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Lappeenranta University of Technology

**LUT School of Business and Management**

Master's Thesis

Master's Thesis

Outotec (Finland) Oy

*DEVELOPING CENTRAL DOCUMENTATION IN AN EQUIPMENT  
DELIVERY PROCESS IN A GLOBAL TECHNOLOGY ORGANIZA-  
TION*

**Confidential**

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Lappeenranta 22.11.2017

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## ABSTRACT

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Master's Thesis. Lappeenranta University of Technology. 85 pages, 23 figures, 10 tables and 8 appendices Examiner: Timo Pirtilä	
Keywords: Quality, organizational psychology, documentation, delivery process	
<p>The aim for this study is to research an in-between-process phase documentation and possibly achieve development suggestion(s) on central documentation in a technology organization, in one of the product lines. Firstly, the theoretical framework is offered with a discussion on matrix organizations operating by projects and quality management approaches.</p> <p>The thesis revolves around also the psychological aspect of organizational life, and the author of the study has been working in the case organization already about half a year before the time of this thesis. Therefore, a psychological framework is consisted, already discussing with some parts of the theory.</p> <p>The research with the current processes and their instructed documentation established that the use of documentation is quite versatile, thus indicating the need for (re)training of the processes.</p> <p>The use of the one central document proved also to be insufficient to be a reliable document in transferring the knowledge between different phases and functions. One improvement suggestion is to develop a semi or fully automated way to follow and control the use of that or any document(s).</p>	

## TIIVISTELMÄ

Tekijä: Teija Autio	
Työn nimi: Laitetoimitusprosessin keskeisen dokumentaation kehittäminen globaalissa teknologiayrityksessä	
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Hakusanat: Laatu, organisaation psykologia, dokumentointi, toimitusprosessi	
<p>Tämän työn tavoitteena on tutkia myynti- ja laitetoimitusprosessin välistä dokumentointia globaalissa teknologiayrityksen yhdessä tuotelinjassa. Työn lopputuloksena tavoiteltiin muun muassa parannusehdotelmaa keskeiseen dokumentointiin, sekä nykytilan selkeää kuvausta. Työn teoreettinen viitekehys muodostuu laatujohtamisen lähestymistavoista matriisiorganisaatiossa, jonka operatiivinen toiminta perustuu pitkälti projekteihin.</p> <p>Työn tekijä on työskennellyt kohdeorganisaatiossa noin puolen vuoden ajan ennen diplomityön aloitusta. Tuosta ajasta rakentui työn psykologinen viitekehys, sillä monet indikoidut ongelmat keskusteluissa tuntuivat vaistonvaraisesti olevan enemmän psykologisia.</p> <p>Nykytilan prosessitutkimus osoittautui melko vaihtelevaksi määriteltyjen dokumenttien osalta. Tämä löydös viittasi lisä-/uudelleen koulutuksen tarpeeseen prosessin osalta.</p> <p>Keskeisen dokumentaation täyttöastetutkimus osoitti myös dokumentin olevan riittämätön takaamaan ehjän tiedonsiirron luotettavasti prosessien sekä vaiheiden välillä. Yksi kehitysehdoteus on luoda osittain tai kokonaan automatisoitu seuranta mahdollisuus keskeiselle dokumentille.</p>	

## ACKNOWLEDGEMENTS

*“You cannot say to the sun ‘more sun’ or to the rain ‘less rain.’”*

-Memoirs of a Geisha

How can I tell apart which are my own thoughts, thoughts that nobody has provoked, nothing that I have read or heard has influenced. In here lies the complexity of human being. How we judge the world before writing, even saying one word.

*Be open to new ideas, and study and read as much as you can.* Many times, you find the answer in silence, and occasionally – there even are no answers.

I thank my family, my dear husband, Olli, for being yourself and being in my life. I thank my two beautiful children, Neea and Väinö, I am blessed to have you in my life.

I thank Mr. Timo Halonen for making this experience in business life even possible. I thank Mr. Sami Jalasjoki for putting up with me.

I thank Mr. Timo Pirttilä for his guidance.

I thank my mother and father for my existence.

Yours sincerely,

In Lappeenranta 22<sup>nd</sup> of November, Teija Autio

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## ABBREVIATIONS

JIT	Just In Time
LOI	Letter of intent
PAF-model	Prevention, Appraisal and Failure cost -model
TEDx	Technology, Entertainment and Design – independently run events – ideas worth spreading
TOC	Theory Of Constraints
TQM	Total quality management
USI	Unexpected Sources of Inspiration

## EQUATIONS

$$\textit{Coordination} = f(\textit{authority} \times \textit{information}) \quad (1)$$

$$\textit{Throughput} = \textit{units in progress} \times \textit{interval time} \quad (2)$$

$$\textit{Netprofit} = \textit{Throughput} - \textit{Operating Expense} \quad (3)$$

$$\textit{Return On Investment} = \frac{(\textit{Throughput} - \textit{Operating Expense})}{\textit{Inventory}} \quad (4)$$



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# 1 INTRODUCTION

*“Tell me how you will measure me, and then I will tell you how I will behave. If you measure me in an illogical way... do not complain about illogical behavior.”*

- Eliyahu Goldratt –‘The Haystack syndrome’ p.26

## 1.1 Background of the study

The case company, Outotec has a long history with versatile acquisitions, as mentioned also in previous chapter. As depicted in figure 1, the product line in which this study operates (filters, formerly Larox Oyj) was purchased by Outotec in 2010 (Outotec, 2017a).

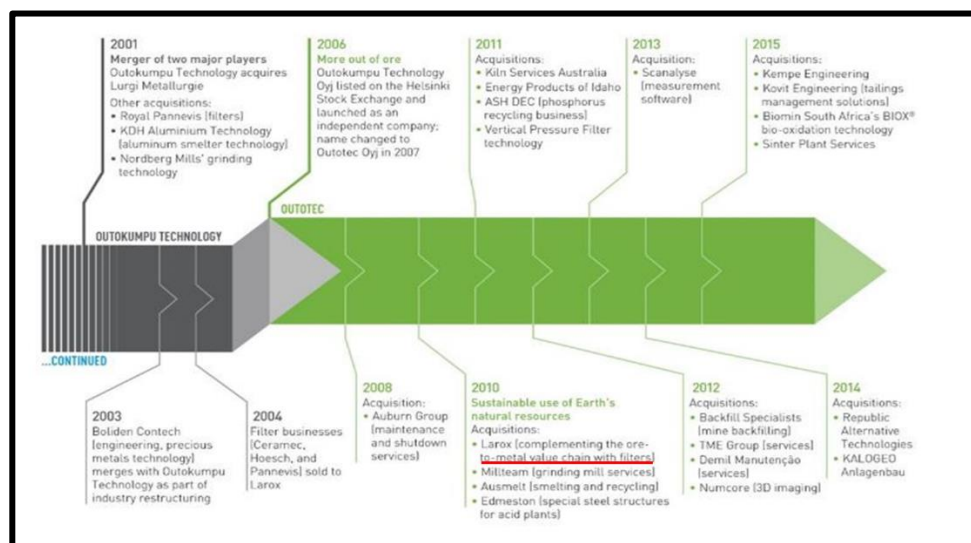
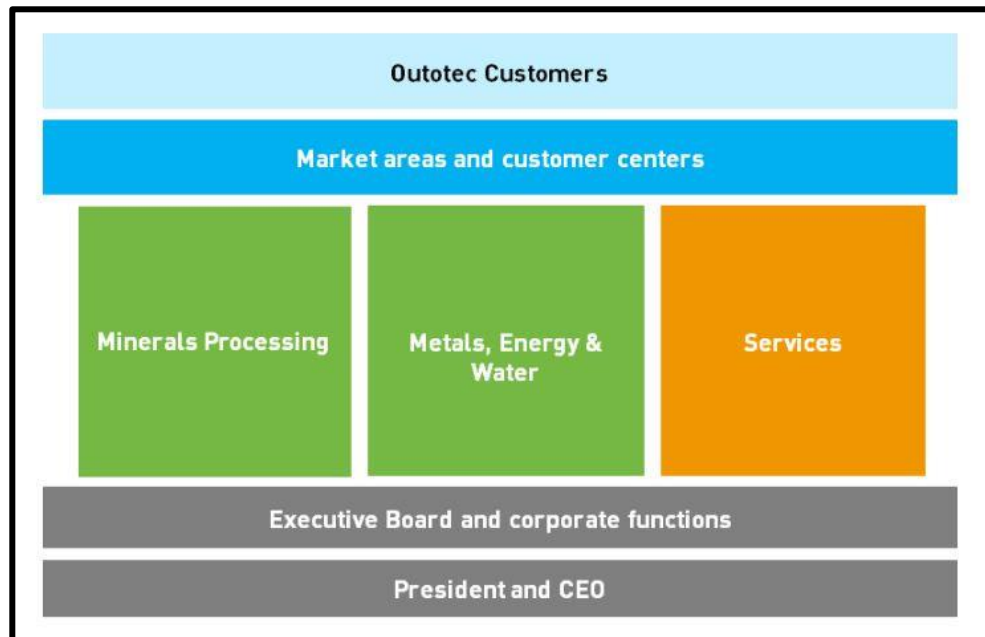


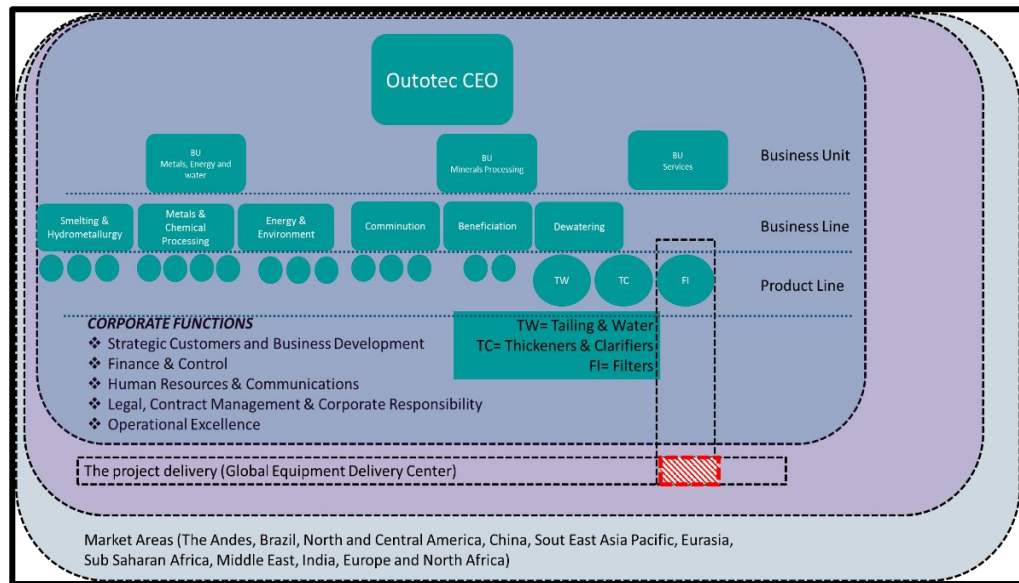
Figure 1 The history of Outotec since 2001

Outotec's operating model is presented in figure 2 (Outotec, 2017b). The operating business is divided in three business units, Minerals Processing, Metal, Energy & Water and Services.



**Figure 2 Outotec's operating model**

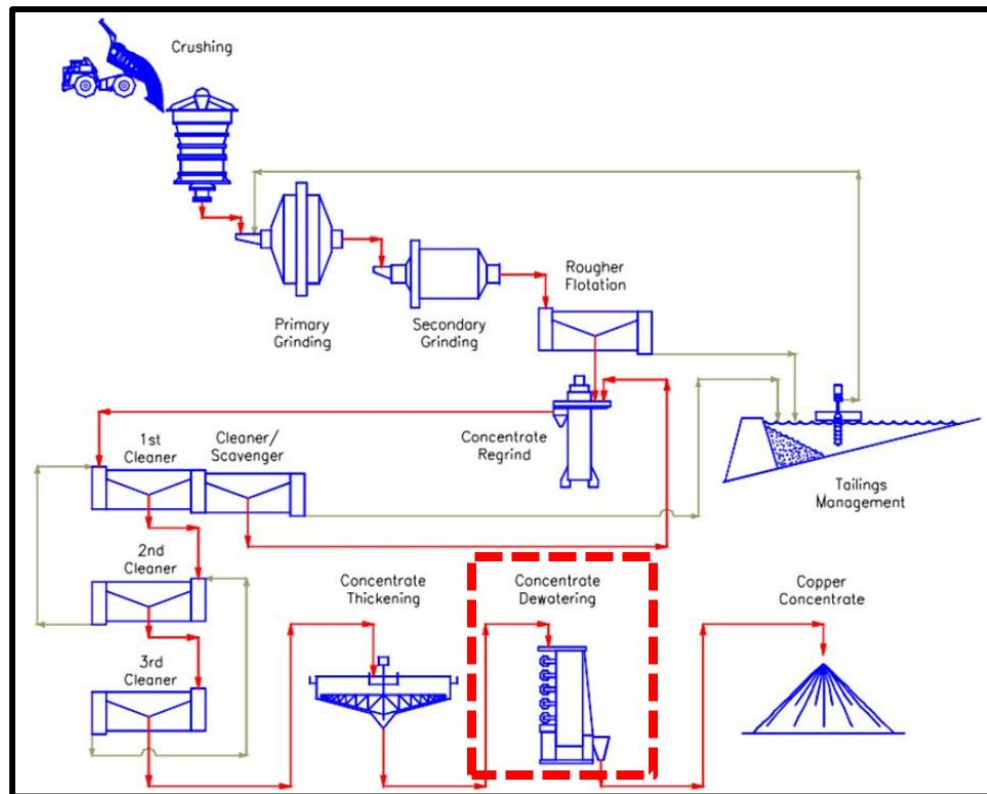
Outotec has organized as a matrix organization. Presented in the figure 3 there is the organizational structure and with red dashed line rectangular shown the product line and area in which this thesis operates. The before mentioned business units have been distributed into six business lines, and those are divided into product lines. In the Minerals Processing business unit, there are altogether eight product lines.



**Figure 3 Outotec's organizational model with indicated the area of this study**

Outotec, in its current mission helps its customers to handle, in the most possible sustainable way, the whole value chain from ore to metals (Outotec, 2017). One equipment in the mineral processing chain is a filter. In Figure 4 (Michaud, 2015) the place of the filter in the copper process appears within the red dashed line rectangular. Filters are used in the process to extract the residual amounts of water from slurry (the mixture originated from the mine).

Outotec's technology covers almost the whole chain so that there are some technologies starting from grinding up until dewatering. Tailings management is also important business opportunity for Outotec's technology solutions, because most of the times, the mine sites are located in areas, where the natural water resources are scarce and tailings solutions offer a good and more sustainable way to return some of the waters back to the process.



**Figure 4 Copper process flowsheet with shown the place of the filtration**

Outotec **delivers filters by projects** and/or as a part of plant solutions. Within the dashed red line lies the scope of the study in the copper process environment. As can be seen from the process flowsheet, filter is almost at the end of the process, so the proper sizing of the filter (i.e. how large filtration area is) is very important. The filter type selection needs as well proper and thorough knowhow because it varies between different applications (i.e., what is the end product such as copper, iron ore, or edible oils even), which is the most suitable filter equipment. One crucial step which is very distinctively in filtration technology is filtration testing. Without pre-contract test work, the selection of the right technology becomes in the worst scenario a mixture of wild guesses.

In addition, the understanding of the customer process is needed, for finding the best working solution in terms of customer requirements, characteristics of application and in the end also the cost competitiveness due to the tightened economic times.

## 1.2 Research objectives and limitations

In Figure 5 is the basic process for Outotec's operating model. The timeline for filter delivery varies, but roughly by average manufacturing time is 9 months, and warranty period is by standard 12-18 months.

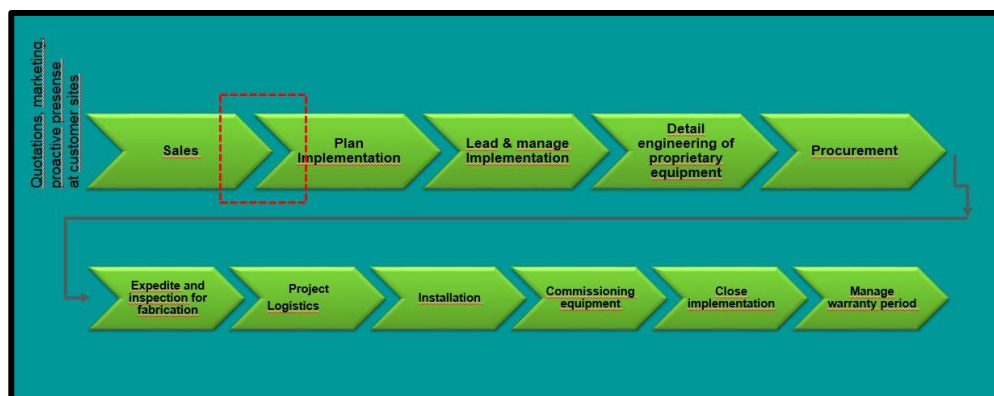


Figure 5 The general process of Outotec's operating model

This study locates in the interphase of two different process steps as depicted in figure 5 with red line dashed rectangular. This study's phase is preceded with already quite a bit of information sharing between Outotec and customer. As can be seen in figure 4, the study limits out the quotation phase (very iterative process in itself between Outotec and the customer), thus starting from the point when the contract between Outotec and a customer **is signed**.

