recognized and acknowledged by manufacturers. However, the quality of instructions is not being produced and maintained at the same level. The quality of work instructions should also be linked to data transfer standards that would allow for better guidance on the production line and overall process. (Haag et al. 2011, 16–17.)

6.4 Aspects for further study

While working on this one, three possible topics for further studies were discovered. The quality of training, cognitive ergonomics, and information quality metrics all influence the manufacturing process. The quality of training has an impact on an individual's viewpoint. For example, if an assembly involves a series of stages that must be completed, but the manual only specifies three of them, it is simple to conclude that the instructions are

inadequate. Even though there is research on the subject, it is unclear what forms of information quality are included in instructional task instructions. A framework might be created with the goal of defining quantifiable categories of quality.

Human behaviour is frequently automated, which means that it is completely acquired by repetition of the same work under the same conditions. Thinking error or error in judgment can trigger various risks, such as accidents, miscalculations, and poor decisions. Aside from these, cognitive errors are also linked to deficiencies in the processing capabilities of humans. How to incorporate cognitive ergonomics into the workplace might result in more effective models and structures. (Väyrynen, et al. 2004, 71.)

Information quality metrics might be built for unique production processes. This could mean that the organization is relying on its personnel and dedicating time to the method and system development so that it can be measured. Small batch variability is something that cannot be avoided due the nature of the customization. However, by dividing the sections and monitoring the timings independently for each stage, it may be feasible to estimate and anticipate the production time more reliably. This might free up time by including time slots on the weekly agenda and providing capacity information ahead of time.

7 Proposal

This study proposes to have a new type of document control system in accordance with the development file from the Engineering Procedures Handbook. The goal is to provide the standards for creating and maintaining engineering project files. All engineering projects will have access to the files, which will serve as a permanent record of design decisions and development history. (Cloud 1997, 374.) Stakeholders will benefit from a customized solution. Textual engineering documentation is used as records, and installation and manufacturing manuals as an asset. These assets can be created fast from the records.

Production processes are not all the same in every manufacturing facility throughout the world. It's possible that the work sequence or arrangement will differ. As a result, sections, chapters, and individual drawings are suggested. In Chapter 3.6, the ontology-based framework is discussed. A technical documentation ontology model is created to describe all the key information in the documentation on how the asset should be handled.

Manufacturing papers, as previously said, are used to introduce new products, refresh your knowledge, and train the new personnel. In several areas of manufacturing, manuals and instructions are necessary. For example, a salesperson uses sales tools to generate cutting lists, and a worker cut and assembles the system. Even if they are both working with the same product, they may only have a few pages of the instruction manual. The processes differ and instructions are about the user and the process.

7.1.1 Tree like structure

The proposal for documents for production includes a tree-like categorization of drawings rather than a lineal categorization. Chapter 3.2 Product documentation approach talks about indexing, how the author should determinate the document’s subjects matter using natural-language expressions. This indexing process should result in subject matter being entered

into the indexing language. The Engineering Procedures Handbook provides guidance on how to organize papers in a structural hierarchy and maintain them. The content of the development file might serve as a foundation for subsequent documents. All documents related to the product development process are maintained in this repository if the product exists. The Engineer also can create multiple files for different languages. (Cloud 1997, 369.) Table 3 shows the structure of a product document control system that handles all the aspects. The list has been shortened and edited from the longer list in the source material. (Cloud 1997, 372.)

Table 3. System document index list (in modified with Cloud 1997, 372.)

