CHALMERS

# Successful Implementation of a Quality Control Program

- How to develop and implement a quality control program

Master of Science Thesis in Quality and Operations Management

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## Abstract

The increasing competition in the global market among manufacturers and producers has led companies to identify competitive advantages and in the last decades the emphasis has been focused on continuous improvement of quality which has become essential for the success of any business organization at present and in the future.

On behalf of one Engineering to Order Company from Europe this thesis was initiated to investigate how to increase the quality of their product by developing and implementing a new Quality Control Program. The purpose of the thesis is to identify what content is crucial in the quality control program and which elements are important for a successful implementation and to achieve higher quality. Furthermore, one potential outcome was to plan and to create training material for the implementation.

The theoretical framework reviewed in this thesis covers the impact of a quality control program in an Engineering to order company, the general content in a program and how to implement one. The results from the contextual data, which was gathered through surveys, interviews and brainstorming sessions, implied that there were five categories of concern. The categories were: need assessment, resources, knowledge and performance, communication and responsibility.

During the analysis of the five categories it was shown that the technical content of the Quality Control Program was not of that high importance but the responsibilities and how they were assigned were. It was also shown that during the implementation it was crucial for the employees to have the right resources and knowledge and have the right support along the whole process. Furthermore, it was also shown that how to communicate the program is a developing process that should be adopted in the whole organization over time.

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## Abbreviations and Descriptions

| | |
|---|---|
| EHS | Environment, Health and Safety |
| ETO | Engineering-to-order |
| GM | General Management |
| KPI | Key Performance Indicators |
| NCR | Non-Conformance Reports |
| TA | Technical Assistant |
| TQM | Total Quality Management |
| QA | Quality Assurance |
| QC | Quality Control |
| QI | Quality Improvement |
| QIF | Quality Implementation Framework |
| QIT | Quality Implementation Tool |
| QCP | Quality Control Program |
| QM | Quality Management |
| QMS | Quality Management System |
| QP | Quality Planning |

# 1. Introduction

*This chapter describes the background of the area of quality control (QC) and the constant need for quality development. The purpose of the thesis is to investigate how to implement a (QCP) and why the implementation of such a programme sometimes can be problematic. The chapter also describes the objective, to understand what content that is important in the QCP to increase quality awareness, followed by the research questions. The chapter ends with the scope of the thesis.*

## 1.1 Research Background

*"The importance of improving competitiveness in main elements of quality management, e.g. continuous improvement, team working, benchmarking, "voice of the customer", etc., is widely accepted. What is more controversial is the concrete framework in which implementation of these concepts is attempted."*

- R.P. Dickenson & D.R. Campbell, 1999, pp 67

The common knowledge about quality impact on businesses is well known all over the world and has its history from Japan as early as the 1950s (Lengnick-Hall 1996). Statistical methods were developed and used to identify and eliminate variations in order to reduce costs (Thomas 1989). In numerous articles and different literature the importance of quality is emphasized (e.g. Bhat 2002, Hoyle 2007, Nanda 2005, Thomas 1989 etc.) The increasing competition in the global market among manufacturers and producers of goods and services has led companies to identify competitive advantages and in the last decades the emphasis has been focused on quality (Van Cuylenburg 1991). Therefore, continuous improvement of quality has become essential for the success of any business organization at present and in the future (Shridhara, 2002).

To most business organizations, quality is a cornerstone of their business strategy. Achieving superior quality of products/services is considered a must in order to capture market shares and to stay profitable (Lengnick-Hall 1996). Producing superior product/service quality in a business takes long-term dedication and is a time consuming process of changing the culture of the organization (Osaywe & McAndrew, 2005). Quality awareness is of high priority in organizations that it has to be considered in every department and process. Quality is these days are considered to be an integrated part of all activities in the organization (Bergman & Klefsjö 2004).

During the last couple of decades the term quality has evolved and the meaning has changed from just taking the specific product quality into consideration to include an overall picture of the culture within an organization (Lengnick-Hall 1996). In 1951 Joseph M. Juran wrote the book *Quality Control Handbook*, which is considered to be the bible for quality management. Juran was referring to Quality Management and the urge to focus the entire organization on customer needs and not only on the statistical data to achieve product quality (Osaywe & McAndrew, 2005).

This thesis uses the definition of quality from ISO 9000:2000: “the degree to which a set of inherent characteristics fulfills the requirements, i.e. needs or expectations that are stated, generally implied or obligatory” (ISO Central Secretariat, 2009).

In the late 1980’s, Quality Management has been described as a management philosophy rather than a set of tools to achieve high quality. The philosophy, often referred to as, *Total Quality Management* (TQM) (Dean & Bowen, 1994) was popularized during second half of the 1980s but many of its elements, as mentioned above, took shape during the 1950s and 1970s (Martinez-Lorente et al. 1998).

Using quality management (QM) as a framework to improve a company’s competitiveness has become very popular and the positive effects on the organizations is proven to be substantial. Quality management today is a big subject around the world (e.g. Blackburn & Rosen 1993, Nanda 2005, Martinez-Lorente et al. 1998, Osayawe & McAndrew 2005, Van Cuylenburg 1991) and some claim that it crucial for a company’s survival (Van Cuylenburg 1991).

Changing the culture of a global company into more QM focused is not always easy. In fact, Kotter & Schlesinger (2008, p.130), write “*it must be considered that there is nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle, than to initiate a new order of things*”.

Different models, to implement change in organizations, have been developed over the years. The different structure of these models depends on the kind of changes applied and in which areas. John Kotter & Leonard A. Schlesinger presented in the article “Choosing Strategies for Change” (2008) helpful tools to choose between these different models such as: m*anaging change through participation* or how to dealing with resistance. These models intend to help organizations understand and adapt to changes, but still many authors claim that organizations’ attempts to manage change initiatives often fall short (e.g. Miller, 2002; Higgs & Rowland, 2005; Keller & Aiken, 2009).

Before implementing a new Quality Control Program (QCP) it is important to understand the underlying facts and background of the organization. This is to ensure the QCP has the right focus and is implemented in appropriate way for a long term positive effect on the overall quality in the company. This thesis will highlight and investigate how to do this background check and its importance for effective implementation of a QCP.

### 1.1.2 Background of the Case Company Characteristics

The scope of this thesis is within a large Engineering-To-Order (ETO) construction company in Europe. The particular company, which will be called "Alpha" in the rest of the thesis, faces a need to increase awareness of quality throughout the whole organization.

#### 1.1.2.1 Alphas product characteristics

The company delivers a core product that was invented over 100 years ago. This products has since then been used in multiple different applications and industries all over the world. It is often used as a part of a bigger system where the company today are able to manage and deliver the whole system as one product.

The market for this kind of product is mature and there are not any major technical competitive innovations taking place is the field. The product life-cycle is fairly long, up to 30-50 years. The customer requirements and demands on the products reliability quality and safety are therefor really high, also because it is a vast investment of the customer. Since it is an ETO-product the costumer can set their own standards and demands depending on the application of the product, which means that the product is 100% customized to each and every costumer. This also means that that there is a development process for each product that is sold to fulfill the requirements of each customer (Asprova, 2013).

These products are usually quite big and can have several different configurations. Depending on if the company is responsible for just the product, the full completion of the product or if there is a consortium (Joint-venture) project the organization behind each product can look really different. Furthermore, this also means that there has to be a constant interaction between costumer and manager in charge of the operation, on-site and from the main office since each product takes usually several years to deliver.

#### 1.1.2.1 Alphas problem background

Key Performance Indicators (KPI) has been used by Alpha since several year back. KPIs are data that that organizations used to define, measure, monitor, and track its performance over time toward the stated goals of the organization (Pollock, 2007). One of these KPI's is the number of non-conformance reports (NCR). A NCR is a report issued when a product, process or procedure does not comply with the set standards for the particular, process or procedure that was under inspection (Chambers & Associates Pty Ltd, 2013). Since a couple of years at Alpha, the general opinion has been that the number of NCR filed during projects is too high, see figure 1 & 2.