It is very crucial that the knowledge transfers right and intact in the beginning so the mistakes and errors can be prevented moving on towards downstream of the process chain. This can be achieved **by building in the needed quality to the handover process**. This study limits to **plain equipment deliveries**, so that the projects chosen to the study are thought as only filter deliveries (even if part of plant delivery).

**This study aims to surface from the abundance of documents some central one/ones**, and targets **to research the use and usability of those documents**. This selection leads on the other hand also to delimiting some documents from

this study, although some suggestions or improvement ideas might be offered affecting those as well.

This study was decided to situate in very early phase of the whole delivery process. The situating of the thesis was made with a consensus between the author, her supervisor and by the development manager of business line. As discussed in the previous chapter, this phase, even if small, but since it is amongst the first phases, seems intuitively be quite critical regarding the success of the following both phases and actions. Setting this beginning well under control, or even achieving standardized procedures, creates the pathway to taking the project to finish line in the targeted time, costs, and quality.

Therefore, the main research questions took following form originating from all the previous thoughts:

**How are the global/local processes described and what is the central documentation in the selected phase of this study?**

**How is the central documentation, in this study's limits, used in the first place, to what degree they are filled, and how about the relevance of the information it consists?**

**How could the progress of projects be measured and followed by utilizing the central documentation in real time?**

### **1.3 Research methods**

Throughout the whole study, the author has felt the need to finely balance in between the area of traditional 'hard data' and the conclusions and intuitive feelings from empathic listening. Building a psychological framework (for chapter 3) takes root all the way back time before this thesis (summer 2017); it is consisted via non-structured interviews, where the author of this work asked mainly



three questions from altogether 42 persons. The questions were so basic, such as 'who are you', 'what do you do' and 'how do you do' it? The objective was to gather information and intuitive opinions on possible quality issues.

This thesis ponders more on the "softer" side of knowledge and change management, thus the literature research (for chapter 2 and partly chapter 3) consisted of search terminology such as knowledge management in projects, psychology in organizations, system of consciousness, quality of attention, knowledge transfer in projects, delivering happiness.. From the references of some of the articles, returned by used keyword searches, arose some new theory approaches suitable for this thesis such as the one combining matrix organization with operating via projects. The theory part of this study strives also to be very applicable.

The process research (for chapter 4) was conducted mainly with discussions with different experts such as total quality management manager (this study's supervisor) and with the former filter deliveries manager. Some of the findings were shortly reviewed with the owner of the delivery process at the headquarters of the case organization.

The author of this study used non-structured interviews and discussions in gathering about half of the research data (for chapter 4, distinctively speaking of the amount of projects selected to the thesis). Another source of project data was gathering projects from network drive according to the best consideration by the author. The author had assistance in selecting process from the filter deliveries manager, product managers and project managers.

All the equipment (filter) projects i.e. deliveries are given a running serial number and the author tried to select the recent projects, since the year 2012. That time limitation was selected, for giving the data the best possible comparability

since it was year 2012, when the first consolidation of work procedures and processes effort was implemented. Altogether 42 projects were selected to the research data. In time horizon that equals roughly to a one year's output.

From the total number of research projects, four are still ongoing and the rest, 38 are already delivered projects.

With the gathered data, the author firstly consisted a database with quite vast amount of information, since the apprehension and knowledge of the author was limited and it was impossible to know, which information would be relevant and which would not.

The relevance of the information in the selected documentation (for chapter 5) was analyzed based upon previous findings in the interviews and discussions with this work's supervisor.

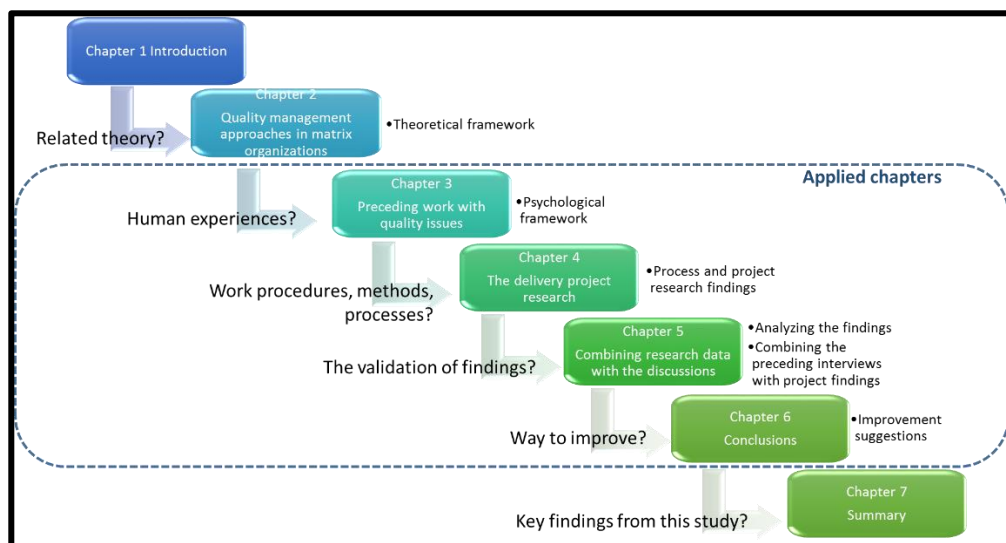
From these discussions and with the guidance offered to the author, the improvement suggestions (for chapter 6) target to be very applicable and simple to the point.

*“Professionals in any role who obscure explanations by using mysterious terminology do themselves, and their roles, a disservice.”*

-Philip Bayard Crosby, *Quality is free*, 1980, p. 3

#### **1.4 Structure of the study**

The work is in chapters with following structure as presented in figure 6. As can be seen in the figure 6, the weighed part of this work is the applied portion. In the left hand side of the figure 6 there is the evolved next question to be answered so that the flow of this thesis aims to be as natural and simple as can be.



**Figure 6** The structure of the study

Chapter 1 offers a background view of this study, focusing mainly on the case organization. It also discusses the research objectives, limitations and methods. Chapter 2 offers a narrow selected theoretical basis for the thesis discussing such themes as quality and change management, organizational structure and the purpose of the organization.

Chapter 3 deepens the understanding the background and the need of this thesis. It also includes the author's consisted psychological and philosophical discussion on the perimeter and environment of this study **based mainly on the work of summer 2017** (time just before this thesis). In addition, chapter three narrowly discusses and weighs different methods and their adaptability in this particular research. Methods are such as total quality management, just-in time, LEAN and Theory of constraints.

Chapter 4 offers the general view of the findings in the delivery process and project research describing the current body of knowledge. Chapter 5 offers in-depth analyzes of the findings in the project data mining and ties together all the data, both factual (project files) and intuitive (discussions and interviews). Chapter 6 discusses of the study's impacts and possible improvement suggestions.

In the table 1 there are yet again the mentioned research questions and their objectives and the main responsible chapters touching the questions.

**Table 1 Research questions and their objectives**

<b>Research question</b>	<b>Objective</b>	<b>Responsible chapter</b>
<i>'How are the global/local processes described and what is the central documentation in the selected phase of this study?'</i>	To present the documentation from the selected process phase and select the most central one(s)	Chapter four
<i>'How is the central documentation used in the first place, to what degree they are filled, and how about the relevance of the information it consists?'</i>	To research the selected documentation (the use, the filling)	Chapter five
<i>'How could we measure and follow the progress of projects by utilizing the central documentation in real time?'</i>	To suggest improvements on the selected documentation	Chapter six

## 2 QUALITY MANAGEMENT APPROACHES IN MATRIX ORGANIZATIONS

*“We place the highest value on actual implementation and taking action. There are many things one does not understand and therefore, we ask them why do not you just go ahead and take action, try to do something? You realize how little you know, you face your own failures, you simply can correct those failures and redo it again, and at the second trial you realize another mistake or another thing you did not like so you can redo it once again. So by constant improvement, or, should I say, the improvement based upon action, one can rise to the higher level of practice and knowledge.”*

*-Fujio Cho, Former Chairman Toyota Motor Corporation, 2002*

The above statement by Mr. Cho (Liker, 2004, p. 3) is not just plainly rhetoric. Toyota has proven themselves *as a genuine learning organization* (Liker, 2004, p. 13). In this Chapter 2, few different quality management approaches are also briefly discussed, since it is rarely that the solution is by only one approach, but a unique mixture of many. In addition, like presented in chapter 2.1.1 the major challenge that top management often encounter, is **how to control the workflow**, this theory discussion studies the workflow point of view.

The constant reminder of deeper understanding of the background and purpose of different methods and means should always follow or even be a priori. However, let us start with discussing the characteristics of matrix organizations infused with project based operating.

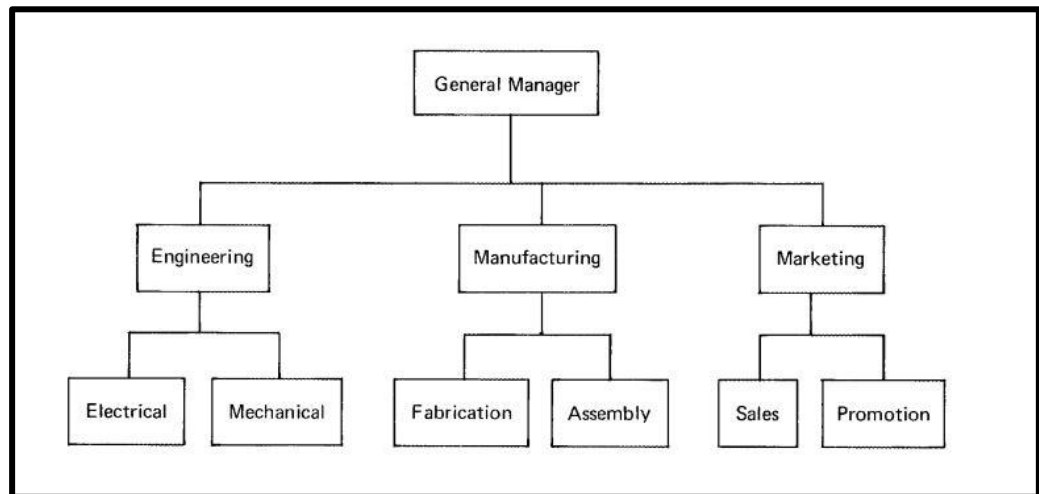
## **2.1 Matrix organizations and operating by projects**

As described in the introductory portion, the case organization operates in a matrix organization. The equipment deliveries (and the plant solutions to mention), are carried out as projects.

Matrix organizations were evolved primarily in the aerospace industry somewhere around 1950s-1960s due to the tight race to space. The choice between organizational structures depends on few factors, which are to be discussed later basis in the chapter 2.1.2. The matrix design is aimed to achieve the benefits of both functional and project based operating. (Galbraith, 1971, p. 29, 38.)

### **2.1.1 Hypothetical case example on transformation from functional to matrix organization**

In figure 7 there is one exemplary hypothetical company operating in functional organization form (Galbraith, 1971, p. 31, 36). Let us research this hypothetical company, Standard Products Co, with a short story. The company will undertake a transformation from a functional to a pure matrix organization. The story is an abstract of the article by Jay Galbraith in the year 1971. The sentences and portions written both in *cursive* and with “apostrophes” are straight quotes from Mr. Galbraith’s article.



**Figure 7 The functional organization**

Standard Products Co. offers a varied line of products, which are sold to other organizations. In the days with their functional organization, the major challenge was **to coordinate the workflow** from engineering through marketing. For the assurance on achieving this, they had some integrating mechanisms:

- Rules and procedures (If all personnel follow the rules, there is no need for on-going communication, since the resultant behavior is integrated)
- Planning processes (for the less repetitive activities Standard specifies a goal or target, this planning reduces the need of on-going communication between specialized subunits)
- Hierarchical referral (Resolving of nonroutine and unpredictable events)
- Direct contact (Removing of small problems from the upward referral process)
- Liaison departments (A separate transaction department. Typically between engineering and manufacturing to handle engineering changes and design problems)

These mechanism worked quite well for Standard Products Co. and they were able to launch new products on schedule and within a budget and the executive level had sufficient time for long-term strategic planning.

The evolving of task forces began, when some competitor from the markets came out with a new design, with a new raw material. Standard hired some specialist in the area and started their normal new product introduction activities. However, the product started to fall behind schedule. It was time to analyze what was going on.

Since Standard did not have the experience of the new raw material, it had led them to underestimate the number and types of problems. Hence, the plans and schedules were not as useful. The problem affected all functions, so that the liaison departments and informal contacts were cumbersome and majority of the problems were escalated upwards. This led to the overload of general managers, which caused even more delays.

The directors of engineering and manufacturing suggested a lengthening of schedule, but the general manager agreed with the marketing director in the thought that the delay of the new product would cost them losing some of their customers. Therefore, a search for some new coordination mechanisms started.

Standard had a previous experience in decentralizing decisions, there was the danger gap, that the low level decision makers could have the current data, but local in scope. A ‘new product task force’ was created in preventing the loss of the input from all the affected units. This task force was temporary, with all major department representatives, and was not to dissolve until all the cross-functional problems were solved. ***“The purpose was to make as many decisions as possible at low levels with the people most knowledgeable”***. In the end, they achieved the right balance in the task force with the *low level engineering representatives* (with knowledge about technical alternatives and consequences) and *high-level manufacturing representatives* (with authority to commit the production to joint decision). Therefore, the result was effective coordination as shown in equation 1:

$$\text{Coordination} = f(\text{authority} \times \text{information}) \quad (1)$$



Despite the positive results brought by the temporary task force, the salespersons started to bring stories about new competitors. Yet again, the task force was set up; since the technical people thought that, the second-generation redesign could be feasible. This time the problem concerning the general manager was not the schedule issue, but the inclusion of the top management nearly day-to-day basis. Needless to say, that the top management did not have sufficient time to think future strategic decisions.

*“Indeed, the more rapid the change in technology and markets, the greater the amount of strategic decision making that is necessary. However, these are the same changes that pull top management into day-to-day decisions”.*

In order to achieve the well-maintained coordination, the team structure was established. This guaranteed that all interdependent subunits were considered in the decision-making. These teams were permanent, unlike the task forces, which were still utilized in solving the temporary problems. In fact, teams only added to the already used coordination mechanisms.

With the team structure in place, the time of the top management freed from daily decisions but the teams’ effectiveness was volatile. Due to Standard’s strategy, they needed *“the addition of highly skilled, highly educated technical people in innovation and completion in the high technology industry”*. This led that sometimes these specialists dominated a team *“because of their superior technical knowledge”*, ending that *“the team could not distinguish between providing technical information and supplying managerial judgement after all the facts were identified”*.

The general manager was caught by these alarm signals, and soon he comprehended that many *“decisions of consequence were being made at lower and middle levels of management, that ought to be made with general manager’s perspective”*. The general manager appointed three technically qualified men to be product managers, in order to establish a reasonable balance of power among the

joint decision makers. Although these product managers did not have any formal authority, they were successful bringing the global, general manager perspective into the joint decision-making process due to their technical competence and interpersonal skills, and were mainly to act as facilitators and chairpersons in the team meetings.

The differences in attitudes and goals between the different functions were the basis for the need of the product manager's role. The differences are needed to ensure successful subtask performance, but equally important is the team collaboration.

With the increase of new product introductions the tradeoffs across engineering, production and marketing lines was also increased, thus adding to the influence of the product managers. *"The next change was the accumulation of staff around the products"*, hence forming the product management departments with considerable influence.

In assurance for having accurate data concerning product costs and revenues, for addition, deletion, modification and pricing decisions, the general manager instituted a new information system, which *"reported costs and revenues by product as well as by function"*.