1	**System Documents**
1.1.	System Description
1.2.	System Generation Breakdown Drawing
1.3.	Other System Documents
2	**Hardware Documents**
2.1.	Technical specifications
2.2.	System Generation Breakdown Drawing
2.3.	Item Lists
2.4.	Bills of material
2.5.	Components And Materials Specifications
2.6.	Assembly Drawings
2.7.	Block Diagrams
2.8.	Schematic Diagrams
2.9.	Component Placement Drawings
2.10.	Parts drawings
2.11.	Testing instructions
2.12.	Sketches of jigs and tools
2.13.	Other hardware documents
3	**Software Documents**
3.1.	Software descriptions
3.2.	Technical specifications
3.3.	Codes
3.4.	Software label data
3.5.	Other software documents

This indexing is known as a document numbering system, and it is recorded in a logbook. Each engineer oversees filling up the manufacturing manual number logbook. Each number

on the manufacturing manual has a meaning and for example MM 2-6-1 reference to Manufacturing manual section 2, chapter 6, and document number 1. The document number assignment logbook will keep hold of all the documents. More design information and technical requirements are covered in the hardware documentation. The components are presented in a product structure, with the option to adjust the amount of breakdown to meet current needs. Different categories are explained here.

System Description

The first section of the system description discusses the system appearance, functions, and limitations. It should include information that allows a new employee to quickly understand what the product is.

System Generation Breakdown Drawing

It demonstrates how to disassemble and service various system components. Breakdown in a part number with higher assembly sequences following.

Other System Documents

Documents that don't belong anywhere else and don't require their own chapter.

Hardware Documents

The documentation numbering scheme and explanations are explained in the first chapter. All procedures using physical components should be documented in hardware documents.

Technical specifications

Technical specifications are used to describe the requirements for a specific part or a group of parts. These documents should contain the necessary information to verify the correctness of the specifications. (ISO 29845 2011, 50)

Item Lists

An item list is a text-based document that lists manufacturing tools used in a processing phase, for example. These item lists might also be a list of the goods that will be included in a sample kit for clients.

Bills of material

A bill of materials is a list of the raw materials, components, assemblies, and other objects that will be used in a project. It displays the amounts used in a project. A general BOM document might demonstrate how quantities in an assembly are related. (ISO 29845 2011, 43.)

Components And Materials Specifications

Engineering creates the product specification as the initial document to support a new product design. To give a consistent and accurate product description, it should be coordinated with the marketing department. The product's title should also include the product's basic name and the bare minimum of modifiers required to identify the scope of the specification.

Assembly Drawings

It illustrates the components list's parts. The aim is to show how the assembling process will work. A dimensional drawing, an assembly drawing, or a generic layout drawing might be used. The part list might be in a separate document, or it could be included in this one. (ISO 29845 2011, 10.)

Block Diagrams

A block diagram is a type of overview diagram that uses block symbols to provide a thorough perspective of an item. For example, timing assumptions for different processing phases might be used to evaluate processes. (ISO 29845 2011, 31.)

Schematic Diagrams

A figure is a representation of the system's schematic. It must be clearly linked to the paragraph it is associated with. Figures must be presented in numerical order at the end of the specification before any appendices.

Component Placement Drawings

When working with raw materials, they must be properly positioned on the machine or jig. These diagrams aid in the communication of directions, positions, and workplace ergonomics.

Parts drawings

This chapter contains a library of part drawings that you may exhibit to suppliers, customers, or colleagues. These documents may be used by purchasing to provide outer measurements for price offers, and sales can see individual components. (ISO 29845 2011, 9.)

Testing instructions

When producing various types of assemblies, testing may be required. The testing guidelines should be followed to know how to test and what to test. If necessary, manufacturing may be readily outsourced using these documents. (ISO 29845 2011, 55.)

Sketches of jigs and tools

Custom tools and their functionalities should be described so that they may be referenced in the future. Documents may be simply shared to support compatibility while sourcing for multiple suppliers for custom tools.

Other hardware documents

All the papers should be collected and preserved for future use, so that the valuation may be completed at any time and information can be saved with references and context.

Software Documents

Software is documented in the same manner as hardware. It provides a written record of a single change procedure, and it allows approvals to be easily obtained. The operating system's specifications include the program's general description, operating instructions, and various other details. The documents also contain descriptions of the various modules and the physical environment of the system.

Software descriptions

Introduces the user to the software side of production. It goes through the essential points, as well as how to use it and its limits. It describes, for example, the various document types created by the software.