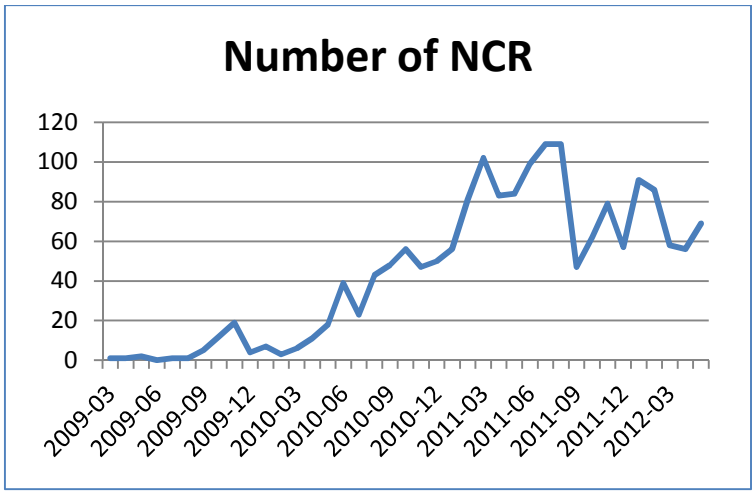


*Figure 1 NCR statistic from Alpha 2013, average number of NCR per construction site*

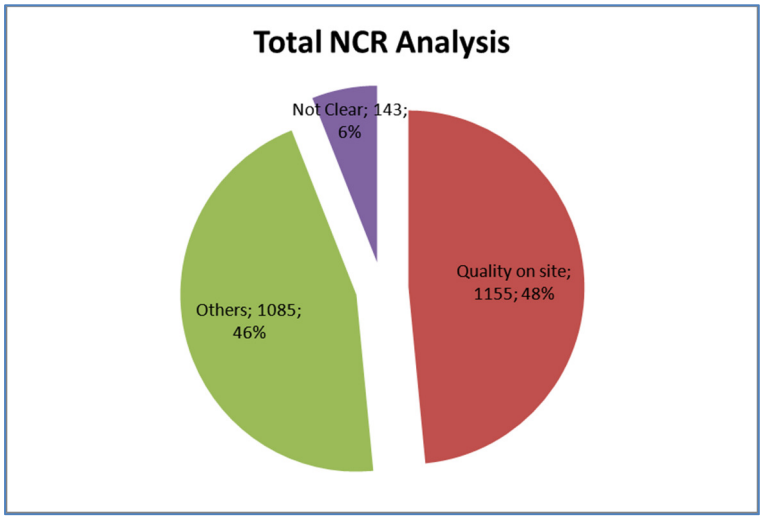


*Figure 2 The NCR distribution at Alpha 2013*

Figure 2 shows that of all number of NCR 2013 reported, 48% of these where due to quality at site. There was also an external thesis, provided by Kenexa which did a profound survey in the industry, which provided information that engagement in the aspects of quality was poor. Therefor the initiative to implement a new quality control program (QCP) was raised.

## 1.2 Purpose

The purpose of the thesis is to investigate the various contents of a QCP and identify the critical elements that support the implementation of a QCP in an ETO company. The outcome of this thesis will be used when creating training materials for Alpha's new QCP and to plan the implementation.

## 1.3 Research questions

*From the purpose two research questions were developed. These questions were used as guidelines for the research.*

**Research Question 1:** What are the content of a Quality Control Program in an Engineering-to-Order company?

When developing a QCP the content of the program is crucial in order to know what to communicate to the user. The content can be what routines are supposed to be used, if there are any standards or certifications to comply or specific actions which is crucial to perform. Are there any content in the program that is more important than any other and is there anything that is needed specifically for an ETO company?

**Research Question 2:** What are the elements that support the implementation of a Quality Control Program?

During an implementation, no matter if it is a new syllabus, a new syllabus at university, a new payment process in a store or a new QCP in a ETO company there are some new routines and processes that need to be communicated to the user. The question is what elements during the implementation of these new programs are important to ensure to achieve the desired results. Examples of elements can be the context of the material of the new program, the setting of the implementation or how the training is performed. Are there any of the elements that are more important to the implementation success?

## 1.4 Delimitations

When introducing the concept of quality, aspects that will not be taken under consideration are the dimensions of a service. The thesis does not cover implementation methods of TQM or QMS which uses similar techniques. The thesis will not consider any other quality initiative than the QCP. Neither will it cover the scientific area of Change Management. The thesis is limited to investigate the quality from Engineering to Construction processes and will not cover sales, marketing, higher management levels or financial aspects.

The final training program will not be presented or evaluated since this is a product for Alpha only. Some information and exact data, such as KPIs, are confidential and could because of that not be presented in the thesis.

# 2. Methodology

*This chapter describes the chosen strategy and design for the research. How the data was collected and analyzed in order to answer the research questions. Also, it contains a short description of the need of the research and why Alpha was initiated the thesis to make the research more anchored to reality. Furthermore, a discussion concerning the ethical concerns and trustworthiness aspects of the thesis will be found in the end of this chapter.*

## 2.1 Research strategy

The purpose of this thesis is to investigate how to implementation of a QCP and to find the crucial elements to reach out to the entire organization at Alpha for a successful implementation. To be able to describe which elements influence the results of the implementation a qualitative case study was chosen as a research strategy since it is easier to produce an overview of what elements has an influence while still working with the content of the results (Alfoldi & Sinkovics 2011).

A rather common view on research would follow a linear model from task 1 to the end, task 6 (Bryman & Bell 2011), as the big arrow to the left in figure 3 shows. The method used in this thesis however follows the same structure but uses iteration and constant comparison between theory and data which is called a progressive approach (Alfoldi & Sinkovics 2011). The aim is theory development or refinement (abduction) rather than rejecting or confirming one theory (Van de Ven 2007).

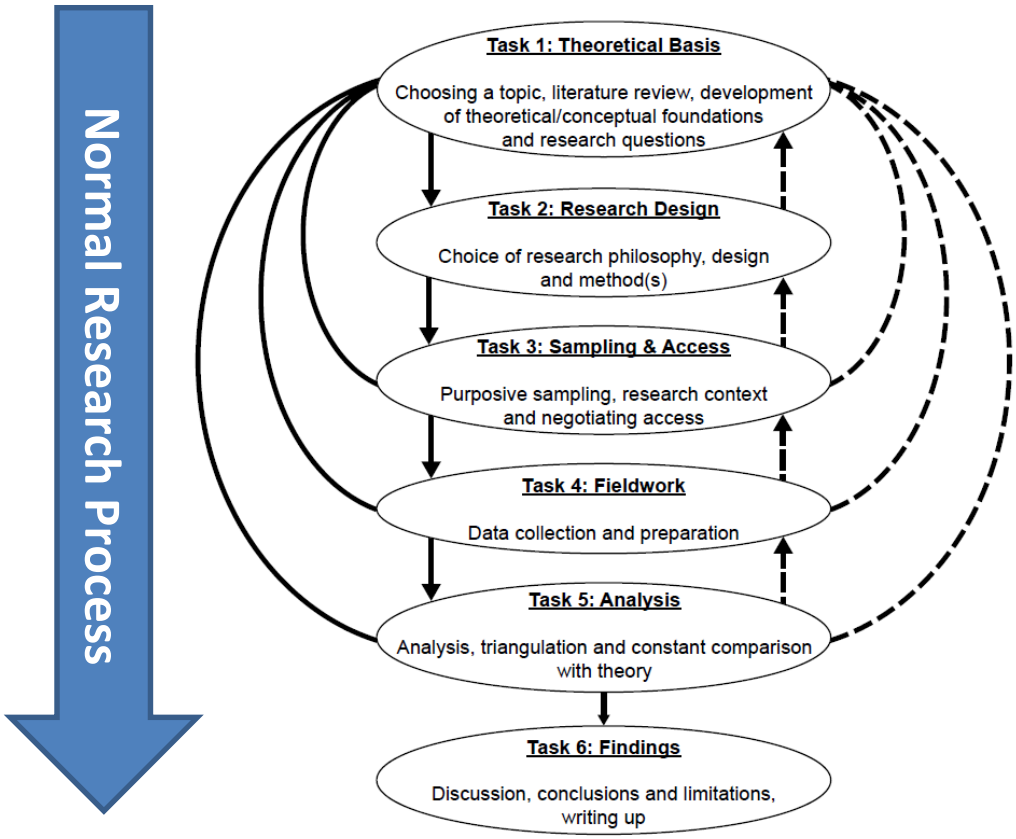


*Figure 3 Alfoldi & Sinkovics 2011 pp. 825*

## 2.2 Research design

The research design provides a framework and guideline the researcher how to the collect and analyze the data throughout the thesis (Bryman & Bell 2011). Since this thesis will deal with a lot of qualitative data a case study would be a preferable research approach. According to Bill Gillham (2010) case studies is preferable when collecting much qualitative input.

Compared to other research designs case studies focuses on a specific situation, process or system (Yin 1994). Since this particular thesis is focused on the quality control process and aimed to produce guidelines of how to implement a new control program a case study is found to be most suitable.