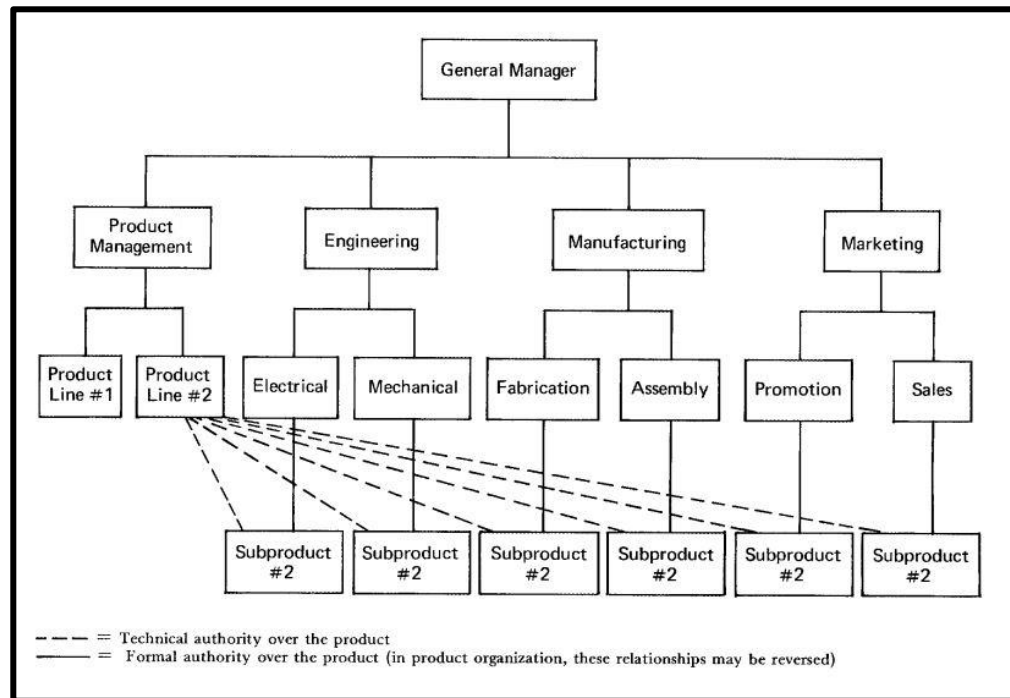
While forming the product departments, the general manager, even though he agreed that better coordination was needed across functions, he did not reorganize around product divisions. He feared that reorganizing *"might reduce specialization in the technical areas or perhaps lose the economies of scale in production"*. Therefore, the general manager stood behind the new modified reporting system and with the expanded product staff group, feeling that these would ensure the good coordination. He *"also maintained a climate where collaboration across product lines and functions was encouraged and rewarded"*.

By this time, *“the Standard Products Co. was a high technology company and its products were undergoing constant change”*. This was resulting in increasing the number of consequential decisions made at lower levels.

So appeared two concerns for the top management. First was the old concern of the quality of decisions in the low levels. The problem was not the middle and top levels, since there the product managers were at help, but a major portion of decisions were made jointly low in the organization, and *“were not always made in the best interest of the firm as a whole”*.

The second concern, used by engineering to back their resist in organizing by product divisions (again suggested by product managers), was *“that the move to product divisions would reduce the influence of the technical people at a time when they were having morale and turnover problems with these employees”*.

In order to let the technical people spend most of their time with technical issues, instead of participating in meetings, the top management created a new role – *sub product manager*. This new role had the dual reporting responsibility – for both general manager and the product manager. Because of the sub product manager’s participation in team meetings, the technical experts were able to concentrate strictly on technical matters. The matrix form is presented in figure 8.



**Figure 8 Matrix organization**

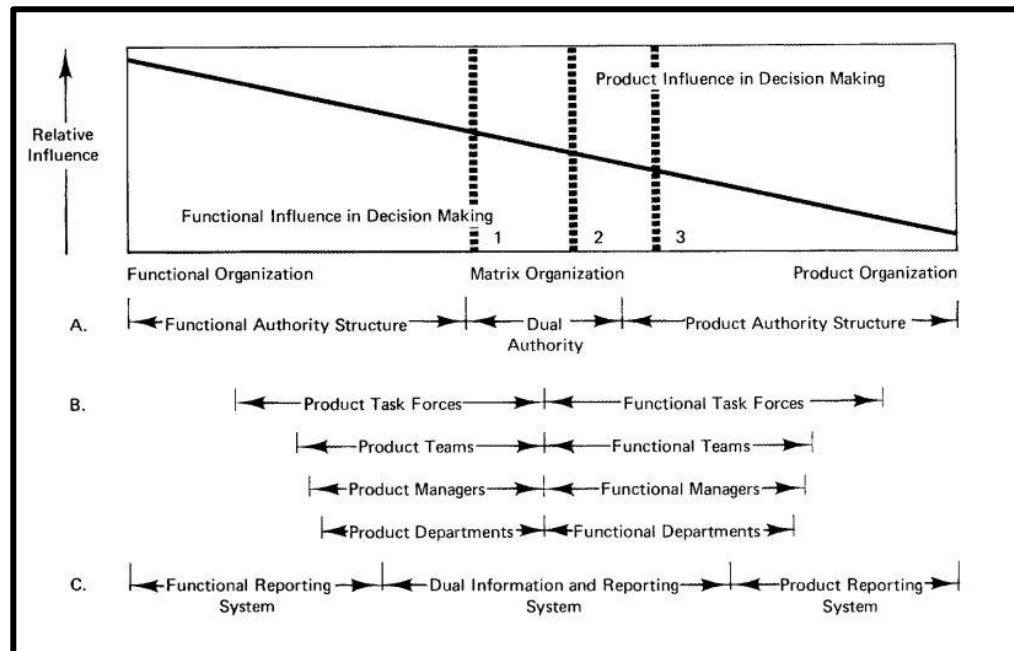
There are two features in pure matrix organization, which distinguishes from the previous functional form:

1. The existence of dual authority relationship somewhere in the organization
2. Power balance between product management and functional sides

The power balance might be extremely fragile and on razor's edge, but it can be obtained *“through enforced collaboration on budgets, salaries, dual information and reporting systems, and dual authority relations”*. The balance is needed, as an insurance that the organization is capable in solving the problems *“on their own merits – not on any predetermined power structure”*.

### **2.1.2 Factors choosing the organizational structure**

With the assistance of figure 9, which is also from the work of Mr. Galbraith, the factors on choosing the organizational structure is discussed (Galbraith, 1971, p. 37).



**Figure 9** Range of alternatives between pure functional and pure product organization

Firstly about the factors on determining the influence: As seen in figure 9 the different design variables “*help to regulate the relative distribution of influence between the product and functional considerations in the firm’s operations*”. The other factors are such as “*roles in budget approvals, design changes, location, salaries, the size of offices and so on*”.

Secondly about the factors in choosing the organizational structure are “*Diversity of the product line, the rate of change of the product line, interdependencies among subunits, level of technology, presence of economies of scale, and organization size*”.

About the factor ‘interdependence’: If rapid response to the changes in the market is the basis for the competition, the activities in the subunits are run rather parallel than series. The effect from here is the increasing of joint decision involving engineering, manufacturing and production. The tight schedule calls for product influence and thus the organizational move is forced more to the right in figure 9. Other factors creating more interdependencies, and thus needing more

coordination in the form of communication and decision-making, are for example the reliability requirements and other design specifications.

So if the new products and interdependency is forcing the organization moving more to the right in the figure 9, what is (or are) the force(s) moving more to the left? It is the **level of technology** being used, hence that needs always more expertise, when operating with unfamiliar materials or solutions. The one way for an organization to acquire such new expertise is buying the knowhow into the organization. Thus, in the next chapter, there is a short discussion on the aspect of organizational growth via acquisitions.

### **2.1.3 Organizational growth via acquisitions**

The growing of the organization via acquisitions puts pressure and creates unique circumstances on the integration of different previously independent companies. Adapting Mr. Eliyahu Goldratt's description on the development of consolidating different approaches:

There are distinct stages when the dominant body of knowledge starts to be insufficient. It is relatively easy to see this stage take form sometime after a new acquisition. Then what happens next can only be named as renaissance. New, independent ideas are evolved simultaneously in different locations. Now, none of these new approaches is more valid than the other is per se, and since the newborn information is quite limited in verbalizing and not mature enough, in retrospect this stage can be seen as a time of biases and strong argumentation against each other's approaches. Sometime after that, consolidation process will begin. Now the efforts are building up to synergism, but since it mainly saturated with compromises and territorialism, this stage lead only to co-existence, not synergism. The compromising mindset actually creates even some artificial gaps between new, valid approaches. The most beneficial stage is yet to achieve, a stage where the internal disputes are resolved and all the existing methods are molded into one extremely powerful body of knowledge. **If the organization**

**sets out to achieve truly meaningful synergy it has to strive to highlight the underlying differences, not just emphasize the similarities.** (Goldratt, 1990, p. 109-110.)

## 2.2 LEAN approach

LEAN thinking has rooted within many organizations. The origin of it trails back to Toyota in Japan. Mr. Niklas Modig got an opportunity to spend almost two years in Japan, observing the Toyota way (Modig, 2013, p. 167).

Mr. Niklas Modig is the author of the book 'this is Lean' and from his work is possible to understand, in a very simple way, the laws behind the operation of processes. These three laws help in the understanding why it is so difficult to reach good resource efficiency whilst having good flow efficiency. The three laws are Little's law, law of the bottlenecks and the law on the fluctuation in processes.

### 2.2.1 Little's law

Mr. Modig (Modig, 2013, p. 34-37) sheds light on the Little's law with an example from airport. Imagine a person arrives at the airport already in a hurry. When going through security check, he/she wants to go fast as possible (short throughput time), and chooses the shortest line. However, the line takes longer than the longer one next to it. Why is it so? There is an additional variable in the equation, *interval time* (equation 2).

$$\text{Throughput} = \text{units in progress} \times \text{interval time} \quad (2)$$

Throughput time is defined dependent on system limits, in other word in this safety check -que example the process starts when the person gets in line, and ends when he/she is through the safety check. No matter how the system limits are defined, the law stays the same. In this example, *units in progress* are the

persons who are queuing for the check and the *interval time* is the time between two exiting units:

Longer que's *throughput* =  $15 \text{ persons} \times 1 \text{ minute} = 15 \text{ minutes}$

Shorter que's *throughput* =  $10 \text{ persons} \times 2 \text{ minute} = 20 \text{ minutes}$

Therefore, in summary, the Little's law points out, that there are two variables in affecting the throughput time.

## 2.2.2 Law of the bottlenecks

Mr. Modig stays with the airport example (Modig, 2013, p. 39-40) with demonstrating the law on the bottlenecks. At the airport, it is impossible not to bump into some roadblocks, where the ques are accumulated. These points are called bottlenecks, which are restricting the throughput. In figure 10 there is an exemplary presentation on bottlenecks at the airport. According to the law of the bottlenecks, the throughput time is primarily dependent on that process phase, which interval time is the longest.

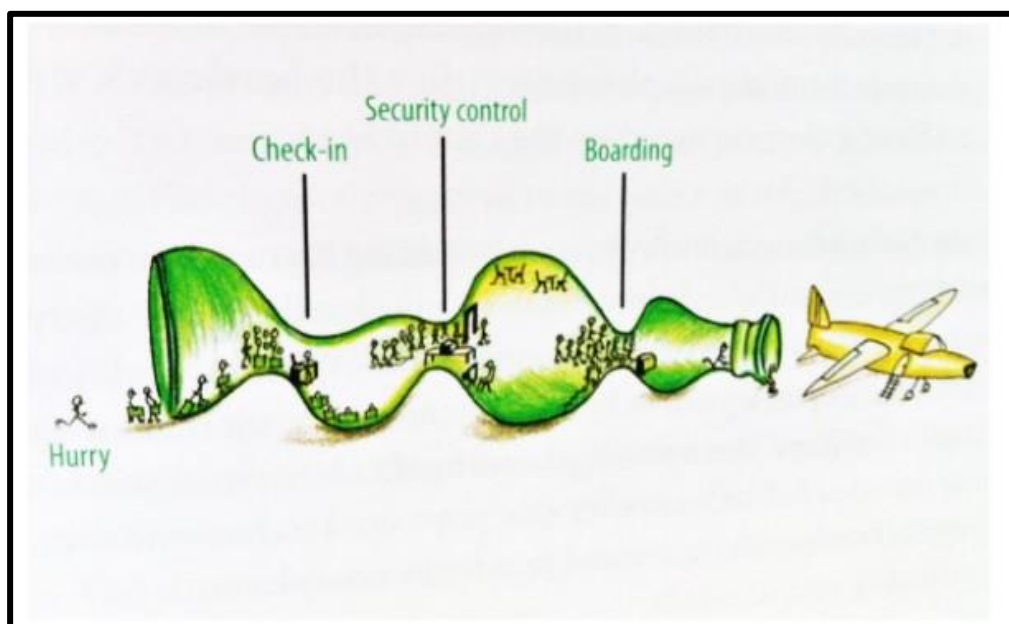


Figure 10 Bottlenecks at the airport



There are two characteristic in processes with bottlenecks:

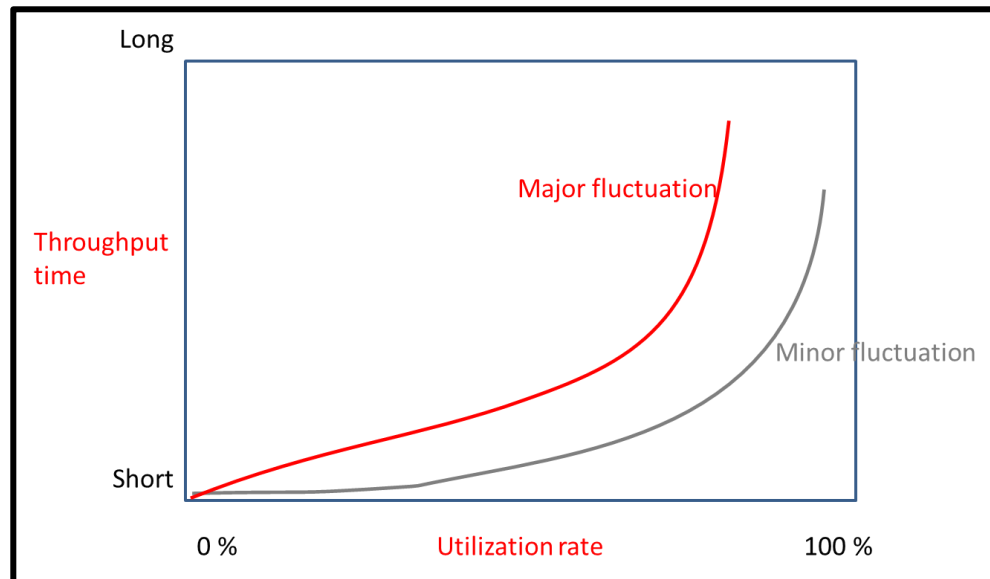
1. A que is always accumulated just before the bottleneck. With units in progress being human or material the bottleneck observation is relatively easy, but with units in progress is information it might get a little more challenging to observe the que, but for sure, the que exists
2. The bottleneck sequential phases are forced to be on waiting time, since they are nor utilized completely, due to the restricted flow of the bottleneck.

There are two reasons why bottlenecks exist in processes. The one being, that there is often some particular sequence of different phases in a process. The other reason is the law of fluctuation, which is discussed next.

### **2.2.3 Fluctuation in processes**

There is always fluctuation in processes. According to Mr. Modig, (Modig, 2013, p. 40-43), the endless reasons can be categorized into three main classes: Resources, units in progress and external factors. No matter what is the cause of fluctuation, it affects either the arrival or working time. Fluctuation exists in time that elapses with different units in progress. **Especially the fluctuation resultant from human beings is almost impossible to avoid.**

In figure 11 there is the correlation between fluctuation, resource efficiency and throughput time. This work is based upon the equation presented by Sir John Kingman in 1960s.