Technical specifications

It provides information regarding the project's environmental needs, safety and security requirements, and software quality aspects, purpose, and scope. These are used while preparing the software.

Codes

There is a specific list of software operation instructions that should be used. It might function as a knowledge base or a connection to the server. All translation tools should be collected here as well, so that they may be tested outside of the software environment.

Software label data

Labels and master pricelist to be utilized in the future, as well as updating the present system.

Other software documents

All additional software-related materials that aren't appropriate for other chapters. These can be in the form of links to video or PowerPoint presentations, as well as other sources of knowledge.

7.1.2 Usage of main document

When multiple documents are needed to specify a part or assembly, one document should be used to represent the main document. Figure 8 depicts the main document, which serves as a connection to the other the content. The company prepares it as an index list containing all the necessary documentation for stakeholders. If the stakeholder is a salesperson, they might want to use documents as a source material for their projects. The main document principle states that all documents related to a given assembly or part are required to be identified as the main document. The technical product documents describe the steps and procedures in a design process for a given product or assembly. They are often used by users to communicate the requirements of the design. (ISO 11005 2010)

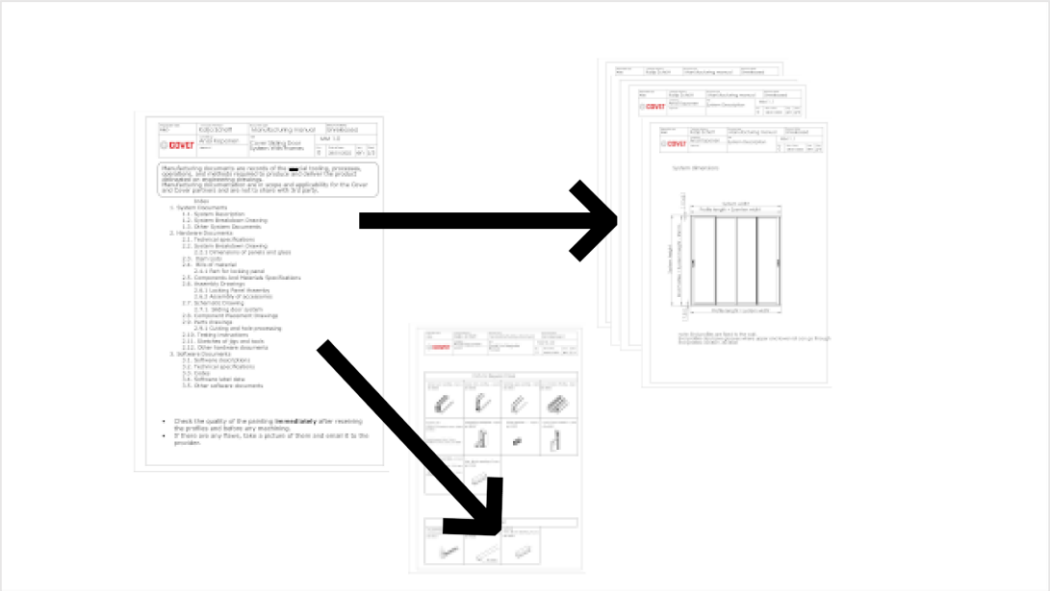

Figure 8. Main document works as a link to other documents

Figure 8 shows the connections between the main document and the others, where the lowest level can be an individual drawing or collection of drawings with the same characters. Documents for production, for example, can be selected according to the main document. The documentation contained in the folder is included in an index in the main document. These files can be combined and shared as a single item.

7.1.3 Symbols

Depending on the sort of sign, it can have a variety of meanings. The stop sign, check mark, click symbol, plus and minus are just a few examples. It is critical to comprehend the context of a sign to comprehend its meaning. Communication and engineering symbols are frequently used to depict functions and processes. (Khan et al. 2020, 869.) In figure 9, a stop sign indicates that something should not be done, a check mark indicates that it is okay to do something, a click symbol indicates that something should be done here, plus represents the inside of a housing symbol, and minus represents the outside of a housing symbol.