Eisenhardt (1989) describes that case studies are powerful to use when building theories on collected data, observations and previous literature. That is why a case study was founded most suitable since the purpose is to build a theory of how to implement a QCP build on the case study.

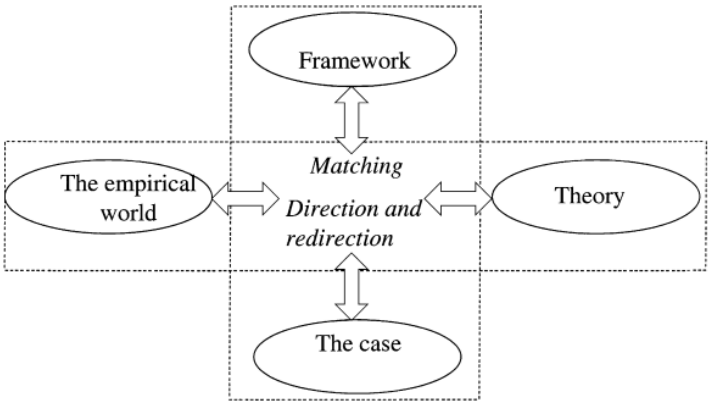


*Figure 4 Dubois & Gadde 2002, pp. 555*

In contrary to other case studies, which is static and linear, this thesis will be using a systematic combining approach. This is a non-linear process where the researchers combine different methods, such as theory, empirical observation, analytical framework etc., to match theory and reality to build a central conceptual model, see figure 4 (Dubois & Gadde 2002).

Figure 5 visualize how the research design will be incorporated in the research strategy in this thesis. As can be seen, it follows the progressive approach together with the systematic combination research design.

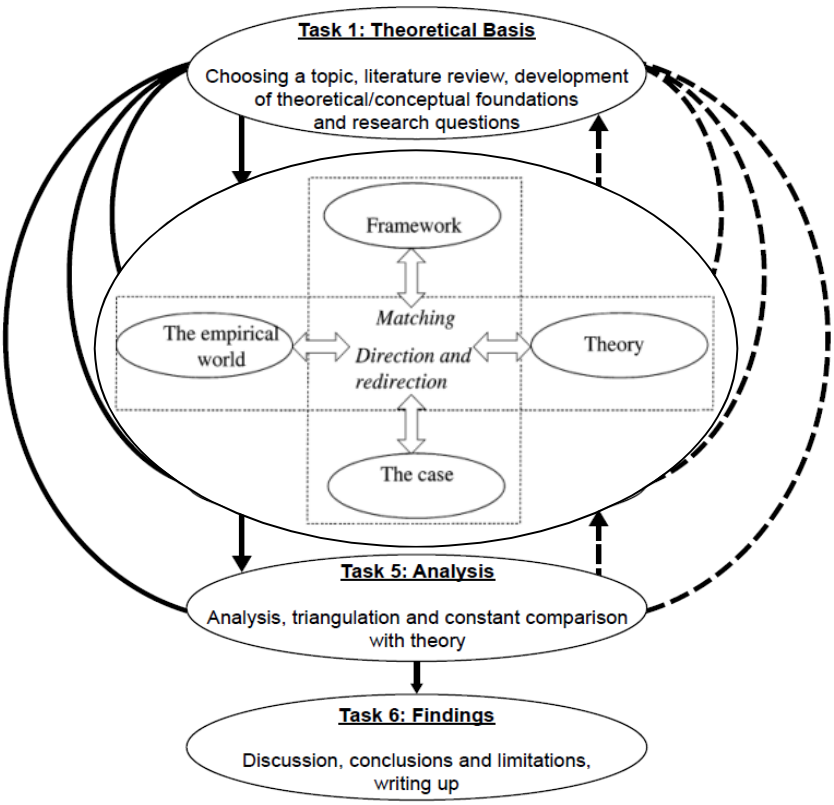


*Figure 5 A combination of Dubois & Gadde 2002 & Alfoldi & Sinkovics 2011*

Furthermore, this case study was conducted on an engineering-to-order (ETO) manufacturer, Alpha, as mentioned before, that represents the typical characteristics of an ETO company. The assumption was that the findings and conclusions could be applied on similar ETO companies even though the conclusions were based on the settings of the particular company (Asprova, 2013).

There has been a lot of studies and research concerning related topics like TQM, QMS, change management and implementation of TQM. However, this thesis will focus on how to implement a QCP and the more practical aspects. This thesis is qualitative in nature and delivered a better understanding of how to implement a new QCP into a global organization. Bryman & Bell (2011) call this kind of research inductive research, when the theory is the main outcome.

### 2.2.1 Need Assessment

The initial discussions started at Alpha where the need for increased quality was a stated fact. They had recognized by several surveys, project results and report that the lack of quality was severe (specific data will be presented in this thesis). This initiated a project to introduce and implement a new QCP. A lot of statistics showed that there was too much money spent on re-works and too many NCR were raised in general (figure 1 & 2), which was the warning signal that something had to be done. The global quality manager got the task to improve the awareness of quality. Which is the scope if this thesis. It is crucial when starting a case thesis to have a well-defined focus to collect the right data otherwise there is a risk of collecting a big amount of data that has no impact in the thesis. During this phase the purpose of the thesis was defined and the overall time frame. Most of the information was provided by the requesting ETO-company as well as resources to conduct to the case thesis. This is also when the

research questions is taking shape, even though they will be reshaped along the way (Bill Gillham 2010).

The reason why Alpha wants to start the initiative to increase the quality at QCP is because of the perception of quality (figure 6). As the figure describes QC as a part of a QMS the opinion is to start the initiative at a smaller scale and evaluate the impact. The evaluation will provide enough information of how to proceed. Whether a bigger initiative is needed or of the improvement of the QCP is enough to achieve the desired quality level.

*Figure 6 Alphas perception of quality*

## 2.3 Required data

Different kind of data is needed depending on which of the research questions that are being answered. In traditional case studies multiple methods of data collection are used and the connection between quantitative and qualitative data is usually revealed when the different data is analyzed together (Eisenhardt, 1989). To answer the research questions a traditional literature study is the main research method used in the thesis. There is also a substantial amount of previous studies conducted in the field of quality that also concerns background of the research questions. Furthermore to create the training material customized to Alphas need, a deeper study of the company current situation is conducted. Through surveys, interviews, discussions and data collection in Alpha's database a wide range of qualitative and quantitative data is collected to support the research.

### 2.3.1 Literature studies

When conducting the literature study some keywords have been used in combination and single-handed such as: "quality", "implementation", "training", "program", "change" and "TQM". The library databases, called "Chans", of Chalmers University of Technology and Alpha's database of KPI's, work instructions and project reports was the major source of literature such as e-journals, online-books, article but books and handouts from Chalmers was also of profound value for information in the subject. References from articles that were used were of great help to find even more relevant literature for the subject.

### 2.3.2 Surveys

Surveys have a number of benefits. They are flexible, can deal with a wide range of data types, and once the survey tool has been produced and piloted, it can provide large quantities of data from a variety of settings (Krosnick 1999). On the other hand they also bring up some concerns since the population might not have been big enough. Also if the sampling is not done randomly the results might give a bias picture of the population (Tanur 1994).

In some researches it is crucial to provide figures that can work as milestones in order to improve the situation. Surveys are a typical quantitative research method that often

consists of questions with multiple-choice answers. This approach is a way to collect a vast amount of data from a large number of participants. The analysis is fairly easy to interpret thanks to the specific results, which will give be represented in percentages of the divided results (strongly agree, agree, disagree or strongly disagree). It can also be perceived as inflexible since it does not leave room for any comments (Moser and Kalton, 1971). In this thesis that has been covered by leaving a comment field by each questions. This information was valuable to get deeper knowledge of specific questions. The data from internal surveys has been the information of most value to this thesis. The survey was created in collaboration with the quality team at the office and covered subjects connected to the purpose of the thesis. Both open and closed questions were asked. It was distributed through the emails to the site manager at the constructions sites and printed were the participants were conducting the survey by hand. The participants were all employees that were involved in the QC process, e.g. site manager, site quality manager, construction workers etc. The surveys were then collected, scanned and send by email to the main office for interpretation and analysis. The response rate was fairly high, about 95%, since it was conducted and administrated by the managers at site and the office. The survey was a part of the employee's compulsory tasks which explain the high response rate.

Other survey was also conducted at Alpha, both on-site and off-site, and some surveys were performed by Alpha in the past were the results was found in alphas internal database. This data was mostly used as background information and motivated the quality team to perform the research in the particular field.