**Figure 11 Correlation between fluctuation, resource efficiency and throughput time**

In order to understand the true flow efficiency, the fluctuation's meaning in processes is essential. In the figure 11 those two lines represent minor (grey) and major (red) fluctuation. The figure shows, that there exists a correlation between the utilization rate and throughput time. The first effect of fluctuation can be derived from the picture; the closer to 100% the resources are utilized, the more increases the throughput time. Second effect is that with major fluctuation, the whole curve shifts more to the left. With the assumption, that the utilization rate is standardized this figure briefly is (Modig, 2013, p.40-43.):

*“The greater the fluctuation in process, the longer the throughput time.”*

#### **2.2.4 Waste**

Mr. Taiichi Ohno is the founder of Toyota production system, and the following is from Mr. Ohno, 1988 (Liker, 2004, p. 7):

*“We concentrate only in the timeline, from the moment of a customer order to the point of when we collect the money. We reduce that timeline by removing non-value adding activity (waste time).”*

*-Taiichi Ohno*

In Toyota, they defined seven different forms of waste (Modig, 2013, p. 75-76):

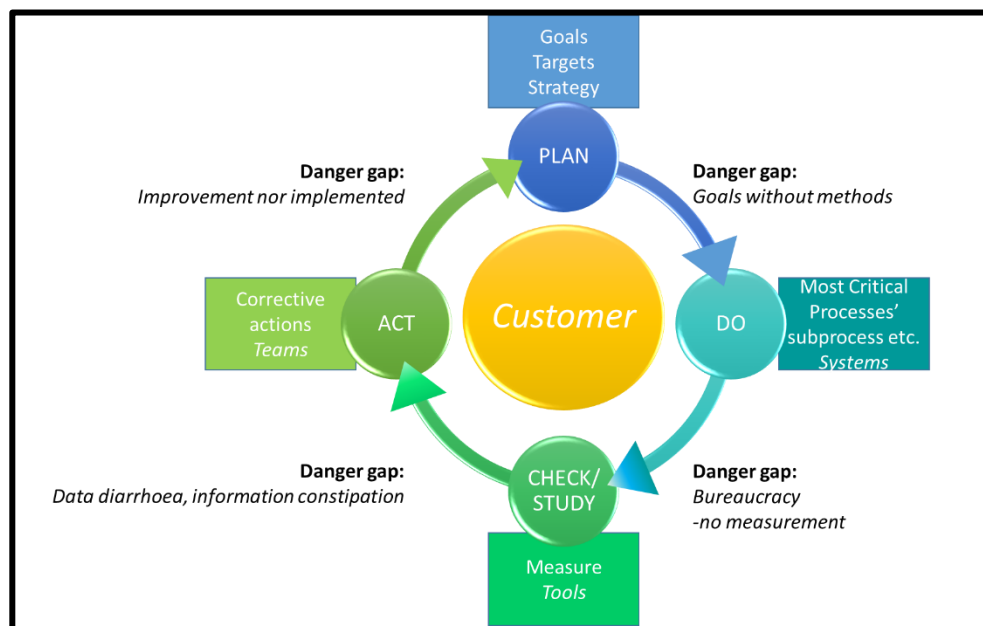
- **Over producing** – each phase must produce only what customer wants
- **Waiting time** – production must be organized in order to avoid all kind of waiting time
- **Unnecessary transportations** – Organize the layout of the factory
- **Over/excess work** – avoid working with the product more than the customer requires. This includes the use of too sophisticated, complex or expensive tools
- **Unnecessary inventory** – inventory is capital invested in processes, and it hides true problems
- **Unnecessary movement of the workers** – plan the work activities

In Toyota making the right things, meant also that they were not in a position to risk sending defective products to their customers. Production management and quality assurance came to be very important things. Every worker took responsibility of the whole picture and it was everybody's business to make all things right. **Problems were positive things, which were to be recognized, analyzed and removed for good.** (Modig, 2013, p. 76.)

### 2.3 Total Quality Management approach

The origin of total quality management dates back to the times of strong industrialism wave after the Second World War. The American gurus Deming, Juran and Crosby have approached the subject through various literature. In addition, Armand Feigenbaum, Kaoru Ishikawa and Genichi Taguchi have taken part in forming the current apprehension of quality management. (Rao et al., 1996 p. 37-51.)

In figure 12 there is the adapted total quality management implementation with Deming's continuous improvement cycle (Oakland, 1993, p. 421).



**Figure 12 Total quality management implementation with Deming's Plan-Do-Check-Act cycle**

Originally, Mr. Oakland had in the center the word 'culture'. In the figure 12, there are clearly stated the possible danger gaps, which a proper implementation targets to avoid.

## 2.4 What is the goal (purpose) of the organization?

Mr. Frederic Laloux discusses in his book 'Reinventing organizations' that each organization exist for some purpose. That there is a fundamental, evolutionary purpose why organizations exists in the first place. (Laloux, 2014, p. 194.)

Mr. Goldratt approaches this same schema in his business novel book 'The Goal' and in his more method descriptive book 'What is this thing called Theory of constraints and how should it be implemented'. Laloux might approach this from aspect that is more philosophical; thus, intuitively, Goldratt's analyze on different methods seemed to offer most valid reference to this study, since this study set off with a clear target of simplicity.

What is common with Just-In-Time (which aims to reduce inventory, i.e. mechanical KANBAN system), Total Quality Management (which aims to increase the quality of products, i.e. procedural Statistical Process Control system) and Theory Of Constraints (which aims to elevate bottlenecks, i.e. mechanical Drum Buffer Rope system)? It is not enough to state that above, descriptively what they are, they all definitely are also overall management philosophies. Does that additional statement however, offer a feasible starting point for consolidation of these approaches? (Goldratt, 1990, p. 110-112.)

These all approaches aim to help the organization **make more money, now and in the future**. Goldratt's theory of constraints states that there are three avenues in increasing moneymaking. The avenues are "*to increase throughput, to decrease inventory and to decrease operating expense*". (Goldratt, 1990, p. 113.)

Equation 3 and 4 present the financial relationships on these three variables. Throughput and operating expense are considered to have the same importance, since they appear in these equations with the difference between them. (Goldratt, 1990, p. 113.)

$$\text{Netprofit} = \text{Throughput} - \text{Operating Expense} \quad (3)$$

$$\text{Return On Investment} = \frac{(\text{Throughput} - \text{Operating Expense})}{\text{Inventory}} \quad (4)$$

Traditionally and intuitively, it seems that organizations are more able to impact on their operating expenses rather in the throughput, since throughput is affected by the market demand. The traditional use of cost accounting in mid and long-range decision making gives more emphasis for operating expenses. This cost accounting approach in the enabler also in disguising some part of operating expense as inventory. Thus, although in might be against the healthy intuition of top management, the reality has been in organizations in the importance scale followed (Goldratt, 1990, p. 114.):

1. Operating expense
2. Throughput
3. Inventory (trailing way behind)

It is to be stated that, total quality management, just-in-time or theory of constraints do not promote or accept this order. In striving to decrease operational expense and inventory is limited, since neither of them cannot exist in negative numbers. However, the case for increasing throughput is inherently unlimited. Judging the importance of throughput and operating expense, within a specific period they are bot equally important, but when evaluating future actions and in order to increase moneymaking on an on-going basis, throughput is to be set first. (Goldratt, 1990, p. 115.)

When considering the right ranking of operational expenses and inventory there is that fact that even the traditional approach in the form of carrying costs and the depreciation of assets takes account of inventory having an indirect impact on net-profit. The one important, yet often neglected aspect is that inventory has an indirect impact on future throughput. Future throughput is the organization's ability to compete in the market, and the parameter in competitiveness are (Goldratt, 1990, p. 116.):

- Quality products (also with engineering aspects)
- The price ( margins and investments per unit)
- Responsiveness (due date performance AND quoted lead times)

Therefore, with that little longer discussion on the different variables it becomes apparent that the more correct scale should be:

1. Throughput
2. Inventory (due to its indirect impact on future throughput)
3. Operating expense (a close third)

This shift in changing the priority scale is amongst the first actions entering the 'throughput world'. The old world with the dominant measurement of operating

expense carries within the impression, that organizations are composed of interdependent variables. Entering the throughput world, the whole picture drastically changes. When we consider that the constraints (bottlenecks) determine the end results, they become the main tools of management. The tool from old world – product cost – can now safely be discarded. *“It becomes obsolete, when we stop to pay according to piece produced and switch to hourly pay. It becomes devastating when our “overheads” grow to be much larger than direct labor. It has become unnecessary now”*. (Goldratt, 1990, p. 118-127.)

*“Why is it that we need inventory in order to protect current throughput?”* Whenever a process or a system involves both dependent resources and statistical fluctuations, the trade-off between inventory and current throughput exists.

As discussed before, with the short chapter of 2.2.3 the fluctuation, when involving humans, are almost impossible to avoid, thus leading to the next research and discussion with the psychological aspects of this study.

### 3 PRECEDING WORK WITH QUALITY ISSUES

*“The failure to recognize the value of knowledge gained through experience, through traditional forms of knowledge transfer such as apprentice schemes and the collective nature of much knowledge, was such that the word knowledge became problematic.”*

-David Snowden, 2002

The preceding course work and the author’s work as a summer trainee offers at least, if not more, a base for discussions in this thesis. During the authors summer work and with the various discussions, some of the stated problems seemed to be more of psychological ones. The indicated quality problems revolved around the quality of the organization’s internal activities. With this remark in this chapter 3, the author has consisted a discussion with the psychological and even philosophical aspects touching this thesis. In addition, this finding sets the pathway to this study, in that sense, that although this study’s findings are easily calculated with hard cost figures, the focus of this research stays in non-monetary measurements.

Goldratt also highlights the importance to take account the organizational psychology (Goldratt, 1990, p. 90). This ideology of collective power to reach unwanted decisions is also discussed in Otto Scharmer’s U. Theory. Scharmer’s Theory U is created to make a shift in attention, and fundamentally transform some of the global collective outcomes, by starting to act from a place of the highest possible future. (Scharmer, 2007, p. 3-5.)

In addition, as mentioned the aspect of organizational psychology is emphasized in Goldratt’s method descriptive book:

*“Unfortunately, the organization itself has its own psychology which is not equivalent to the psychology of its individuals.”*(Goldratt, 1990, p.93)



### **3.1 Preceding findings and psychology of the study**

What is science? It seems that there is no one straightforward answer to that question. Science is a mixture of “finding the secrets of nature”, having a precise answer for every situation and science is a collection of well-established procedures (Goldratt, 1990, p.23).

The background for this work is versatile. The author herself stayed very immature and clueless of ‘hard business life’ up until before the course work for the case organization. It is stimulating to witness with one’s own eyes how the theory meets practice.

Unfortunately, in the author’s personal opinion, that course work stayed too superficial. It was purely intuitive feeling that the futile attempt to start to solve, as a summer trainee, the numerous problems indicated and gathered via discussions, would only fade away. The stated problem’s causes seemed to be rooted deeper below the surface, and thus would not be solved in an instant.

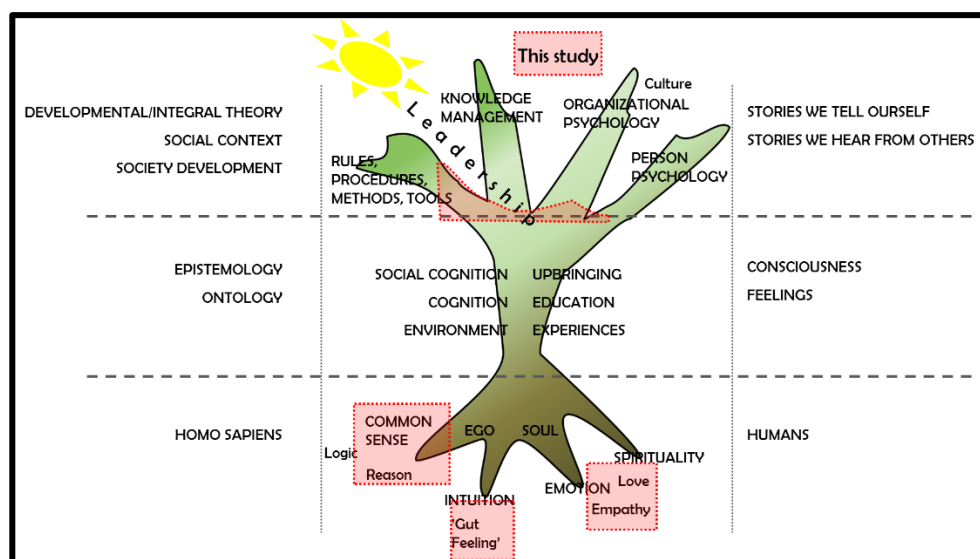
### **3.2 The framework ‘Organizational life factors’**

Figure 13 – The organizational life factors –framework is consisted by the author from the various literature, YouTube videos and discussions with colleagues from summer of 2017. The author has watched a numerous amount of TEDx talks, searched different databases and read many books. The vast amount of opinions, knowledge and feelings have been mixed with the authors own perspective. It is unnecessary to try to tear these apart, since the author spent the whole summer to try to make sense about the big picture, and all the things connected. At the end of this chapter, there is a table, in which some of the source material for this framework is consisted.

One key influence to mention is Mr. Frederic Laloux. He describes in his book, Reinventing organizations, the development of organizational models. His book

is a product of a three years research. He suggests that the humankind is limited by the current way that organizations are run. Could it be that genuine happiness is possible in organizational life? (Laloux, 2014, p. 3-4.)

The unyielding chase to capture the bigger picture, and the will to defend/highlight each worker's right to happiness, drove the author to consist the following framework in figure 13. Firstly, about the layout of the framework called 'Organizational life factors'. Left hand side represents the logical, rational, and even scientific, when thinking very conventionally, side of life. The right-hand side represents the traditionally thought 'softer' side of life such as emotions and even spirituality. This study's focus points are highlighted in figure 13 with red rectangular shapes.



**Figure 13 The organizational life factors -framework**

'The organizational life factors'-framework adapts itself into basic human life as well as organizational life. The central piece in the framework is a tree shape. It illustrates the essence of human being or an organization. All beings have roots (figuratively speaking) but most of the time they are inherently or consciously kept away from other's sight. These roots represent the mind, thoughts, and the brains.

Then as time goes by, and a human/organization grows, so does the tree create a solid trunk covered with bark. The invisible parts of the brain activity is still carried within the tree trunk, and even though it is possible to assess someone based on observing for example family history, educational and vocational career, some parts of those factors as well stay hidden within the hard bark.

Next, in human, as well as organizational life, the tree starts to create more mass and this evolvement is illustrated as four branches in the framework. Starting from the person psychology side, there is no escape from these factors even in organizations, because even if the branch is sawed off, there are the millions of conduits and microscopic passages leading to the stump. In addition, as can be imagined that the tree uses an awful lot of energy on healing, so does a human being waste a huge lot of effort to keep up the charade. Laloux discusses the wholeness of a person as an important part of new soulful organizations (Laloux, 2014, p. 173).

The next branch is called organizational psychology, which carries in itself the culture of the organization. There are numerous of studies performed in that area and it is not possible to escape totally that branch either. The organizational culture affects each individual working in a particular context or in an organization. At the time of this writing, there has been a new strategy launch in the case organization, and the author stands at a viewpoint observing the movement, or stillness, what effects and manifests the rollout of strategy is creating.

The author read a fantastic business novel or more it was like autobiography in business – *Delivering Happiness* by Tony Hsieh. The book discusses about the importance of the culture, Hsieh's believe system is that profits follow culture. One of his businesses is Zappos, and right from the establishing of the company the superior customer service and organizational culture have been number one priorities. (Hsieh, 2010, *Delivering Happiness A Path to Profits, Passion and Purpose*, p. 163-165.)

From the two branches left, the other is knowledge management. Granted, it is very broad terminology, but since this framework can be adaptable to different kind of organizations, it is not mentioned plain 'project knowledge management', which would be more suitable in this particular research.

Last branch consists of rules and regulations, methods, procedures and tools. It is the *weighted point of this study*, but since already established; it is not possible to escape the other factors, so these also are carried within the study at least in the manifest of thought.

*One particular incident stays and revolves in the author's mind, when discussing in the hallway of the case organizations hallway and one colleague expressed total fatigue and depression of the current situation in work life, and said that there was **no one in the organization to go and ask for help**. The author responded that colleague could talk to her and it should be everybody's business to notice if anybody faces a loss of strengths and reduction in coping with pressure.*

Lastly, but not least, **the bark which covers the whole tree is the leadership**. It can be seen in the framework, that leadership offers the direction, the vision for the whole organization. At the same time, it offers the shelter from sometimes-turbulent environment but it also sets the limits.

One additional remark of the framework 'Organizational life factors' shall be the notion, that as does the tree constantly grow and evolve, so are the changes constantly (or have at least been) **present in the case company**. It has been through with four rounds of laying off people and each time the **organizational structure has changed**. This highlights the importance of flexible and resilient leadership.

Already from that previous point, it is possible to intuitively draw assumptions that people are affected by the lay-offs, and due to the nature how the case organizations has grown (via acquisitions) it is just plain logic to assume that the whole organization is still in amidst of change. This is crucial to understand and keep in mind, so that the restricted resources can be pointed most effectively for specific improvement actions.

As stated, the framework presented earlier adapts as well as a human life factors. So the author ponders: if it is just intuition, does that make it somehow scientifically not valid? Is not intuition a part of the person who is conducting the research? Are not all scientific researches at least to some extent subjective, due to the person's upbringing, education, experiences and expectations? (Figure 13.)