Figure 9. Symbols. Stop sign, check mark, click symbol, plus and minus (in accordance with Khan et al. 2020, 8697.)

These symbols might have come from a variety of places. The nature of a broad symbol implies that these symbols are well-known. Because visual symbol identification is mostly focused on identifying them in context, these symbols function for multilingual publications. A logo, for example, is frequently recognized as a sign that symbolizes the company. With planned basis for documentation, filling in the blanks where there is a lack of information is simple in an ontology model. If new symbols are required, they should be created and refined later.

Figure 10 shows how the corporate logo may be utilized to identify where it can be located on the product. The symbols bottom side and top side are examples of localized symbols, which need only a fragment of a phrase or word to be translated. Arrows can be used to indicate where to find something, such as the logo. They can also be used to show walking patterns or assembly steps. Longer arrows may be divided into smaller junctions to represent something significant. For example, slower movement.

Figure 10. Example of symbols

Based on the findings in Chapter 3.4.1 Graphical and textual documentation, the proposal includes a title block that may be utilized with technical engineering drawings. A standardized document is easy to recognize and may be altered when new or updated content becomes available. The title block's measurements in millimetres are shown in Figure 11. Upper title-block can indicate a difference between customer documentation and internal documentation. A different layout is noted more easily from other ones, and the document's information is accessible.

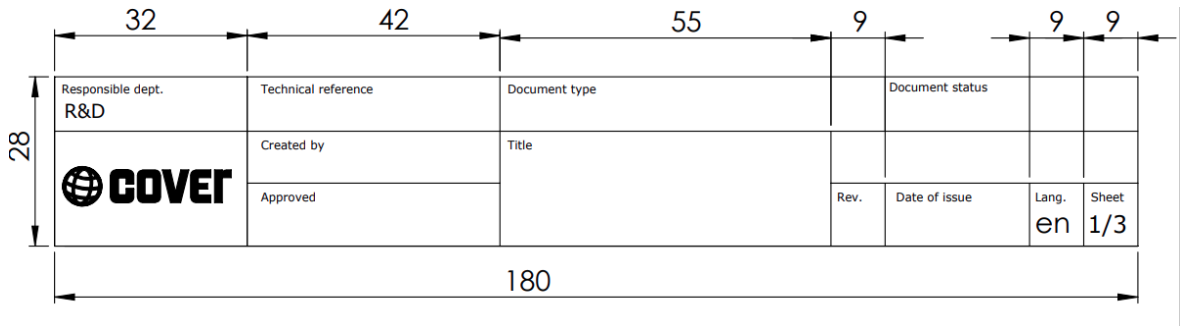

Figure 11. Upper title block

The responsible department is the one tasked with keeping track of the document. The person who creates the paper may or may not have technical expertise of the subject. As a result, the person who responds to the subject should be the technical reference. Person who approves might be a product owner or a project manager, for example.

The document type should follow the types mentioned before, title should be descriptive, and the document code should be placed beneath the document status in the right. The revision letter continues to demonstrate that the modification has been completed. Date of issue should be in the form DD/MM/YYYY, and language should be written in two letters, with the sheet indicating the page number in multi-paged documents.

8 Summary

The company’s processes are documented in various types of documents, such as specifications, models, and textual documents. These documents help stakeholders in various manufacturing and installation phases. When a need for a new document is identified, the industry typically gathers data and models and uses those to fill in the gaps in the content. The technical document should be considered as an asset that may be updated.

The theoretical portion of the study introduces to the technical communication. It describes the production operation, product documentation, and ontology-based framework. Operations may be found everywhere and documenting them is critical to understanding the concept of manufacturing. Product documentation discusses standards or how to make documentation with same framework. The use of an ontology-based framework bridges the gap between practice and what is written in the papers.