### 2.3.3 Key Performance Indicators

Alpha has since many years been collecting Key Performance Indicators (KPI) from their projects. Alpha uses KPIs to evaluate its projects over time and to evaluate the performance of a particular activity. The vast amount of data was categorized, sorted and analyzed. This data was mainly discrete

### 2.3.3 Interviews

A great deal of knowledge and information was gathered using interviews. Interviews are a suitable method for collection of data since much of the know-how and professional expertise are inside the minds of the employees and not always documented (Crabtree & DiCicco-Bloom, 2006 & Bryman & Bell, 2011). The interviews were conducted at internally at Alpha, mostly unstructured and open questions such as: "What is your opinion of the quality on Alpha today?" During the unstructured interviews, the interviewers do not follow a strict structure of questions, but instead have only one or a few questions for the interviewee, making the interview more like a conversation and the interviewer responding to points that seems worthy of following up. The interviews never lasted more than one hour, were the interviewee took notes and directly afterwards transcribed to a document. In total four different employees at Alpha were interviewed, which was considered to be sufficient since the interviewees were deeply involved in the QC process since a long time. There were also follow up interviews conducted to ask further questions. One with the Vice President of Quality, three interviews with the Global Head of Quality, two phone interviews with two different Site Quality Manager (SQM) and two interviews with site personnel.

## 2.5 Data analysis

Rather has coding been helpful to break down the data into components and which also the key process is in grounded theory (Bryman & Bell, 2011). The collected data was summarized into a framework of information, figure 5, supporting the research questions. Then coded and categorized to give a good overview. Through brainstorming, together with the concerned quality experts at the global quality department at Alpha, the most important elements were chosen to focus on. This was performed in a non-structural way where the elements were chosen by the head of the department. The employees where randomly divided into groups where each group had one element to first discuss the background and possible root causes. Lastly, each group had to come up with some ideas to present to the rest of the employees of how to handle the particular element and how that could help to increase the quality.

When the first theoretical and empirical data was summarized a common estimation of how the design the training was decided. Since the key concept, the case study, of this thesis will be incorporated systematic combining approach the training material for the new QCP will be created in parallel as the empirical data will be analyzed. The training material will then be used to address the most important problems that the data from the different analyzing methods will reveal. Which parts the training material should focus on to address to the receiver the most important effects of a new QCP. This will be an iterative process between analyzed data, theory and designing the training material and will finally generate theories and training material for Alpha.

Throughout this process there will be a constant comparison of data in order to see patterns so that concepts can emerge (Bryman & Bell, 2011). These emerged concepts are then given names which is easier for member of Alpha's quality organization to relate to. The more one of these concepts occur in the research the higher of importance to bring it up in the training material. Since a category can contain more than one concept it is consider being a higher level. These concepts are then compared to find factors and areas with high potential of improvement. These findings also need to be compared and evaluated to the theory from the previous written literature. In collaboration with the quality managers these categories where then determined prioritized. The outcome of this analysis will then form the framework of improvement ideas and work as the base to build the training material up on.

## 2.4 Research Ethics Consideration

According to Bryman & Bell (2011) there are four ethical key elements to take under consideration while collection data for a thesis: harm to participants, lack of informed consent, invasion of privacy and deception. Each of these elements is equally important to consider during the research but to begin with, the researchers ensured protection of the participant's privacy and the conducted data.

Maintaining anonymity in a small-scale project is essential in not causing harm to participants and non-participants. Secondly, the researchers explained and clarified to each of the participants individually, and concerned parties, the purpose and objectives of it as well as the way the data will be processed and used before everyone

accepted to participate, to fulfill the informed consent. None of the activities performed invaded participants privacy. All information asked was not related to participants' personal lives. Thus, given all these consideration, when results were presented, there was no deception or surprise of any unexpected conclusion.

It is easy to guarantee that there was no physical harm to the participants during this thesis. However, that they participant did not suffer from any psychological harm is harder to guarantee. Since the some questions during the interviews could have been interpreted to be too personal or that the interviewee felt accused or singled-out. During the surveys, some questions could also have led to some frustration which has to be counted as psychological harm. Furthermore, no of the discussions were never concerning the individuals but the processes and functions in the quality control process and how it could influence the quality.

All the participants were informed about the research topic before asked to participate in any survey or interview. Information such as background, potential outcome, how anonymity was maintained and how the data was going to be used was always presented prior any research activity. This were done in beforehand in order to make it possible for the participant to ask questions if there were any kind of uncertainty. It is important to mention that all interviews were encouraged from higher management which means that there is no clear knowledge if the participant really participated by free will. However, all interviews and surveys were always arranged without management involvement which made it easier for the participant to ask questions or raise any concerns.

None of the recorded questions were on any personal nature. If they were in any personal level, it was not recorded and the question was asked to keep the discussions in the unstructured interview going. In many of the interviews it was the interviewee that decided in which the direction the interview was going to address their opinion of where to focus the research. To ensure the privacy of the participant all the data was kept generic and confidential.

As been mentioned before, there was always a short presentation of the topic, background and reason for the research before conducting any of activities. This was also performed in order to clarify that the research is not use in any purpose than the one the participant agreed on participating in.

## 2.5 Trustworthiness & Research Quality Concerns

All research has to be examined with a critical eye and be judge to ensure the quality of the thesis. Trustworthiness is usually the term used while conducting a qualitative thesis. According to Bryman & Bell (2011), trustworthiness has four key elements: Credibility, Transferability, Dependability and Confirmability. When conducting surveys and cross-sectional research it is important to consider the aspects of reliability, reliability and validity as well (Bryman & Bell 2011, Ghauri et. al 2008).

### 2.5.1 Credibility – *How believable are the findings?*

With credibility means how well the results corresponds to reality. Does the finding actually reflect the reality? This was something that was repeatedly discussed by the manager in charge of the project, if the results from the surveys were reasonable even

though they might come as a surprise (Alfoldi & Sinkovics 2011). Or if some findings during interviews might be different than the general opinion the overall results was credible. Many of the measures were also used to triangulate the other results from external sources to guarantee that the results were true (Krefting 1990).

### 2.5.2 Transferability – *Do the findings apply in other contexts?*

With transferability means if the findings and results could be useful in other context, if the results are generic enough to be transferred and used in other studies. The external survey is a good example that could be used in many other contexts (Krefting 1990). The survey and interviews conducted in this thesis are probably too specific for Alpha to be transferred but the finalized training material and concept is aimed to be general enough to be used in any ETO company (Ghauri et. al 2008).

### 2.5.3 Dependability – *Are the findings likely to apply at other times?*

With dependability means that if the same kind of research was conducted the results would be the same and not differ too much from the original results. The documentation is crucial in the outcome where the concepts should be able to audit the conducted work. Since the theory is going to be derived from data that was systematically gathered and analyzed through the whole research process in a detailed timeline it will be easy for the involved parts to follow the progress of the thesis and raise their concerns if necessary (e.g. Alfoldi & Sinkovics 2011, Bryman & Bell 2011, Krefting 1990).

### 2.5.4 Confirmability – *Has the investigator allowed his/her values to intrude to a high degree?*

With confirmability means that the researcher should not let personal values affect the results or findings by directing the research a long a specific path. This is a struggle for every researcher since it is very hard to be completely objective. There is also a risk to be affected by the participants during interviews (Ghauri et. al 2008, Alfoldi & Sinkovics 2011). Some people are more compelling than other even though they might not have a better understanding of the actual problem. Along the way of the thesis the findings were discussed with many of the people involved and it was clear that the findings were not contradicting. This was an ongoing process that was performed at several occasions (Krefting 1990).

### 2.5.5 Validity

Since this thesis used a combination of qualitative and quantitative research it is important to take all the quality issues into account. The different aspect can in many aspects be connected or perceived as similar but there as some distinction differences especially when both qualitative and quantitative research has been used in the same thesis (Yin 1994).

The measurable validity was one thing that could have been questionable. This on the other hand is very important information since the aim of training program was to clarify and distinguish the importance of the new QCP. This was good leads on where to focus some of the training material but could have been clearer if a different scale would have been used in the survey (Alfoldi & Sinkovics 2011). The external validity could with reasonable doubts be fulfilled in an external environment because the generic nature of the thesis. Furthermore is Alpha active in a big business with several

big competitors and the aim is that the training material and concept is applicable at all levels at the company (Krefting 1990).