In the below table 2 there are some of the references (with links to the web material), that the author of this work has been subjected lately:

Table 2 Some of the subjected references of this thesis

Author / presenter	Year	Format
Asacker, Tom	2014	TEDx talk [ <a href="#">Why TED Talks don't change people's behaviors</a> ]
Goldratt, Eliyahu	1990, 2004	Books [Theory of constraints, The Goal]
Hsieh, Tony	2010, 2014	Book and website [Delivering happiness, <a href="#">Delivering happiness-make happy work</a> ]
Hämäläinen, Pekka	2001, 2009	Books [Sinulla on vain yksi elämä, Jaksamisesta innostumiseen]
Laloux, Frederic	2014	Book [Reinventing organizations]
Liker, Jeffrey	2004	Book [The Toyota way]
Modig, Niklas	2013, 2014, 2016	Book, USI talk, TED talk [This is Lean, <a href="#">This is Lean Management</a> , <a href="#">The efficiency Paradox</a> ]
Mooji	2017	YouTube [ <a href="#">This Exercise is All the Help You Need</a> ]
Roesmischer, Jessica	2002	Article. [ <a href="#">The Never-Ending Upward Quest</a> ]
Scharmer, Otto	2007 2017	Book and Massive online course [Theory U, <a href="#">U.lab course at MITx</a> ]
Yammer in Outotec	2017	Web based collaboration tool, organization social media.

*“The experts in an organization are already generals. As a leader, you don't give them something to run from, but something to run to.”*

*-Adapted from Richard Webber*

Although the stated emphasis of this thesis is on the non-monetary aspects, let us discuss briefly, since the findings of this thesis are possible to introduce as hard monetary figures as well, *the cost of quality*.

### 3.3 Quality costs

The author started firstly in mid-March with a course work, and familiarizing with quality costs. In the case organization there are currently some development projects touching quality costs ongoing still. These projects aim to get control over the quality costs such as rework, scrap and various waste work.

Authors own work on quality costs led to the suggestion of classification, which is depicted in figure 14, the house of quality costs. The figure is adapted from Blocher et. al's book 'Cost Management' (p. 759-761). The idea is that in an organization quality costs can be divided to positive and negative ones.

This 'house of quality costs' adapts also straight from Philip Crosby's PAF-model; he divides quality costs as Prevention, Appraisal and Failure costs. Within this quality cost model, this thesis situates in research how could the internal failure costs be diminished. It is to be said, that the real target why these costs are measured in the first place even, should never be lost. The use of quality cost as a management tool helps to focus attention. (Crosby, 1980, p. 105-107.)

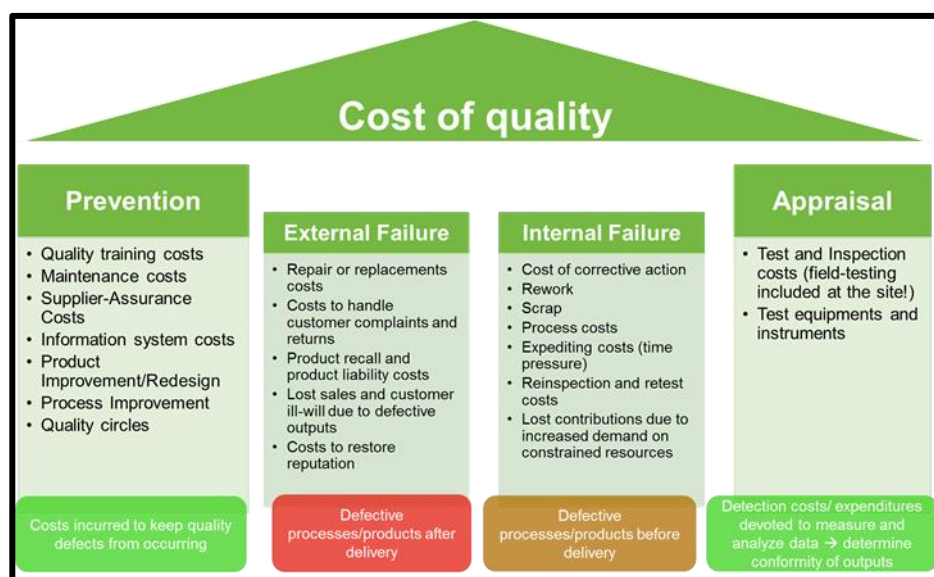
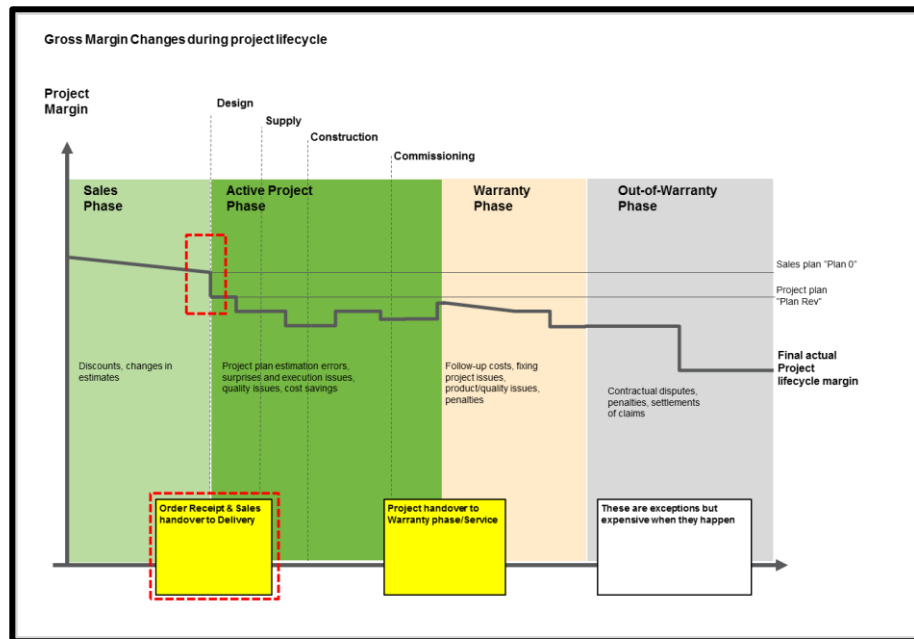


Figure 14 Classification suggestion of quality costs

In figure 15 is the exemplary gross margin deviation depicted in a delivery project, and the scope of the study is shown with red dashed line rectangular. Already intuitively, it has been recognized in the case company that among other things the **mistakes, erroneous assumptions and inadequacy in knowledge transfer between the phases** leads to that original margin to drop.



**Figure 15 The exemplary Gross Margin Deviation during project lifecycle**

Mistakes, errors, and deficiencies in knowledge can be measured or classified straight to internal failure costs as depicted in figure 14, so this study takes place in targeting reducing the internal failure quality costs from that perspective. It should be noted, that for a short time the prevention costs might expand, since also this study's findings might lead to the point, that the organization's processes should be improved.



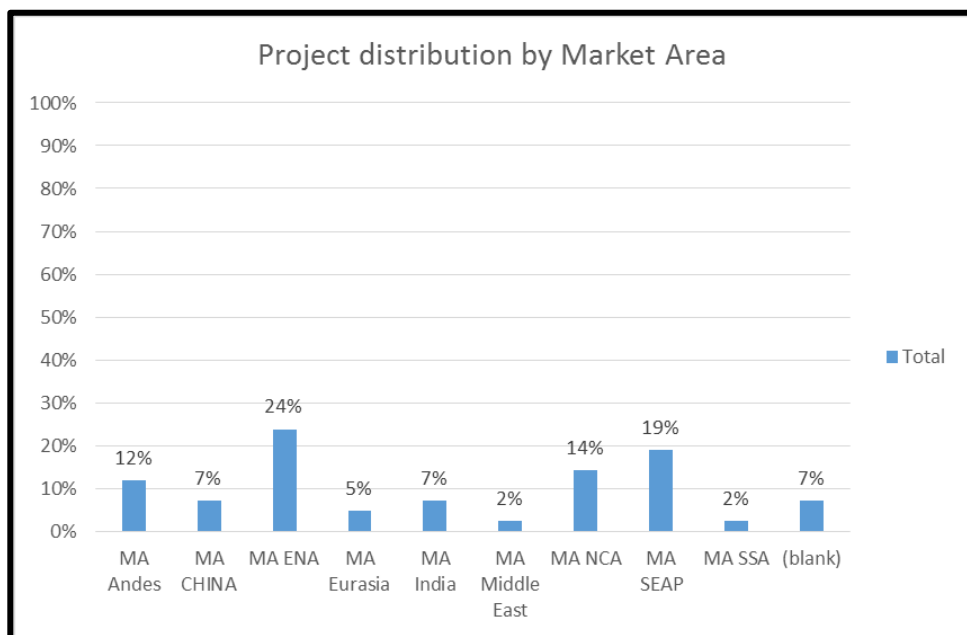
## 4 THE DELIVERY PROJECT RESEARCH

*“Without data you’re just another person with an opinion”*

- W. Edwards Deming

### 4.1 The selected projects in general

Forty-two projects were selected to this study. In figure 16 there is the distribution of the projects by market areas. There are ten market areas: The Andes, Brazil, North and Central America, China, South East Asia Pacific, Eurasia, Sub Saharan Africa, Middle East, India, Europe and North Africa and some countries (in the study’s projects: Iran, Egypt) sales are handled by agents (in figure 16 as (blank)).



**Figure 16 Projects by Market Areas**

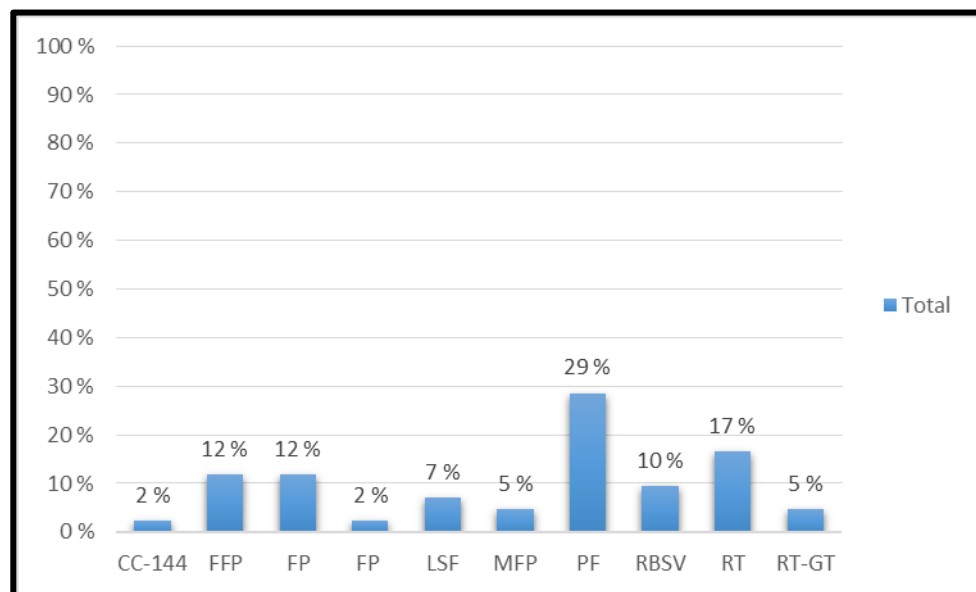
In addition distribution by market areas, in the selected projects there were other variables such as different filter types, customers, applications, sales persons, project managers and package engineers. These figures are presented in table 3. In the appendix one is the more detailed distribution of these variables. There

were also some data left blank, due to not finding the information from the project files.

**Table 3 The sums of different variables in the project research data**

Total amount of projects	Filter types	Customers	Applications	Sales Persons	Project Managers	Package Engineers
42	10	42	30	27	21	8

Some of these variables are presented more detailed in the chapter 4.2.1. In figure 17 there is the distribution of project data by filter type. The most frequent filter type is Pressure Filter (PF).



**Figure 17 Project distribution by filter type**

## 4.2 Current processes, use of documents and project file management

The processes at the case organization are presented in process portal, accessible via organization's intranet. Since the study is located in between of two process' phase, it was necessary to draw a clear flow chart of the different process steps

with the instructed documentation (this is as an appendix 2). From that, the author was able to start searching the network drive for the mentioned documents.

The network drive's project file structure is given certain structure and instructions in document saving (figures 18 [old] and 19 [new]), and by following these structures the research for the documents was conducted.

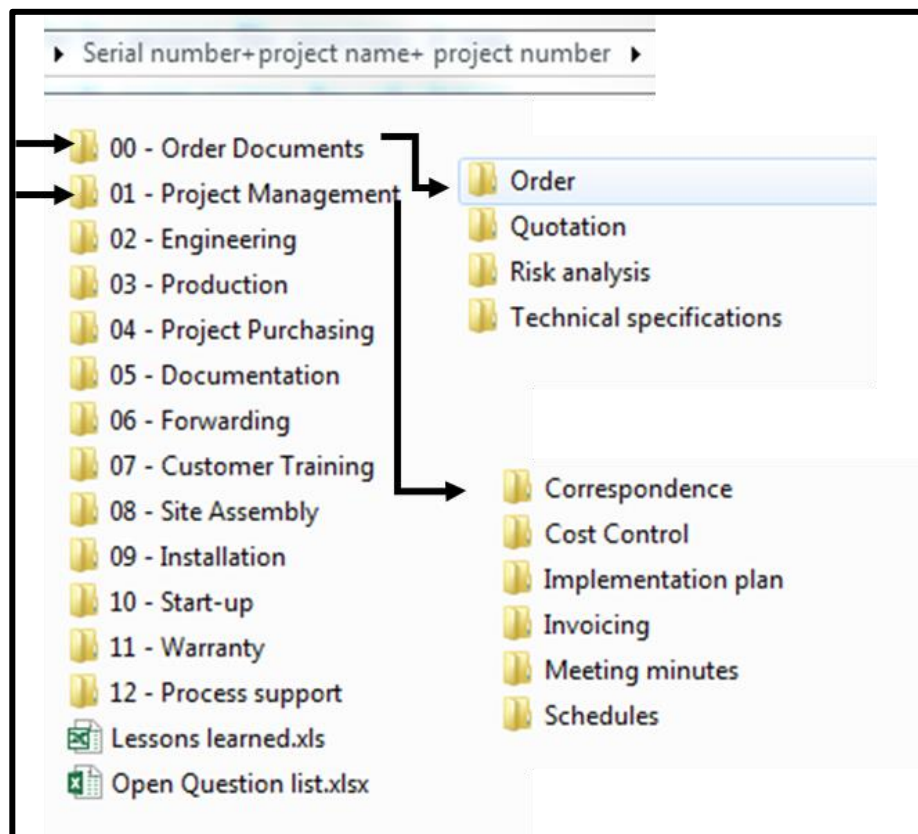
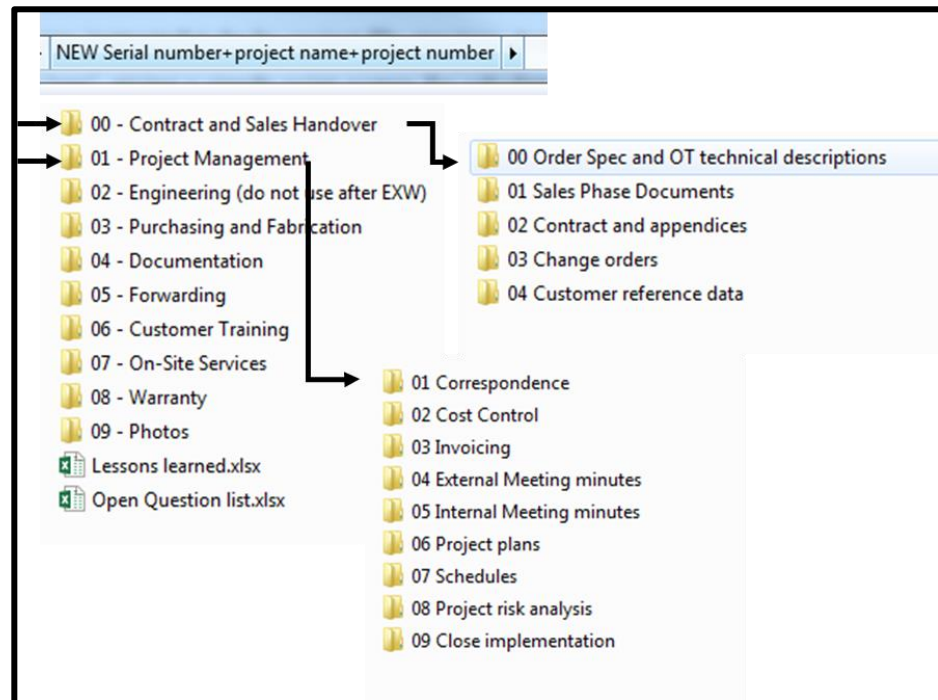
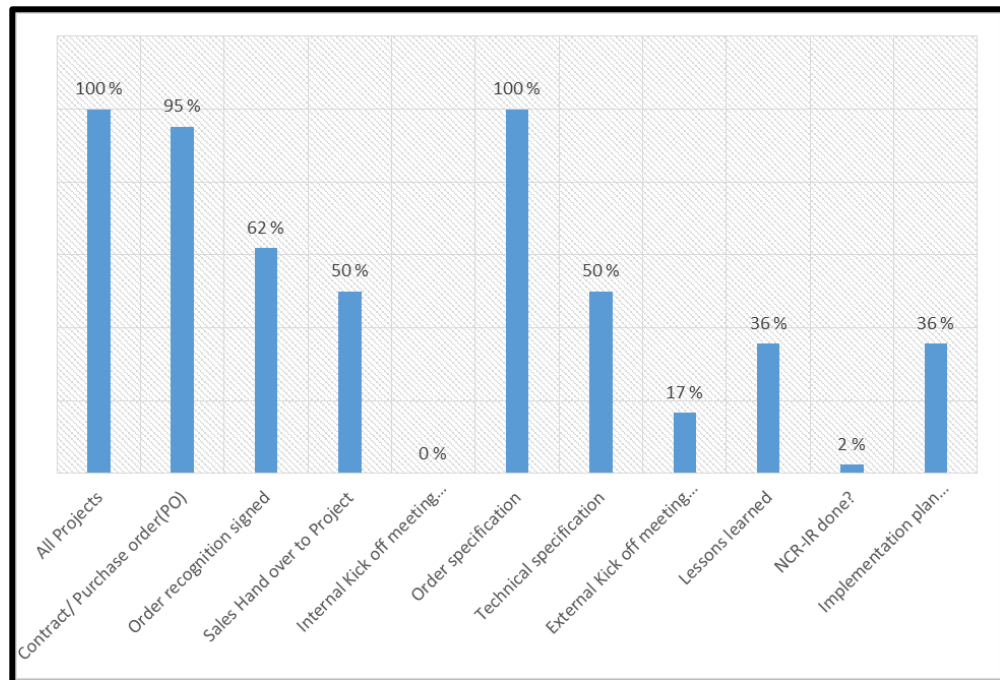