The study was confined to one Finnish company with a small group of employees. The number of interviewees was four, and the author recorded notes. Interviews are categorized to the result chapter and the analysis chapter's objective was to elaborate on the thematic issue that the author identified during the interviews. These insights may be applied to the company's other problems now or the future. The research itself has a practical contribution to the documentation control on the company. It focuses on researched information and the interviews.

The proposed documentation management approach is applicable for custom manufacturing enterprises of various sizes. Companies should adopt systematic techniques to assist in the creation of new documents. Although companies usually spend a lot of time on operational activities, companies should still spend their time planning future business as well as product and service development. When a company concentrates on the necessary things and does them well, it gains a competitive edge now and in the future.

Chapter 7 presents a document management system based on an ontology-based technique for modelling technical documentation, with three important elements: structure, use of the main document, and the addition of new symbols. When reading technical product manuals, it is vital to understand the meanings underlying the objectives. This indicates that the documentation structure, content, and symbols are, and will be, planned. Because some critical information is easily available and structured, people in charge may enhance their quality control on all systems and databases. Making it simple to include everything you need to produce manuals.

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Appendix 1. Interview Questions 1

1. Production worker	Question
	1. What things do you need to know to be able to perform your daily tasks?
	2. Where can you get the information, you need for your daily work?
	- In what form is the information in?
	- Is there room for improvement in the quantity / quality / accuracy of the information?
	3. Do you add information yourself in your work? And in what form and where does the addition take place?
	4. Where are the potential problems?
	5. What things are going well?
	6. How would you rate the amount and quality of information in your organization?
	7. How do you assess the suitability of information systems for information sharing?
	8. What should be improved to make work easier?
	9. do you have experience of a very smooth flow and sharing of information?

2.Production manager	Question
	1. In Finnish companies, work instructions have generally been drawn up in production and not all work tasks have been documented due to the high professional skills of the employees. How do you see this in your own business?
	2. Do you have assembly instructions that describe what to do and in what order, and with what tools to perform the assembly?
	3. What do you think needs to be shown in the work instructions so that the installer can perform his work safely, with high quality and productively?
	4. Typically, assembly instructions have been, and still are, printed in many places on 2D line art, parts lists, photographs, and explanatory text. How has this been treated with the company?
	5. Work instructions are mainly used in problem situations, to support memory and in connection with the release of new products. Is this true of your business?
	6. Where are the potential problems?
	7. Are the correctness of the installation sequence, clarity of detail and ergonomics important in the work instructions?
	8. What should be improved to make work easier? E.g., new product guide, review of work instructions

Appendix 2. Interview Question 2

3. Chief Operation Officer	Questions
	1. In Finnish companies, the most typical work instructions are still partial, and drawings and work instructions are generally made and published in A4 format. How would you describe what your work instructions consist of?
	2. What is the significance and purpose of company's work instructions in recent years?
	3. What visual instructions such as photographs, drawings, or CAD models are used?
	4. What kind of product-specific work instructions should be generated automatically?
	5. Do you find it too laborious or unnecessary to make and maintain instructions?
	6. What should be improved to make work easier?
	7. Where are the potential problems?

4. Product Development Coordinator	Questions
	1. Usually, a new product is consistent with the company's portfolio. As an example, the marketplace, price range, and industry area. Is that visible in the product's design or visuals, or do you think it's not significant?
	2. Did the development department make use of manufacturing comments?
	3. In engineering, computer-aided design has become the standard. This method uses 3D rendering software to create a computer model of your final design. How useful do you think 3D software modelling is as a tool?
	4. Do you believe that the manufacturer's working ergonomics or the adjustability of the product during installation should be considered when designing a new product?
	5. Do you think that feedback and testing will allow for further development and sensible product improvements?
	6. Textual engineering documentation can be difficult to translate at times; how do you perceive the use of visual aids and text balance in your work?
	7. Do you regard the installation and production manual as a chore or as a means of explaining the system? How would you explain your interactions with them? Now and/or in the future?