Concerning the internal validity the research was performed in such way with a lot of involvement from different actors which ensured the internal validity but one concern that should be mentioned is that the research was built around knowledge and skills (Tanur 1994). Furthermore, during interviews and surveys there is always a risk that the respondents will complete the questionnaires in a in a relatively automatic compliance because of lack of engagement and energy (Krosnick 1999).

# 3. Theoretical framework

*This chapter will handle the theory which will help to understand the problem area. A general description of quality, quality management system (QMS) and quality control (QC) is presented, followed by different principles of implementation and how to plan an effective implementation. Last in the chapter the importance of evaluation and feedback is highlighted and how to perform it.*

## 3.1 Quality

Quality has been defined by the International Organization for Standardization as:

"The degree to which a set of inherent characteristics fulfills the requirements, i.e. needs or expectations that are stated, generally implied or obligatory"

(ISO Central Secretariat, 2009)

However, there are more than one view and definition of quality. Edward Deming defined quality as: "Quality should be aimed at the needs of the costumer, present and future" while Joseph Juran, another proponent of quality, defined quality as: "Fitness for use" (Bergman & Klefsjö 2004).

Since this thesis is based on an ETO construction company the relevant quality dimensions are related to a product. According to Garvin (1988) there are eight dimensions in product quality. Garvin's dimensions do neither consider the safety of the product nor the user and does not consider the environmental impact it might cause. These are very important dimensions for Alpha, and have been highlighted by the society the last couple of decades. This is why Bergman & Klefsjö (2004) dimensions are more applicable to consider in this thesis. These dimensions are:

1. **Performance** - the primary operating characteristics of the product
2. **Reliability** – the frequency with which the product fails
3. **Durability** – the lifetime of the product
4. **Maintainability** – how hard or easy it is to detect & fix a problem
5. **Environmental impact** – how the product effect the environment in the aspects of emissions, recyclability and construction
6. **Appearance** – a design parameter such as color etc.
7. **Flawless** – that the product does not have any deficiencies by the time of delivery
8. **Safety** – that the product does not cause any damage or harm to person or property and that it offers enough protection against such risks

Organizations need to address these dimensions of quality in order to stay ahead of competition. They also need to understand the potential trade-offs between the different dimensions desired, depending on the costumer. By consciously adjust the different dimensions and take advantage of the potential trade-offs it can help to increase the competitive advantage even more (Garvin 1988).

A specific study show that competitive advantage gained through product quality is substantial, especially if the company is unable to compete with lower prices (Stajano, 2006).

### 3.1.1 Quality effects on Cost

Each feature of a component or product has a maximum allowable deviation or tolerance level that can be determined. It is important to estimate and record the deviation since if the deviation exceeds the tolerance level a decision to take action is necessary. Depending if there is a need of correction or not it can lead to big expenses. By identifying the deviations of particular components it can be used to justify expenditure when applying quality improvement (Taguchi 1989).

Quality costs are made up of two different sides; *the losses due to poor quality and the cost to achieve high quality*, see figure 6. There is often one act of balancing, to ensure that one of the components do not cost more than it is worth to control the other. As one example, let consider the cost of rework versus the cost of controlling products for mistakes. By performing controls on the products right away, the risk of rework will decrease but the controls costs as well. What is the perfect balance? Performing more controls will cost more than the cost of rework at one point. Or at that point where more controls will not identify more defects. That is the balanced point which can be very hard to find. These two components, *the losses due to poor quality and the cost to achieve high quality,* depend on each other (Haworth 1990).

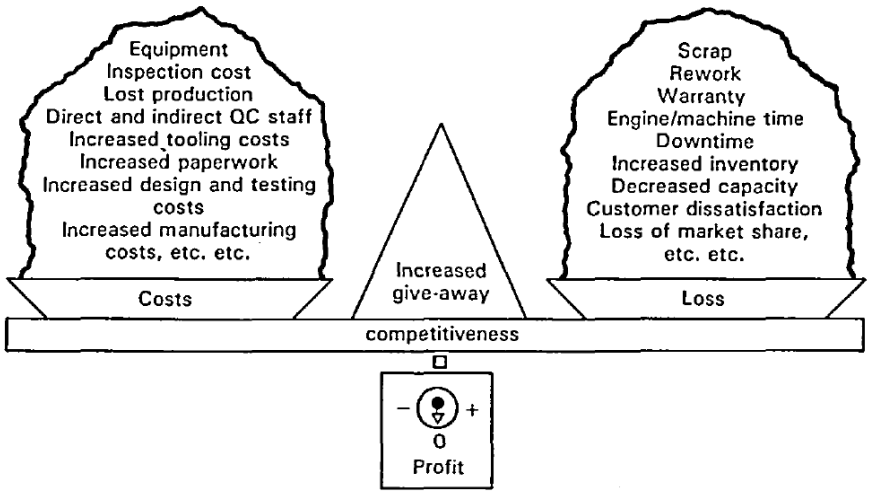


*Figure 7 Haworth 1990 pp 22.*

Taguchi stated (1989) that loss is created as soon as a product or component deviates from the ideal value. The loss increases rapidly the further the deviation has been stretched from its tolerance limit and the longer in time it is proceeds.

## The incremental increase of cost of Quality in Construction Projects

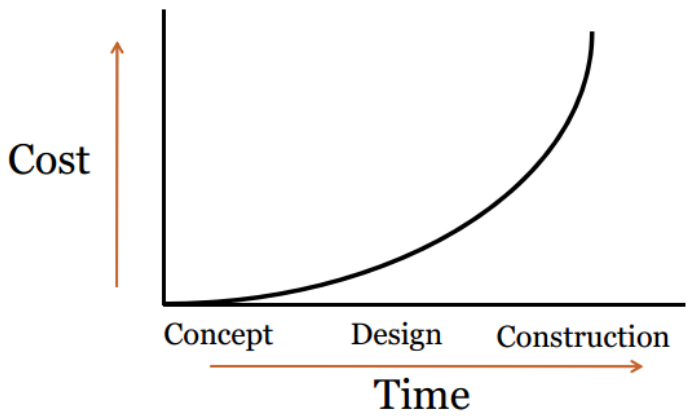


*Figure 8 Taguchi Deviation Loss-Time function (1989) pp. 44*

Figure 7 shows the increase cost of quality in relation to the time it takes to complete an ETO project (Oulawan, 2013). The more time that passes the more expensive to make changes due to poor quality. This is why it is crucial to consider quality in an early stage of the project.

Further research and statistics shows that quality issues have a big impact on the economy and final costs of projects. This also effect the competiveness

- Out of a quality and productivity standpoint, labor are accountable for 30% of project costs (Picard, 2003)
- Labor mismanagement and construction delays were found to contribute to 40-60% non-productive time for on-site work (Xueliang, 2007)
- Re-work contributes up to 12% of the total project costs and up to 11% of total project working hours (Meshksar 2012)

### 3.1.2 Quality effects on Safety

Construction defects due to poor quality management can be costly as well as the risks for severe injuries and even death. One example is in Paris, France 2004 when some sections of Terminal 2E collapsed at the Charles de Gaulle Airport in France, which led to four deaths and several severe injuries. It was the lack of quality and interest of safety precautions which lead to the events of construction defects and finally compromised the structure (Torres 2004).

If a robust quality control program would have been applied during the construction the shortcomings of the construction and design might have been identified. This would have spared lives and money. That is two advantages why safety professionals and quality management should strive to maintain a high standard of quality in construction and ETO-projects (Andrews et al 2012).