Figure 18 Older file structure with indicated area (arrows) for this research



**Figure 19 Newer file structure with the indicated area (arrows) for this research**

If the document was where it was instructed to be by project file structure, or if the author recognized the correct file, even if saved in different location, it was collected to the database as 'yes', giving a simple point system for calculation (0=not found, 1=found). The collected datasheet is in appendix 3, where the running serial number, customer, application, sales, project manager and package engineer are given coding, in order to assure confidentiality. In the figure 20 there are the use percentages of different documentation in the scope of this study.



**Figure 20 The use of documentation in the study's process phase**

In the above figure 20, on the far left are all the projects presented as 100%. Moving right, the different documentation (Contract, order recognition, hand-over from sales to project, internal kick off meeting, order specification meeting, technical specification, external kick-off meeting, lessons learned template, non-conformance report/improvement request and implementation plan) are depicted as a percentage of the grand sum of projects (42 projects).

The case organization's documents are given document codes and thus identification in the first sheet of the document (example in appendix 4). During the research, there were documents, from which these markings were removed, and the content of the template was changed (appendix 5).

The time horizon between different process steps in this study is presented in table 4. There is the difference in days between the steps counted as average, and as median, since there were quite big variation in the differences (appendix 6).

**Table 4 The differences in days between the process phases**

	The time difference between LOI and contract	The time difference between contract and order recognition	The time difference between order recognition and sales to project handover	The time difference between contract and sales to project handover	The time difference between sales to project handover and internal kick off	
Average	-44	5	-12	-2	10	DAYS
Median	-43	7	0	5	5	DAYS

#### 4.2.1 Presenting the use of documents by variables

The ‘sales handover to project’ –document (checklist) is in the process to ensure that the knowledge transfers intact. In table 5 there is the use of this document presented by sales persons, project managers and filter types. In addition, in the project manager portion the use of ‘lessons learned’ template is presented.

**Table 5 The use of handover template and lessons learned by some variables**

Sales persons	Use of Sales Hand over to Project	Project manager	Use of Sales Hand over to Project	Use of LF LPR 118 Lessons learned	Filter type	Use of Sales Hand over to Project
AI	100 %	A	100 %	67 %	FP	100 %
AO	100 %	J	100 %	0 %	MFP	100 %
AY	100 %	I	100 %	100 %	RT-GT	100 %
AA	100 %	M	100 %	0 %	FFP	80 %
AAA	100 %	O	100 %	0 %	PF	58 %
AE	100 %	R	100 %	0 %	RT	43 %
AG	100 %	RA	100 %	0 %	FP	40 %
AH	100 %	F	67 %	100 %	CC-144	0 %
AK	100 %	D	50 %	0 %	LSF	0 %
AL	100 %	E	40 %	60 %	RBSV	0 %
AQ	100 %	C	25 %	25 %		
AR	100 %	H	25 %	25 %		
AU	100 %	B	0 %	50 %		
AZ	100 %	L	0 %	0 %		
AM	50 %	G	0 %	0 %		
AS	50 %	K	0 %	0 %		
AN	33 %	N	0 %	100 %		
(blank)	0 %	Q	0 %	0 %		
AV	0 %	T	0 %	0 %		
AB	0 %	U	0 %	0 %		
AF	0 %	(blank)	0 %	0 %		
AAB	0 %					
AJ	0 %					
AP	0 %					
AT	0 %					
AW	0 %					
AX	0 %					

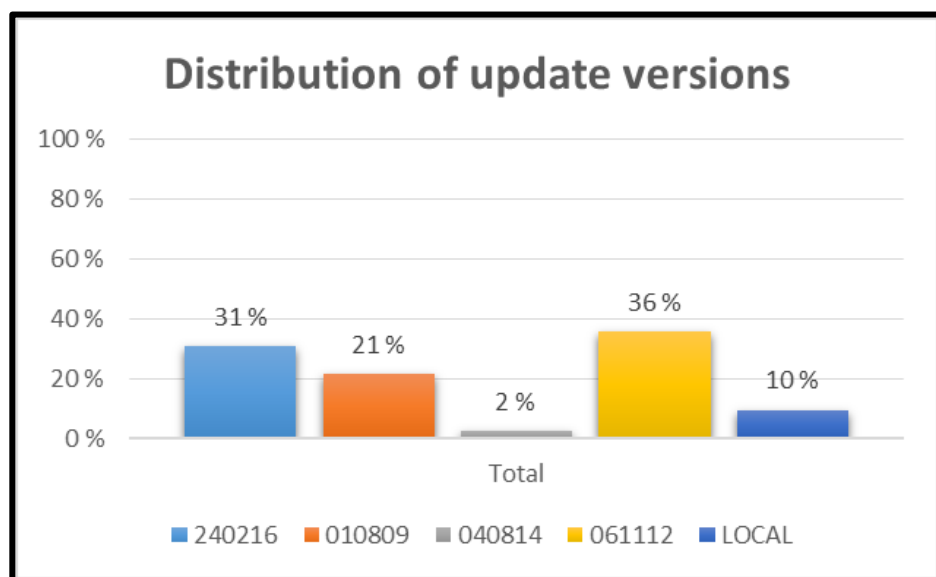
The document called ‘order specification’ (which appendix is the technical specification) is a deviation from global process, in other words, these documents are

not mentioned/described in the global process, anywhere else than as local hand-over documents in the global handover protocol document (appendix 5). This order specification meeting is organized instead of internal kick-off meeting.

Order specification template is a legacy document by Larox Oyj. In the next chapter, the findings related to order specification template are introduced.

### 4.3 'Order specification'-document research

Since the order specification document was found in every project, it was decided to be more thoroughly examined. In the selected projects, there were five different update versions of the order specification document as shown in figure 21. The most used version in this study is the one dated on 6.11.2012 (061112).



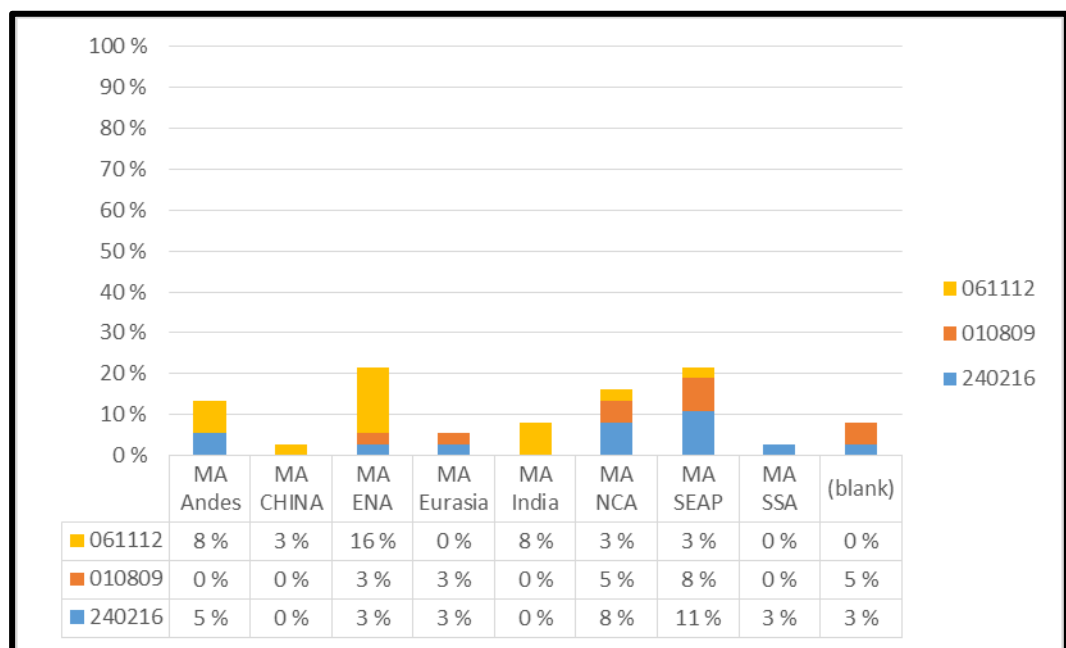
**Figure 21** Order specification document's versions

The content of these different versions is more or less quite same, but there is a clear change between the version 061112 and the latest update, 240216, in the last section of the document there were nine quality indication questions, and these are removed from the latest version. The questions are presented in table 6.

**Table 6 Quality indication questions**

	<i>Answer Yes=1, No=0</i>
1	Are representatives from necessary teams at present?
2	Was the order information package and order specification file delivered 3 working days before the meeting?
3	Were invitations to order specification meeting sent 3 days before the order specification meeting?
4	Is the scope of the delivery clear?
5	Is the list of the filters, auxiliaries and spare parts clear?
6	Are the technical specifications clear?
7	Is the scope of technical services clear?
8	Are the packing, forwarding and invoicing instructions sufficient?
9	Are the customer documentation requirements and schedule specified?

Since the update versions 040814 and ‘Local’ (the date was not found in this version, although it was the only version, which included the instructions on the use of order specification document) were the smallest, they were delimited from the continued research, leaving **37 projects** to the order specification research. In figure 22, there is the distribution of the selected version updates, 061112, 010809, 240216, by market areas. Market areas South East Asia Pacific and Europe and North Africa are the most presented market areas in this sampling.



**Figure 22 Distribution of order specification by market areas**

The ‘order specification’ document is in a word form, and consists of different section which in the earlier update versions are with headings and in the newest version is given a numbered headings. The content of each project’s form was



transferred to excel in order to conduct calculations. The idea for this research on how the document is filled is yet again the very simple point system, if the place in the document is filled, it is counted as one, and if not, it is counted as zero. Therefore, from the selected sampling, it was possible to get the fill up percentages by sections in the document as presented in table 7. In the combined portion the average for section 1 'Project information' is counted from older version's general information. For the last section 10 'Contractual documents' in the combined calculation the percentages from older version sections 'handover from sales' AND 'order spec meeting' is counted for. This procedure aims to ensure the validation of the data.

**Table 7 The fill up percentage by versions and combined in the last column**

Version 010808		Version 061112		Version 240216		Combined	
AVERAGE BY THEMES							
TOP PART	72%	TOP PART	54%	TOP PART	24%	TOP PART	50%
General Information	35%	General Information	35%	1 Project information	73%	1 Project information	48%
Commercial spec.	48%	Commercial spec.	35%	2 General Information	32%	2 General Information	34%
Forwarding	35%	Forwarding	31%	3 Commercial information	26%	3 Commercial information	36%
Guarantees	36%	Guarantees	42%	4 Forwarding	33%	4 Forwarding	33%
Documentation req.	37%	Documentation req.	37%	5 Guarantees	42%	5 Guarantees	40%
Technical field services	10%	Technical scope	14%	6 Documentation requirements	42%	6 Documentation requirements	39%
Tech.Scope	16%	Tech. Field services	23%	7 Technical scope definition	13%	7 Technical scope definition	14%
General Tech. Data	43%	General Tech. Data	28%	8 Technical field services	22%	8 Technical field services	18%
Handover from sales	36%	Handover from sales	26%	9 General technical data	36%	9 General technical data	36%
Order spec meeting	19%	Order spec meeting	23%	10 Contractual documents	27%	10 Contractual documents	26%
<b>Total Average</b>	<b>35%</b>		<b>31%</b>		<b>34%</b>		<b>34%</b>

Since in the market areas China and Sub Saharan Africa there were only one project in each, these were delimited from the next presentation in order to avoid strong statistical illusion. In table 8 the fill up percentages are gathered combining the entire version updates (010809, 061112, and 240216) and presented by the remaining market areas.

Table 8 The fill up percentage by market area

COMBINED	MA Andes	MA China	MA ENA	MA Eurasia	MA India	MA Middle East	MA NCA	MA SEAP	MA SSA	Agents
AVERAGE BY THEMES										
	<i>TOP PART</i>	42 %		57 %	52 %	56 %		38 %	61 %	11 %
1	<i>Project information</i>	61 %		49 %	42 %	28 %		41 %	52 %	50 %
2	<i>General information</i>	35 %		36 %	21 %	28 %		31 %	37 %	13 %
3	<i>Commercial information</i>	34 %		42 %	24 %	36 %		32 %	43 %	11 %
4	<i>Forwarding</i>	40 %		24 %	35 %	37 %		25 %	46 %	11 %
5	<i>Guarantees</i>	45 %		43 %	33 %	38 %		32 %	42 %	33 %
6	<i>Documentation requirements</i>	46 %		41 %	31 %	23 %		38 %	45 %	26 %
7	<i>Technical scope definition</i>	20 %		7 %	5 %	7 %		16 %	13 %	14 %
8	<i>Technical field services</i>	24 %		22 %	5 %	1 %		8 %	28 %	2 %
9	<i>General technical data</i>	45 %		36 %	36 %	20 %		35 %	40 %	43 %
10	<i>Contractual documents</i>	22 %		29 %	28 %	24 %		11 %	26 %	10 %
	<b>Total Average</b>	<b>38 %</b>		<b>35 %</b>	<b>28 %</b>	<b>27 %</b>		<b>28 %</b>	<b>39 %</b>	<b>20 %</b>

#### 4.3.1 Presenting the filling 'order specification' template by variables

The variables (sales persons and project managers, who are responsible in filling the order specification form) were selected based on the count of projects. The distribution of project counts can be seen in the table 9.