Statistics shows that construction fatalities account for 22% of the U.S. total, while employing only 7% of the workforce. In comparison, manufacturing employs 15-21% and accounts for only 11% of fatalities (BLS, 2003). This shows why quality and safety is that important to consider in an ETO construction company. Below are more statistics that supports that statement:

- Workers compensation premiums cost contractors anywhere from 1.5% to 6.9% of total project costs (Agarwal & Everett, 1997)
- A construction company operating on a 3% profit margin would need to increase sales by $333,000 to pay for a $10,000 injury, such as amputation of a finger (Construction Chart Book, 2002)
- Indirect costs associated with worker medical injuries were estimated up to 20.3 times greater than direct costs (Hinze & Applegate, 1991)

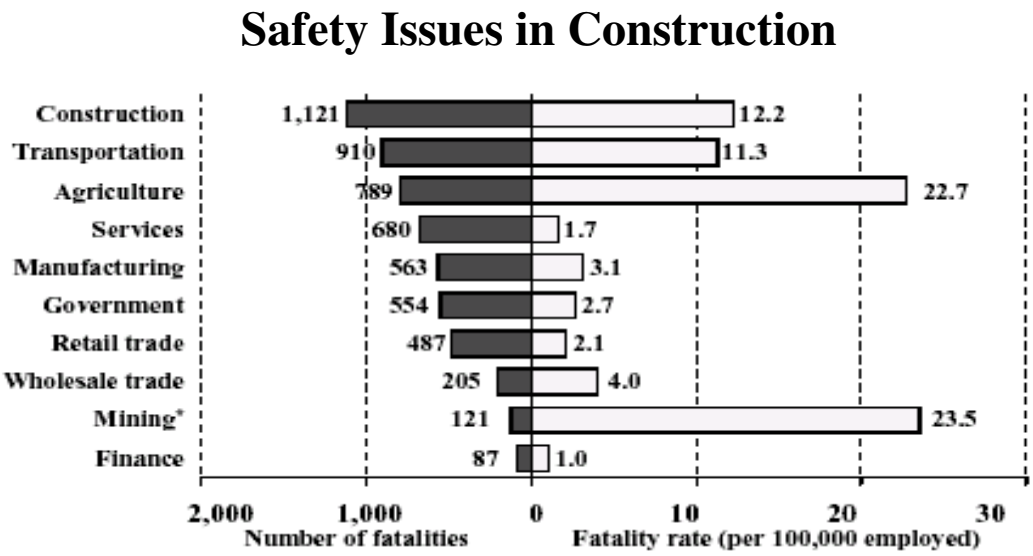


*Figure 9 Hoonakker & Loushine (2003) pp. 60*

## 3.2 Quality Management System (QMS)

The following statement by Andrews's et al (2012 pp.39) can be viewed as an incentive to all organizations why QMS should be considered and implemented:

*"Better-managed construction companies with robust safety and quality management programs also are more likely to deliver projects on schedule and on budget*."

QMS incorporates quality planning and provides a framework for managing the activities that enable the company to finish projects which consistently satisfy the customer requirements and construction regulation (Andrews et al 2012).

The definition of QMS according to ISO 9000:2000 is:

*"A quality (management) system consists of the organizational structure, procedures, processes, and resources needed to implement quality management"*

The QMS works as a foundation to support the continuous improvement throughout the whole organization. It is important that every department, such as Economical, Environmental Health & Safety, Sales etc., support the QMS for successful adoption of QMS (Brassart 2013).

The QMS commitment includes several tasks, such as addressing quality standards and governmental requirements and to ensure that each department fulfills these requirements. The QMS also support and push the organization to meet applicable quality assurance (QA) requirements stipulated by government, sub-contractors and costumers. All changes applied to the QMS are reviewed, evaluated and approved by the General Management (GM) (Andrews et al 2012).

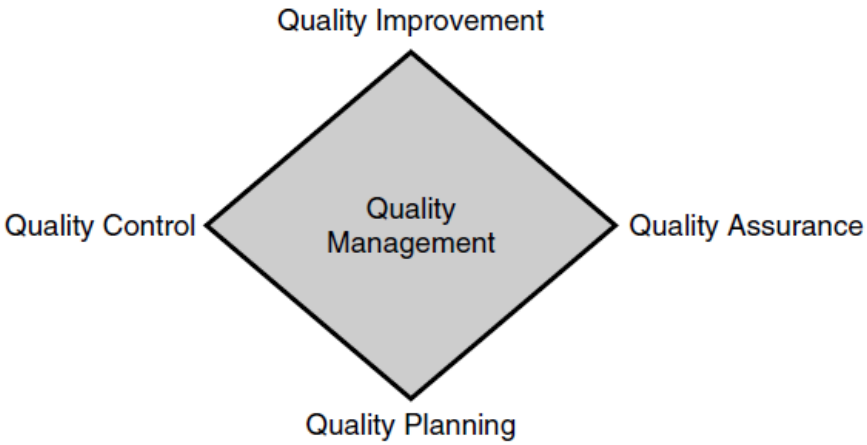


*Figure 10 Nanda's model of Quality Management System (2005, pp. 8)*

Nanda's model of QMS, figure 9, connects four specific elements, Quality Improvement (QI), Quality Assurance (QA), Quality Planning (QP) and Quality Control (QP), which are the cornerstone to achieve quality (Nanda 2005).

To understand the whole picture these four elements will be briefly investigated but since the purpose of the thesis is to implement a new QCP the major part will be focused on those parts directly connected to QC, as Quality Management (QM) and how to plan a QC.

### 3.2.1 Quality Improvement (QI)

The definition of quality improvement states that it is the actions taken throughout the organization in order to increase the added benefits to both the organization and the customers. In other word: any kind of activity that affects the quality performance in a positive direction (Bergman & Klefsjö, 2004).

The constant strive to enhanced quality is important to develop the company and its products or services. The element itself contains different tools and methods to achieve this goal. One famous method is Deming's Plan Do Check Act cycle (PDCA) which provides a framework for an effective quality improvement process (Nanda, 2005).

- Plan - The change or improvement
- Do – The Implementation of the change or improvement
- Check - Verify that the change/improvement meets the requirements
- Act - Deploy the change/improvement, modify and evaluate the change, or decide not to implement it

Tools that are useful in quality improvement initiatives are for example: Tally Sheets, Pareto Diagrams, Scatter Diagrams and Flow Charts. There are more tools such as Statistical process control (SPC) programs which can help to identify the areas to be improved by analyzing previous collected data, like KPI's and other similar data that has been collected over the years in the organization (Hart, 1992).

### 3.2.2 Quality Assurance (QA)

The definition of quality assurance (QA) stated by American Society for Quality (2013):

*"All the planned and systematic activities implemented within the quality system that can be demonstrated to provide confidence that a product or service will fulfill requirements for quality"*

There are two major parties that are interested in QA: the management and the customers. Both want to ensure that the prerequisites and requirements will be met and QA has a direct impact on the level of confidence whether it is going to be met or not. By demonstrating that the organization has the right resources and plans on how to handle different obstacles, e.g. remain within the timeframe, in the process, the organization can assure that quality requirements are met. Typical things to demonstrate to provide confidence of high quality are (Nanda, 2005):

- Plans exist for how the achievement of quality requirements should be met
- The necessary methods exist to specify how requirements for quality are to be achieved, such as procedures, work instructions and checklists, etc.
- Methods necessary to achieve quality requirements are available and well deployed in the organization, such as internal or external audits.
- Demonstrations of resources, i.e. that the company have adequate resources and knowledge to meet the requirements for quality, e.g. reviewing previous quality records and measurements from older projects.
- Methods exist to correct deviations or discrepancies if they occur, e.g. QC.
- Plans exist to investigate and evaluate quality-related risks continuously
- Methods exist to evaluate that all quality requirements have been met and regulation are fulfilled before the handover to the customer.

### 3.2.3 Quality Planning (QP)

The QP is a fundamental element of a QMS and should outline the QC and QA activities that are being implemented (American Society for Quality 2013). It means any kind of activities that are performed to establish quality objectives. No matter if it is short-term or long-term objectives or qualitative or quantitative objectives. Long-term quality objectives are stated by management as a vision or strategy. The QP contains directives on how to achieve long term quality and how to facilitate an organizational environment that supports striving for quality (Nanda, 2005).

The QP includes a schedule and a time frame of the implementation and an outline of the process. It also includes an overview of the resources needed for the implementation process. The QP is an internal document that should be used as a support to ensure that the implementation is going the right direction and fulfills its purpose and is completed in time (American Society for Quality 2013).

A typical plan for QMS contains all elements which are necessary to meet the requirements for quality. Elements that are crucial to plan for are:

- Establish product development and support processes
- Establish control milestones and clear entry and exit strategies for the inter stage between milestones
- Define methods and tools for each activity
- Establish workmanship and activity standards
- Resource management

Planning for process execution according to the QMS entails planning for the application of each activity that are needed in order to reach the requirements to meet the desired quality (Nanda 2004).

### 3.2.4 Quality Control (QC)

The perception of quality control can sometime differentiate, e.g. what QC is and how it is used in an organization, why the definition stated by the American Society for Quality (2013) is used throughout the whole thesis:

*"The planned and systematic activities implemented in a quality system so that quality requirements for a product or service will be fulfilled."*

The QC process is used to ensure that a product or services attain the required level, or higher, of quality. No matter of what product or service the company provides some actions to control the quality is necessary. Mostly the process involves a thorough examination and testing the product or the result of the service. The underlying goal is to ensure that the examined and tested product or service reach the specific requirements. General examples of quality characteristics could be that it is safe, dependable and financially reliable.

Manufacturing companies usually have a dedicated team that is specifically focused on quality. They test randomly selected products. While an ETO-company has to have constantly running QC processes to ensure the project fulfills the requirements. This team constellation looks different in each organization depending on company structure and business area. If a quality defect is identified, it is the QC team or responsibility to engage and make sure that the defect is corrected. Depending on the nature of the defect problem it might not cease entirely after actions have been taken. This might mean that production or construction must stop, which also means that the company will suffer financially. This is why it is crucial for any company to ensure that these problems occur to the smallest possible extent. When problems are fixed it is important to trace the cause of the defect and to document the process to enable everyone else in the organization to learn from the problems (Wisegeek, 2013).

QC can also involve evaluating employees and co-workers and their performances. If the employees do not possess the proper skills or knowledge it might harm the quality and furthermore the company reputation. This is especially bad if the company is in service business where the employees deliver the service to the costumer (Mangino 2001).

QC is often mixed up with Quality Assurance (QA) but there are some fundamental differences. QA examines the process that leads to the final product while QC examines the final product (Wisegeek, 2013).

Mangino (2001, p. 8.4) describes a typical QC system with the following design:

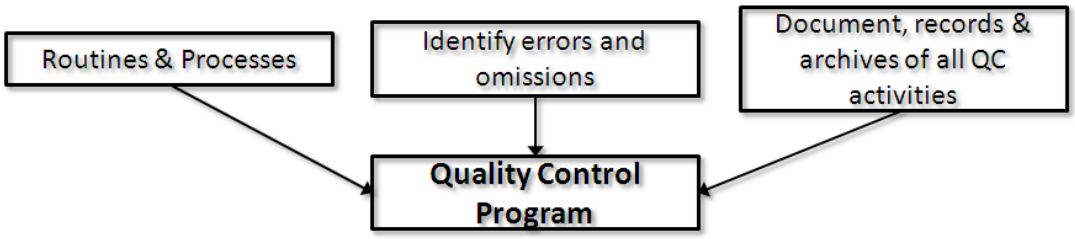


*Figure 11 Mangino's QC framework*

QC activities include general methods such as accuracy checks on data acquisition and calculations and the use of approved standardized procedures for emission calculations, measurements, estimating uncertainties, archiving information and reporting. Higher QC activities include technical reviews of source categories, activity and emission factor data, and methods.

#### 3.2.4.1 Responsibility differences in QCP between managers at site and in the office.

The roles managers at the main office and managers at site play in the QC vary in accordance with the different responsibility. The responsibility and function of the quality team is established and clarified early at the quality planning phase, which are held by the head of quality at main office (Dimitris &. Chorafas, 2013).

In general, a qualified manager at office has responsibility of all quality processes in a QMS as a whole and while the manager at site is more responsible for reviewing the quality control process, and facilitating training activities. (Fanslau & Young 2008).

Due to the different management level, the assigned responsibility would also differ from managers at office and managers at site in case there are quality failures. The QC problems could be avoided early if smooth communication between managers at office and managers at site or quality team members is guaranteed. For instance, the NCR to the engineering specification could be assured at the early stage, such as incoming material rating. To avoid QC problems down the line, QC need to work in close cooperation with all departments in well-organized company. (Dimitris & Chorafas, 2013)

Similar situations could be improved by introducing quality training and competency assessment for their specific job position where they are assigned or employed to do. (Lam Sally, 2011)

## 3.3 Principles of Implementation

*This chapter will show examples of implementation of different Quality Initiatives and describe the major benefits and flaws of the different approach. In the end one condensed implementation logic will be presented that could be used as an implementation framework. As a part of the scope of this thesis, one is to investigate how to effectively implement a new QCP into Alpha. Not to mix up with "Change Management", which is a science of its own with inherent difficulties not to underestimate.*

### 3.3.1 The Nature of Implementation

Implementation means the carrying out, execution, or practice a methodology, plan or design of some kind. Such an implementation is an action plan that is following some kind of order or structure to achieve a certain goal (Rouse 2007). In the context of implementing a new QCP means all those processes and actions that are executed in order to getting a new QCP to work in the desired environment. That includes planning, developing the program, training and supporting the users and finally evaluating the results of the program.

There are two main decisions to consider when implementing a QM. It is around these two general questions that the implementation process is designed (Sousa & Voss 2001). These two questions are:

- *What to do?* – What is the *content* and to what extent of different practices should be used.
- *How to do it?* Which process is going to be used to conduct the implementation of the new QM

The former logical implication was that the organization should adopt and use the whole set of QM practices and tools to the same extent, regardless of the context. Recent research, however, have shown that the influence of the organizational context in practice actually have an impact on the results (Sousa & Voss 2001).

The research suggests that the efficiency of an individual QM practice is depending on the organizational context (Sousa & Voss 2001). Examples of contextual elements are: corporate support for quality, managerial knowledge, external quality requirements and product complexity, organizational uncertainty and manufacturing strategy context (Benson et al., 1991).

There may not be one particular best approach to implementation that suits all organizations but each company may need a tailored implementations program (Van der Akker, 1989). A possible approach is to derive general implementation principles and tailor them to the particular case and apply them together for a successful implementation (Sousa & Voss 2001).

> *"The importance of quality implementation has been well-documented, but achieving quality is a complex and demanding process."*
>
> - Durlak, 2013 p. 11

### 3.3.2 Two Examples of Quality Implementation Methods & Tools

Several different implementation methods and set up of tools to implement different quality programs or management system has been developed over the years. Which method that suits for which application depends on several different factors, such as organization size, available resources, compatibility with the local setting etc. Many of the tools are possible to tailor to the specific task of implementation (Van der Akker, 1989).

#### 3.3.2.1 Quality Implementation Framework (QIF)

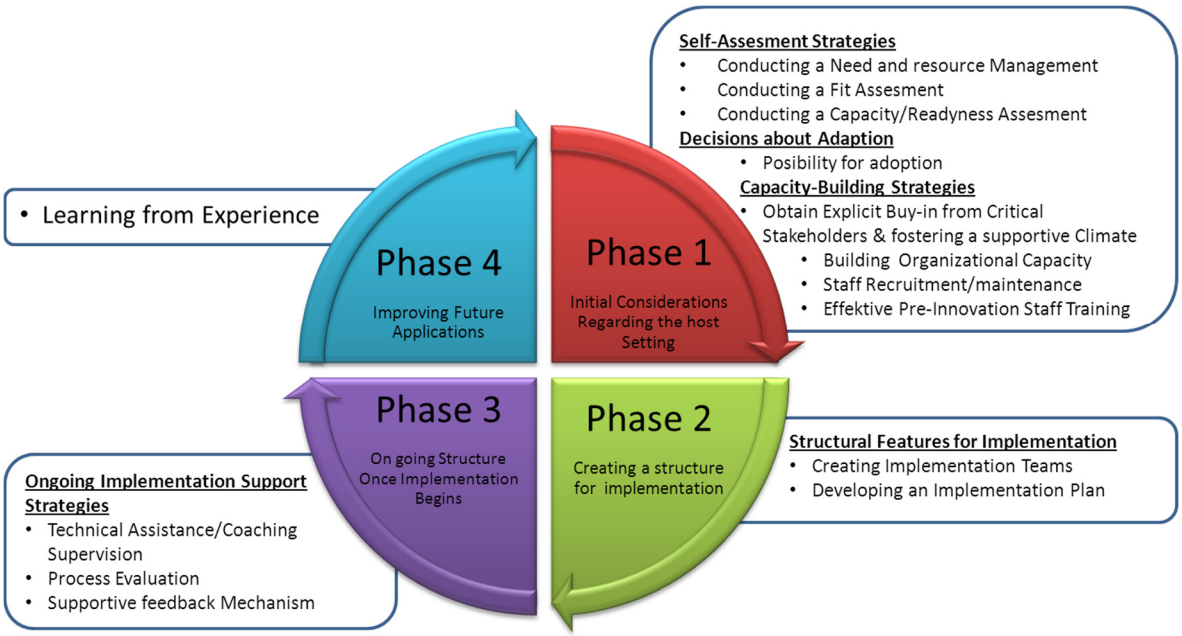


*Figure 12. Implementation Framework, Durlak et al. 2012, p 475*

Durlak et al. (2012) presented a Quality Implementation Framework (QIF), see figure 11, which comprises four phases: Initial Considerations Regarding the Host Setting, Creating a Structure for Implementation, Ongoing Structure Once Implementation Begins, and Improving Future Applications.

The idea of the framework is to support an implementation of a Quality Initiative by following the critical steps of the model. This will support the implementation process

throughout the whole transition phase. This particular method has a practical focus on infrastructure and innovation capabilities (Rogers 2003).