**Table 9 The count of projects by project managers and sales**

Project manager	Count of Project		Sales person	Count of Project
A	6		(blank)	4
E	5		AV	3
H	4		AI	3
C	4		AN	3
F	3		AB	2
B	2		AY	2
L	2		AS	2
D	2		AF	2
J	2		AM	2
R	1		AO	2
(blank)	1		AZ	1
T	1		AAB	1
G	1		AT	1
Q	1		AL	1
I	1		AX	1
RA	1		AG	1
M	1		AAA	1
U	1		AA	1
N	1		AU	1
O	1		AH	1
K	1		AW	1
			AE	1
			AJ	1
			AQ	1
			AK	1
			AR	1
			AP	1

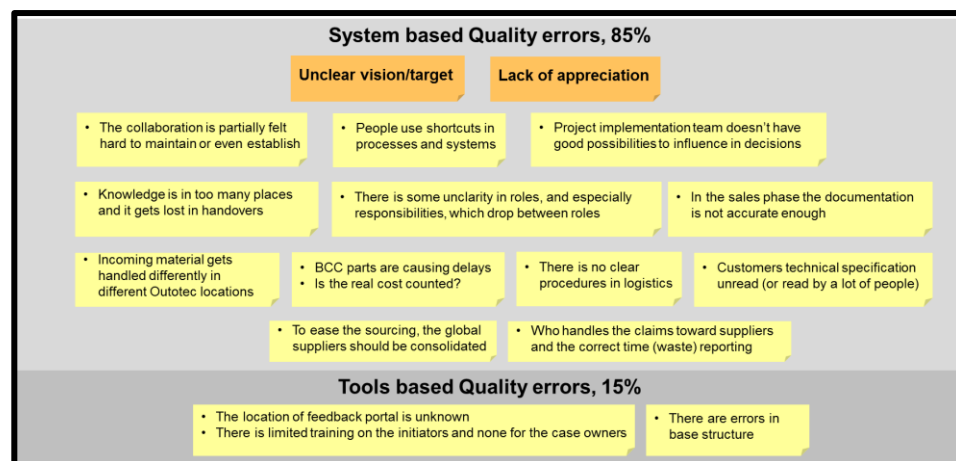
In the following table 10 the fill up percentage is presented on the part of project managers A, E, H and C and sales persons AV, AI and AN.

**Table 10 Fill up percentages by certain variables (project managers, sales persons)**

	COMBINED	Project managers				Sales persons		
		A	E	H	C	AV	AI	AN
	AVERAGE BY THEMES							
	TOP PART	60 %	58 %	36 %	35 %	50 %	54 %	33 %
1	Project information	50 %	27 %	63 %	53 %	57 %	46 %	54 %
2	General Information	34 %	27 %	35 %	33 %	32 %	54 %	34 %
3	Commercial information	42 %	34 %	36 %	29 %	29 %	26 %	29 %
4	Forwarding	36 %	31 %	38 %	28 %	38 %	37 %	27 %
5	Guarantees	38 %	35 %	40 %	31 %	50 %	34 %	29 %
6	Documentation requirements	54 %	28 %	42 %	42 %	48 %	28 %	39 %
7	Technical scope definition	16 %	8 %	15 %	7 %	21 %	24 %	10 %
8	Technical field services	28 %	16 %	16 %	13 %	29 %	28 %	17 %
9	General technical data	42 %	32 %	38 %	33 %	52 %	32 %	32 %
10	Contractual documents	33 %	19 %	21 %	36 %	23 %	26 %	26 %
	<b>Total Average</b>	<b>39 %</b>	<b>29 %</b>	<b>35 %</b>	<b>31 %</b>	<b>39 %</b>	<b>35 %</b>	<b>30 %</b>

## 5 COMBINING RESEARCH DATA WITH THE DISCUSSIONS

It is not without a good reasoning that there is a chapter about psychological aspects in the perimeter of this study (chapter 3). In the figure 23 there is a summary and a rough categorization of the discussions during the summer 2017 from the perspective of this work's supervisor, total quality management-manager (Outotec, 2017d).



**Figure 23 Summary and categorization of the themes in the discussions held in summer 2017**

The above figure sets the framework for the next analyze of the research data.

### 5.1 Combining delivery project research with practice

*“The greatest waste in America is failure to use the ability of people. Money and time spent for training will be ineffective unless inhibitors to good work are removed.”*

- W Edwards Deming

### 5.1.1 Process discussion

Intuitively, within the discussions during summer 2017, it has been recognized by multiple interviewees, that the case organization suffers from the lack of leadership. Some of the findings back this intuitive finding. Such as the use percentage of the different documents described in processes or the free change of document identification. Although this thinking offers also another perspective, should there be a clear differentiation between leadership and management? How are those two concepts understood in the organization? Leadership is more of that psychologic approach and management is the work, which ensures that the agreed procedures are being met and the work flows from the start to the wanted outcome.

On the other hand, if people state that they take shortcuts in the processes, why is it, that they lack the initiative to suggest improvements **considering processes**? One explanatory aspect might be found in the organizational structure of the case organization.

As the case organization has stated in their mission and vision they want to be technology leaders in their business. However, for example the amount of different equipment in filter product line has grown significantly. Back in the time before the acquisition there was only one filter type, Pressure filter, and it had the personnel about of 15 persons. Currently the product manager per filter is mainly the soul person when talking about product teams.

As discussed in the hypothetical transformation of company Standard Products Co. (in chapter 2.1.1), it is possible to draw conclusions that in the current time in the case organization exist a misbalance with the general manager and technical personnel power relations. The one finding in the discussions reinforces this, since it was stated, “Product management do not have the control or true ownership of the products”.

At the time of the filters product line acquisition, there were no global processes, in which to integrate the newly acquired product line. The global processes were just firstly rolled out in the year 2012. (Vice president of QEHS, Outotec, 2017c.) At the current time of writing this thesis, the second revision of the processes is ongoing (Delivery process owner, Outotec 2017c.).

As indicated in the interviews, the process training is felt to be poorly executed. The same was the feeling towards the first integrating actions. As highlighted in chapter 2.1.3 one size and model does not fit all. Coercing was intuitively the grasped observation on the integration actions. However, it might be that the current time is somewhere between co-existence and true synergism. How could we move from just co-existing with different locations into the beneficial stage of synergism?

### **5.1.2 Variables discussion**

Amongst the 42 selected projects, there were quite a few variables. Since the key roles in this phase are sales persons and project managers, they were analyzed in order to study the use of handover protocol (a document, which is to assure quality of the transmitted information) and the use of lessons learned template. The handover document is supposed to be filled by sales person and it should be discussed through with project manager. From the table 5 it could be possible to draw assumptions in forming effective pairs when considering sales persons and project managers. Roughly, the data indicates that the use amongst sales is more common than in the project manager side. Since project managers should want the information as well, one could assume that they would even ask for the document and its related discussion. The use of handover document was analyzed by filter types as well. Interesting point here is that indicated by discussions, the PF (pressure filter) is the “gem” product, but could it be that there is some over confidence in the way the information is handled and transferred? Throughout the discussions, the legacy tacit knowledge was raised to the subjects, as being one big factor on continuing quality problems.

As discussed in the theory chapter 2.2 whenever a variable is a human being, it is almost given for sure, that the fluctuation exists (2.2.3). This is reasonable even with common sense, since humans are all but rational and logical (Chapter 3).

Another aspect when involving many human variables, is that as stated in the chapter of bottlenecks (chapter 2.2.2), when the units in progress is information such as in this research, the observation for bottlenecks is challenging. The indicated time spans in the findings may help in this analyze. There is by average five days waiting time between the time of the date and order recognition (table 5). By median days expand to seven. This indicates that the information (and the progress of the project) is idle on waiting somebody to fill the order recognition (which is needed in establishing the project).

### **5.1.3 File structure and content discussion**

During the research, it became obvious that there was some diversity in the file structure. In addition, even when the structure was as instructed, there were many different ways on naming the documentation in this study's scope. In this study's product line exists instructions in deviating from global processes, but this is not mentioned in the process portal. Since the organization's new employee onboarding seems to rely currently mainly on self-learning, therefore the success depends mostly on the personality of the person who is the closest supervisor and guide to the new recruit. Intuitively, this approach is not sufficient in assuring the quality of on boarding. Especially if there are deviations from global processes to local, but these are described in very different place, how is it possible to make sure, that this deviation information reaches each new recruit?

The author of this study also has been through the self-onboarding and it was not up until the end phase of this study was only then able to find out, that there exists a database with about 75 % accurate data on delivered equipment. This knowledge would have been handy in the start of this research, but it did not even come to mind, that one could ask for such database. However, from this the

author takes soul responsibility, as this study has shown already that whenever struggling to find/gather out some 'new' data, start from the assumption it has been done already! Since again referenced to the discussions, it is the implementation part, which has been a struggle to carry through.

#### **5.1.4 Handover -discussion**

One additional aspect on the organizational structure is that during the summer's discussions, it was stated that even for the persons working in the organization it is sometimes extremely difficult to find the right persons, who could possess the right information. The clearing on roles and responsibilities is an ongoing process, at least it should be, as written in the figure 23 also, the subjects falling between roles, would be solved and handled, if there was the culture of continuous improvement. The real danger in this inadequate training or knowledge even with the structure of the organization is that there is a real possibility for double and overlapping work.

These different handover protocols are built to fill the danger gap whenever information is transferred. Instead of not using them, they should be scrutinized constantly to ensure the validation of the document content. Indicated in the discussions, as in the language of the Deming cycle, the organization seems to lack the most important phases of the cycle, those being the check and act parts. As described in chapter 2.3 there are some danger gaps, which can be avoided by the selection of right tools, measurements and efficient and healthy teams.

In the discussion portion, it was described many times and even during this thesis, it was clear, that the current way to handle handovers is to slow down the motion and start over. The organization lack the skill to carry on the motion, which begins already way before the scope of this study. Why are the contracts read AFTER being signed, in order to have a clear comprehension what has been sold? Should not we be sure BEFORE the signing that we have a consensus with the customer what has been sold? Since the author of this study does not possess any contractual skills, from the beginning this part of the process was delimited.



Still, it has been stated, that when the handover from sales to project takes place, starts the interpretation of the contract, in order to achieve the understanding what has been agreed. Motion halted altogether. If the sales person is already running, should not we establish such processes, that the next process phase is able to start jogging, thus preventing the movement to stop?

This figurative running-stopping-walking- cycle is nothing but waste (chapter 2.2.4). The re-reading (and interpretation) of the contract or any document is over/excess work, which is one form of waste described in LEAN philosophy.

In the case organization there is in use the 1+1 sales model. Meaning that there are roles 'customer lead' and 'solution lead', the latter being technically extremely qualified person with true knowhow on the equipment and that is to ensure the right choice of technology in the projects. However, enter Little's law (chapter 2.2.1). There was a discussion during summer, when one customer lead was asked how many projects are there on his table and the answer was roughly '75'. With using 1 day for each, the throughput time is 75 days. What happens if the projects on the table need a little further knowledge digging, and even discussions/questions with different persons on another side of the globe in a different time zone? It is recognized in the case organization, three days is the norm even to get anything done, so it sums up to *3 days x 75 projects = 225 days*.

## **5.2 Combining 'Order specification' –document research with practice**

*"15% of all quality problems are related to a particular worker or tool. The other 85% arise from faults in the company's system and will continue until the system is changed."*

- W. Edwards Deming

### 5.2.1 Content of the document

One enabler in assuring the constant, stable movement is the ‘Order specification’ document. It has been in use in the product line since the 1990s. The content of the document has changed during times. One of the clearest changes was the removal of quality indication questions. In the scope of this study, those exact questions were quite significant, if properly filled and taken into account. There has been also in the history a separate Quality Indication Document (Appendix 7), which was filled after the order specification meeting, in order to control the quality of execution of this particular meeting.

However, the validity of the content in the document should be put under discussion, as should be the form itself. At the current time, there is no way to follow or control the use of this document, other than is it used or not. In addition, if it is stated that in some projects some information is valid, and in other is not, these should be somehow recognized in real time, while project is ongoing. In retrospect it is extremely hard to try to remember projects and their characteristics. This same ideology concerns the document lessons learned. It is impossible to reminisce problems or challenges almost a year afterwards.

One intuitively presented subject in the summer’s discussions was the mismatch of the key performance indicators. This was the one reason for the chapter 2.4 in the theory portion. The ultimate goal of an organization is to make money. All the measurements should be tied to this common goal. Based upon Mr. Goldratt’s work there is three avenues in order to achieve that goal of making more money. Decreasing operating expense translates directly in this work into the decreasing of quality costs (chapter 3.3) when the double work (such as with the contracts) is removed. The other avenue straightly connected to this work is to increase the throughput. A controlled, efficient way of use and filling of the documents is crucial in that throughput world. With these thought as basis, some of the findings on the research how the document was filled is next discussed.

### 5.2.2 Fill up percentages of the document

In chapter 4.3 the tables (7, 8 and 10) are given conditional formatting, in the bigger the percentage, the greener, and the closer to 0 % the color of cell appears red. With the first analyze of just combined versions in table 7 it is remarkable that no percentage is above 50 %. The top part is exactly 50 %, but even with the restricted knowhow of the author, this top part of the document contains hardly the most relevant data. As indicated in one discussion the most usual reason for even legal disputes or customer claims is the technical data. The technical data is misinterpreted, lost, or simply wrong. Very interesting finding in this filling of the document research is that the technical scope portion of this document scores lowest (or second lowest) nearly throughout the analyzes (tables 7,8 and 10).

The percentages were analyzed also by market areas (table 8). Countries handled/counted as 'Agents' scores the lowest. From that, it is very natural to draw an assumption, if in the organization itself the filling of the document is not well under control, how can it be when moving further from the core organization? Strongest market area in this study were the Andes, ENA (Europa and Northern Africa) and SEAP (South East Asia Pacific), but still, scoring way below the total average of 40%. It is like playing the lottery, where not even the every second ticket wins.

The project managers and sales persons, who had the most projects in the projects of this study (table 9), were analyzed as well (table 10). Although yet again the total fill up percentage stays significantly low in general, there are differences between the project managers, with A and H scoring the double percentages compared to E and C in technical scope definition (intuitively the root reason for the problems concerning the execution of the project). In addition, the difference in total percentages between sales and project manager is not significant. This remark is noticeable, since within the discussions it was many times indicated that in the sales phase the documentation is not sufficient.

The order specification is instructed (Appendix 8) to be the 'must' document, which should contain the valid and updated information through the whole execution of the project. It is on the shared responsibility of sales person and project manager. Still somehow, at least in the light of these fill up percentages it seems to be overlooked and the path on going through multiple times the technical details from quotations, contracts, deviation lists and technical descriptions is chosen.

## 6 CONCLUSIONS

One of the main issues suggested by this study is also verbalized aloud, as stated in one of the discussions: “It takes roughly 10 years in order to achieve a fully integrated organization working in uniformity (Quality manager, Outotec 2017c)”. The case organization is still, in the scope of this study amongst a huge change process, therefore the more crucial it is, that the processes are continuously improved and the atmosphere (culture) supports these improvement individuals (catalysts) and healthy teams (doers).

The selected data consisted of 42 projects. In order to assure the validity of the data the sampling should be expanded to cover at least all the market areas and to ensure the coverage on the subject.

The work in progress should be limited or more resources allocated to the upstream part of the equipment deliveries. What is the approved/targeted throughput time for quotations, handovers and so on? The Little’s law should *always* be noted. There are *two variables* in the equation.

This research’s findings suggest also that **there is a lack of management** present in the organization. The numerous different legacy tools and overlapping work procedures and methods indicate this. The case organization consists of extremely clever experts, but as discussed earlier, if the mindset is set to target true synergism and collaboration, management (in addition to leadership), is needed, in setting the pace and direction. Another truly important aspect of **management** is also the fact, that a manager must straighten mistakes or misbehaves along the way, in order that the team achieves the target goal. This research **emphasizes the importance of authentic management**, in a way that managing is also actions not just fine wording.

There have been good and working practices in the product line in the time before acquisition, and some of those have been maintained as legacy practices. From the viewpoint of this research, it seems that neither the legacy way of

working nor the way of global processes is sufficient in ensuring the transfer of the knowledge intact in the upstream of the whole process.

Perhaps a brand new approach would be in place. If this is to be considered, the change of the word-based documents should be assessed as well. Excel-based document's main strength is the more structured appearance and the possibility to create followed documents for use.

However, at least the control and following of the use on central documentation is strongly suggested. In addition, what might be needed in the organization is a pinch of ability for envisioning. Agreed, it is not an easy task to possess (the author can vouch for that!), but the blurring of sight at the edges of "own play mat" is most restricted approach to the common good. Therefore, instead having the (sometimes maybe too inflated) appreciation of only towards one's own work the mindset should be in striving to see the whole chain of events leading up to the common target; to get equipment delivered on time, on cost with the requested quality, to make more money under the line.

From **small streaks** forms big rivers, the task is not without hard labor and strong integrity, but for sure, it is rewarding both economically and psychologically.

Adoption from Mr. Frederic Laloux (2013, p. 232) tightens the message and purpose of this thesis: *"If we focus on **quality of the daily actions and decisions, profits will follow**".*

## 7 SUMMARY

The case organization delivers equipment project based and quite often *comprises multi-locations and many stakeholders*. It has a unique history with versatile acquisitions and culture clashes and some varied integrating efforts throughout times.

This research aimed to study an upstream phase of the equipment delivery process and its central documentation. After the process research 42 delivery projects were chosen and from those 37 projects were selected to the study of the ‘order specification’ –document. The main conclusion from the research was that **neither the use of legacy documents nor the documents instructed by global official processes, by themselves, in their current usage methods, are sufficient in ensuring the intact knowledge transfer**. Although from the selected research data it was possible to have some statistics, the expanded research in the delivery projects is suggested.

From the viewpoint of the author of this work, the intuitively toughest challenge in the way forward is definitely: *“How to change the attitude of persons from the resistance into the real can-do/will-do perspective, in order to achieve the culture of continuous improvement?”* Without anybody evolving into cynicism.

The world itself never sleeps or halts. The success in catching the biggest fish does not matter; it is about does the organization learn how to fish. As written by Mr. Aram Rasa Taghavi (2017), the transformation in the attitude follows loosely the transformation of this old saying:

*‘Give a man a fish and you feed him for a day, but teach him to fish and you feed him for a lifetime’*



*“Teach a man the value and motivation behind personal development and knowledge acquisition, so that he will love learning to best understand fishing from every technological angle.”*

In addition to all the above this study has been striving (or at least has tried) to **keep in mind also the old saying:**

*“If it ain’t broke, don’t fix it.”*

*-Unknown*



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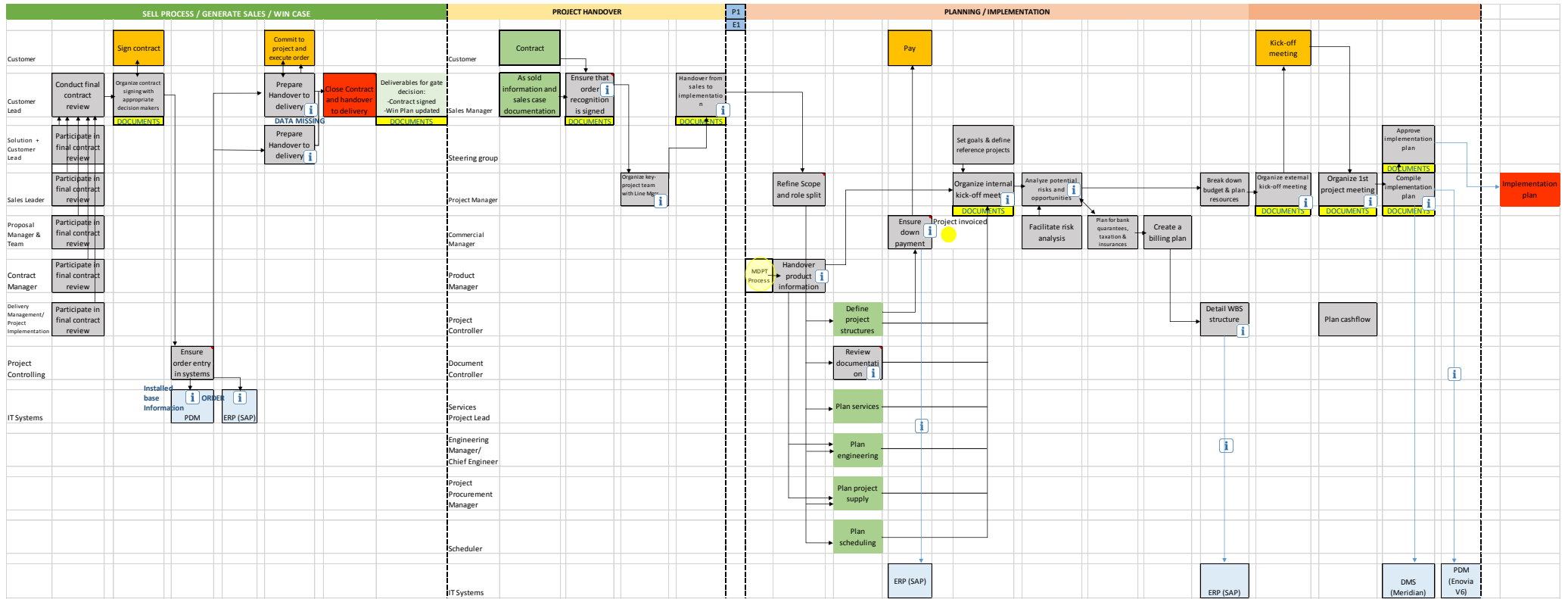
## **APPENDICES**

- APPENDIX 1. Detailed information on the amounts of variables in the study
- APPENDIX 2. Process flow chart
- APPENDIX 3. Project research data (coded)
- APPENDIX 4. Template identification portion
- APPENDIX 5. Changed handover protocol template
- APPENDIX 6. The time spans in the research data
- APPENDIX 7. Quality indication document snapshot
- APPENDIX 8. Instructions for order specification document



# APPENDIX 2.

# Process flow chart







APPENDIX 4.            Template identification portion

Project ID: TEMPLA- TES	Plant Code: ZZZ01	Plant Unit Code: ZZ01	Document Type: ABB11	Running No: 00001	Revision: 1	Sheet of Sheets: 81 (85)
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APPENDIX 5.

Changed handover protocol template

Supplier quotations		
Open issues with customers, e.g. from technical or commercial discussions		<b>ORIGINAL</b>
Preliminary Project Supply Plan incl.: - Preliminary Procurement Plan - Preliminary Logistics Plan		
Risk Assessment		
Lessons learned information from previous projects		
Sharing information of - Cross and up sell opportunities - Change/claim risks or opportunities - Additional service offering or additional sales opportunities - Specific contractual stipulations		
Tax Planning, Calculation and HR Planning form (not mandatory for all cases)		
As-sold structure in format of: - Equipment list (document) OR - Products with Sales Item information OR - Configuration in PDM (only for agreed cases and products)		
Customer and local requirements (standards, statutory requirements, diagrams, drawings)		
Product Line Specific Handover documents (such TDS = Thickener Design Sheet, FDS = Flotation Design Sheet, RDS = Reactor Design Sheet, Order Spec.)		<b>Order specification</b>
Technical specifications (for Proprietary Equipment) and possible changes to proprietary equipment		
Internal Technical Specifications (for Proprietary Equipment)		
Meeting Minutes from the Handover Meeting		

Supplier quotations	Y	<b>CHANGED</b>
Open issues with customers, e.g. from technical or commercial discussions	Y	<b>CHANGED</b>
Preliminary Project Supply Plan incl.: - Preliminary Procurement Plan - Preliminary Logistics Plan	Y	
Risk Assessment	Y	
Sharing information of - Cross and up sell opportunities - Change/claim risks or opportunities - Additional service offering or additional sales opportunities - Specific contractual stipulations	Y	
Tax Planning, Calculation and HR Planning form (not mandatory for all cases)	N/A	
As-sold structure in format of: - Equipment list (document) OR - Products with Sales Item information OR - Configuration in PDM (only for agreed cases and products)	Y	
Customer and local requirements (standards, statutory requirements, diagrams, drawings)	Y	
Product Line Specific Handover documents (such as TDS, RDS, FDS, Order Spec.)	Y	
Technical specifications (for Proprietary Equipment) and possible changes to proprietary equipment	Y	
Internal Technical Specifications (for Proprietary Equipment)	Y	
Meeting Minutes from the Handover Meeting	Y	

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TEMPLATES	ZZZ01	ZZ01	ABB11	00001	1	4 (5)
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APPENDIX 6. The time spans in the research document

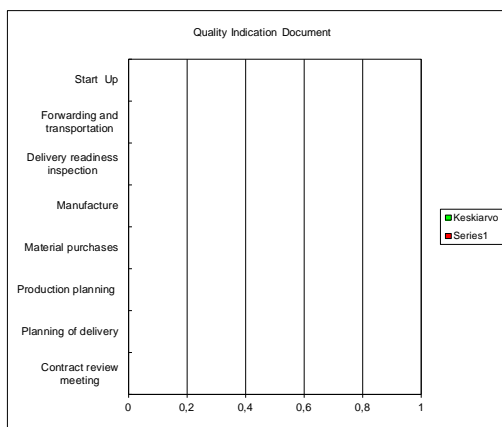
Project	Contract	Order recognition	LOI	Handover	Int. Kickoff	Ext. Kick off	Project	The time difference between LOI and contract	The time difference between contract and order recognition	The time difference between order recognition and sales to project handover	The time difference between contract and sales to project handover	The time difference between sales to project handover and internal kick off
13	20.12.2013	14.1.2014	24.9.2013	30.9.2013	3.10.2013		13	-87	25	-106	-81	3
37x	6.2.2015	11.2.2015			16.2.2015		37x		5			
41	30.9.2015	22.10.2015			9.11.2015		41		22			
14	25.11.2015	18.12.2015		9.12.2015	29.12.2015		14		23	-9	14	20
15	22.12.2015	23.12.2015			7.1.2016		15		1			
1	17.8.2016	19.8.2016		19.8.2016	30.8.2016		1		2	0	2	11
2		24.11.2016	15.11.2016		29.11.2016		2				0	
3	14.12.2016	21.12.2016		18.12.2016	5.1.2017		3		7	-3	4	18
16	20.3.2017	30.3.2017		2.1.2017	7.4.2017		16		10	-87	-77	95
17	20.9.2013	11.10.2013		30.9.2013	3.10.2013		17		21	-11	10	3
28	2.10.2013	9.12.2013		15.10.2013	15.10.2013		28		68	-55	13	0
38	15.5.2015	15.5.2015					38		0			0
18	5.8.2015	29.1.2015			17.7.2015		18		-188			
39	26.6.2015	3.7.2015		2.7.2015	10.7.2015		39		7	-1	6	8
19	12.1.2016	28.1.2016		25.1.2016	21.1.2016		19		16	-3	13	-4
20	17.2.2016	22.2.2016			25.2.2016		20		5			
21	22.2.2016	8.3.2016		4.3.2016	9.3.2016		21		15	-4	11	5
4	2.5.2016				6.5.2016		4			0		
37	18.8.2016	19.8.2016			22.8.2016		37		1			
22	29.12.2016			18.1.2017	18.1.2017		22				20	0
29	10.10.2013	19.11.2013		14.11.2013	15.11.2013		29		40	-5	35	1
30	20.5.2014	6.5.2014		22.5.2014	27.5.2014		30		-14	16	2	5
31	5.8.2014	6.8.2014	23.6.2014	18.7.2014	22.7.2014		31	-43	1	-19	-18	4
32	4.12.2014	19.12.2014			19.12.2014		32		15			
33	7.5.2015	12.5.2015		12.5.2015	27.5.2015		33		5	0	5	15
23	20.8.2015	8.10.2015			18.9.2015		23		49			
34	19.6.2014	19.6.2014			24.6.2014		34		0			
24	26.9.2014	7.10.2014		7.10.2014	14.10.2014		24		11	0	11	7
40	29.12.2016	5.1.2017		9.1.2017			40		7	4	11	
5	27.10.2016	31.10.2016		3.10.2016	10.10.2016		5		4	-28	-24	7
25	19.12.2014	19.12.2014	17.12.2014		8.1.2015		25	-2	0			
6					15.12.2016		6	0	0	0	0	
35	23.12.2011	3.4.2012			11.1.2012		35		102			
36	26.3.2015				20.4.2015		36			0		
26	30.6.2015				1.7.2015		26			0		
7	9.9.2016				7.10.2016		7			0		
27	29.12.2014	15.9.2014			26.11.2014		27		-105			
8	23.1.2017				20.2.2017		8			0		
9	24.7.2017	31.7.2017					9		7			0
10	8.9.2017		13.6.2017		16.8.2017		10	-87		0		
11	13.9.2017			18.9.2017	25.9.2017		11				5	7
12	20.7.2017	21.7.2017		21.7.2017	28.7.2017		12		1	0	1	7
							Average	-44	5	-12	-2	10 DAYS
							Median	-43	7	0	5	5 DAYS

APPENDIX 7. Quality indication document snapshot

QUALITY INDICATION DOCUMENT ( QID )		BN.2.1.2.13E
Customer: xxx		
Filter Type: Proto		
Serial No. to cell C5:	9999	
Work No.: Bvvfd, xxxx		
REPLY: Yes = 1, No = 0		
<b>5. ORDER / FORECAST</b>		
1 Quotation analyses / delivery capability checked		Project Man.
2 Forecast order (included in the 6 month list 6 months before the order)		Project Man.
3 Order in accordance with annual budget		Project Man.
	0	
<b>6. ORDER SPECIFICATION MEETING date:</b>		
<b>Estimator</b>		
1 Are representatives from necessary departments at present?	1	Project Man.
2 Has the order been confirmed?	0	Project Man.
3 Was the Order Information package pre-filled and distributed three days after receipt of order?	0	Project Man.
4 Was the Order Specification and project main schedule distributed three days prior to the meeting?	1	Order spec. meeting
5 Was the order specification meeting held within 10 days from order?	0	Order spec. meeting
6 Is the scope of supply specified?	1	Project Man.
7 Do necessary initial data of sold equipment exist (filter, spares, auxiliary equipment)?	1	Project Man.
8 Does the Preliminary Project Plan exist (main schedule, prel. budget )	1	Order spec. meeting
9 Has mech. eng., automation, production and service prepared prel. project plans?	1	Project Man.
10 Have (mec) deviations from a "standard product" been technically defined?	1	Project Man./Mech.Enc
11 Have (aut) deviations from a "standard product" been technically defined?	0	Project Man./Aut.Enc
12 Is the planned delivery time 3, 4 or 6 months or longer?	0	Project Man.
13 Was the sales commission calculation prepared?	0	Project Man.
14 Were the invoicing instructions sufficient and clear?	1	AV
15 Are the customer documentation requirements and schedule specified	1	Order spec. meeting
	9	
Why = 0		
If any answer with 0, please mention the question n:o and the reason:		
<b>5. ORDER / FORECAST:</b>		
<b>6. ORDER SPECIFICATION MEETING</b>		

QUALITY INDICATION DOCUMENT ( QID )

Customer: 0  
 Filter type: 0  
 Serial No.: 0  
 Order date: 0  
 Delivery date: 0



ANSWER: Yes = 1, No = 0

5. Order / Forecast order	
1 Quotation analysis / delivery capability check made	
2 Forecast order (order month and the previous month)	
3 Budgeted order	
	0

8. Planning of delivery	
1 Order confirmation to customer on time	0
2 Dimensional dwg (mech) to customer on time, date	
3 Dimensional dwg(automation) to customer on time, date	
4 Descriptions of standard parts (technical, PV, hydraulics) on time, week	
5 Was technical description received on time? (week)	
6 How correct was the technical description(1 version=5 points, 2 version=4 points etc)	
7 No last minute changes by customer during delivery time	
8 Constructions of std. parts and dwgs ready on time, date	
9 Constructions and dwgs per customer ready on time, date	
10 Constructions and dwgs of automation ready on time, date	
11 Was info on deviations of electric, autom std received on time?	
12 Automation(program) ready before testing	
13 Were automation components received on time?	
14 Spares, auxiliary equip. to feed system on time	
15 Was the planned info on measures/weights/packages received on time?	
16 Were there clear shipping instructions?	
17 Were the shipping instructions received on time?	
18 Was the advance info on packages, measures, weights correct?	
	0

9. Production planning	

## APPENDIX 8. Instructions for order specification document

### Instruction for the order specification form

#### Order specification form

Order specification form is the most important internal document related to project summarizing content and scope of the project. Form **MUST** contain the valid and reliable information during the whole project. Order specification form is also memo of the hand-over and order specification meetings. The open issues recognized in the meetings should be recorded in the form.

Technical definitions are not anymore included in the order specification form itself. There is always only one order specification form, which lists only equipments, auxiliaries and spare parts to be delivered and link to separate technical specifications. Technical details of each filter are defined in separate technical specifications (quotation technical specifications), which are essential part of the order specification and **MUST** be updated before the hand-over meeting to include all the latest changes in sales phase. Technical specifications **MUST** include all the relevant technical information, which is basis for the engineering and production. Technical specification should be named TEC999\_v0.doc, in which 999 is equipment's serial number and 0 version number of the document.

#### Responsibilities

Order specification form is one of the documents transferred from sales process to delivery process. **Sales person** is responsible for filling in the order specification form and updating technical specifications with all the valid information. Fields under sales person's responsibility are marked with black. Project manager will update red fields later. Information must be in line with the contract and other documentation agreed with the customer.

Project manager and Sales person review the order specification form and technical specifications in hand-over meeting. After that **project manager** is responsible for updating the form and technical specifications. After each change project manager **MUST** update and save the form and/or technical specifications as a new version and inform project members about the change.

#### General about the form

Order specification template can be found from Intranet's instructions with keyword 'order specification'. Form is MS Word form with pre-defined fields. Form is protected from any format changes. If you have any need to add rows in tables, you can first remove protection, add lines and add protection again. Protection can be removed and added by selecting review->Protect document->Restrict formatting and editing. Please do not make any other format changes in the form.

Most of the fields have status bar help. When you click the field, you can see the help in the status bar.

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