To make the innovations even more user-friendly and increase usability, this QIF suggest creating manuals, guides, worksheets or other tools to facilitate the implementation. Gradually this system may develop more evidence-based strategies to implement new quality initiatives in different context (Durlak et al. 2012).

#### 3.3.2.2 Quality Implementation Tool (QIT)

Chien et al. (2012) presented a Quality Implementation Tool (QIT) which was built upon previous studies done by Meyers et al. 2012. The QIT has six critical steps which contains components of quality implementation that comprise the QIT. Each component has its specific action steps, see figure 12, which in the end will lead to successful implementation. Full QIT tool appendix 10.1.

*Figure 13. Quality Implementation Tool (Chien et al. 2012)*

The QIT is, just as Durlak's QIF, divided into phases but in Chien's case there are three:

1. planning for quality implementation
2. real-time monitoring of implementation
3. evaluating the extent of implemented with quality initiative

The QIT itself is in the format of a worksheet which gathers each action step into groups that relates to the component of quality implementation. Each of these action steps is listed as a row in the worksheet which allows the user to add more detailed information about the specific action step. This makes it easy to add personal information and tailor each step for the future (Chien et al. 2012).

Each row is divided into three columns which correspond to the three phases mentioned earlier. This is because each action step has one distinct purpose in each of the three phases. This means that the QIT worksheet has rows for each action step and three separate columns. Each column includes empty space to write down how the specific action step should be (1) planned, (2) monitored, and (3) evaluated (Chien et al. 2012). The example in figure 14 is only shows the worksheet for the first category in the QIT.

| **1. Develop an implementation team** | **Before implementation, how are you PLANNING for this action step?** | **During implementation, how are you MONITORING progress on this action step?** | **After implementation, how are you EVALUATING how well this action step happened?** |
|---|---|---|---|
| Assign a team leader | | | |
| Recruit team members | | | |
| Assign team members roles, processes, and responsibilities | | | |

*Figure 14 QIT Worksheet*

The QIT is built upon two system groups, one Support System group and one Delivery System group. The members of the support system group should be have the all the necessary knowledge about the implementation science and process evaluation. Their task is to support and guide the implementation. The members of the delivery system are supposed to have the contextual knowledge about the organization, hierarchies and the decision-making model of the setting (Chien et al. 2012).

The final design of the QIT is completed through a collaborated process between the delivery system and support system. This process proceeds throughout all the three phases. During this process several decisions are made, one example of decision can be to exclude one of the action steps.The support system members are supposed to ensure that no action step is neglected and that the decision for each action step is strategic in line with the implementation requirements (Chien et al. 2012).

## 3.4 Planning Implementation of a Quality Control Program

*This chapter will focus on some common general steps to be taken while planning the implementation process and how to prepare the organization prior to an effective implementation of quality control program in terms of process, formulation, monitoring and evaluation.*

All activities during an implementation, such as preparation of material, training, follow-up, feedback and continuous improvement need to be discussed and managed before any actual implementation is considered. A plan that handles the time frame, how to deal with resistance and other issues that might occur during the implementation process should be completed before an implementation is enforced into an organization (Adebanjo 2001).

A typical implementation plan, according to Nanda (2005), has the following structure:

1. Implementation Goal
2. Implementation Team
3. Implementation Climate
4. Implementation Process
5. Implementation Cost
6. Implementation Time Frame

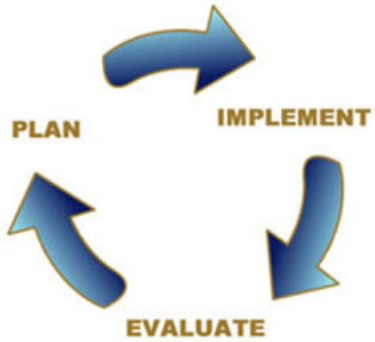

*Figure 15 Plan - Implement - Evaluate cycle*

### 3.4.1 Implementation Goal

No matter what kind of change that is planned in an organization, there has to be a clear goal of what it is trying to be achieved. Having clear, stated and common team goals enhance team performance (Latham & Locke 2006). These goals will also reflect the organizations ambition and work as guidelines during the implementation process. Nanda (2005) recommends the S.M.A.R.T. model (Kovac 2005) when setting a goal for the implementation. S.M.A.R.T. stands for:

- **S**pecific
- **M**easurable
- **A**ttainable
- **R**ealistic
- **T**ime related

The goal should be stated as couple of sentences that entitles the criteria's above. To maximize the chances to achieve the project goal, milestones should be tied to employee objectives as part of the employee performance appraisal process for all employees. This will serve as incentive and will facilitate the achievement of the final goal. Furthermore, if the organization can tie the milestones to a reward system with bonuses, it will work as a concrete incentive for the employees (Nanda 2005).

### 3.4.2 Develop an Implementation Team

One prerequisite that need to be achieved before starting making plans for an implementation is to set up an implementation team. This team is responsible for the whole implementation process and should consist of a cross-functional team with representative from different departments (Nanda 2005).

There is a need for one assigned implementation manager, or management team, to be in charge of the full implementation from beginning to the end. This manager should have prior experience in quality initiatives and preferably implementations as well. A cross-functional supporting team with members from different department to facilitate the implementation of a Quality initiative is a recommendation as well (Nanda 2005).

Employee participation is the extent of which the employees are a part of the actual implementation, maintenance and further improvement of the quality initiative. It is crucial to involve the employees in an early stage since they are the one that are using the program when it is implemented and executes the processes. They will also be the first one to will be able to provide feedback of the program (Nutt 1986). Employee participating will also help to reduce the resistance to change and make personal barriers less problematic (Nutt 1986).

### 3.4.3 Foster a Supportive Climate for the Implementation

The implementation process is a social process by its nature which is intertwined with its context where the implementation takes place. The context includes all the environmental characteristics in which the implementation occurs. It is important that the environment has a supportive climate to ensure a successful implementation (Davidoff 2008). There are several different elements that are important to consider increasing a supportive climate (Chien 2012). The major elements are:

- Communicate the need and benefit of the implementation within the organization
- Establish routines that reduces the resistance to change
- Create policies that support shared decision-making and effective communication
- Ensure that the program has adequate administrative and management support

#### 3.4.3.1 Communicate the need and benefit

If there are any doubts that the implementation of the quality initiative will bring any benefits to the organization or if any of the stakeholders doubts there is a need for the new initiative it is unlikely that the efforts will be successful (Fixen et al. 2005). That's why it is important to communicate the need and benefits with the implementation. Preferably with concrete examples to constitute a solid base why the implementation is important to the organization (Greenhalgh et al. 2004; Hall and Hord 2010). The need and benefit of an implementation is also preferred to be done repeatable times to really be perceived as constitutional. This can be addressed during the introduction, during the training and advantageously throughout the whole implementation process (Rogers 2003).

#### 3.4.3.2 Establish routines that reduces the resistance to implementation

The resistance to change can be addressed throughout the whole implementation process why it is important to establish routines early in the process that reduces the resistance (Lehman et al. 2002). One example of how to decrease the resistance is to have the particular negative stakeholders be involved in the process and give them the sense of ownership of the implementation (Hall and Hord 2010, Lehman et al. 2002). Additional efforts to decrease the resistance are recommended and will increase the likelihood that the implementation is successful. Using the input from the end-user which will have the first feedback on the implementation will shed a light on what should be improved first and will make the end-user feel involved and thereby minimize the resistance to the implementation (Hall and Hord 2010).

#### 3.4.3.3 Create policies that support shared decision-making and effective communication

Damschroder et al. (2009) found that formal communication was characterized by open feedback, collaboration and clear communication of purpose and goals contributed to successful implementation. Standards, routines and policies are a way to formalize such practices in an organization. By using similar procedures as feedback or reviews is used to enhance the implementation process shared decision-making between stakeholders can be used to facilitate effective communication (Durlak and DuPre 2008; Fixsen et al. 2005; Greenhalgh et al. 2004 Stith et al. 2006).

#### 3.4.3.4 Ensure that the program has adequate administrative and management support

The implementation of a quality initiative can enhance its chances for a positive outcome by engaging the organization and right decision-makers and involve the executive authorities. (Durlak and DuPre 2008, Fixsen et al. 2005, Greenhalgh et al. 2004). Insufficient administrative support can have devastated consequences and can lead to severe damages on many levels in the organization. However, by establish proper support functions, facilitate an administrative structure and ensuring that adequate resources are present these unfortunate events can be prevented (Fixsen et al. 2005).

#### 3.4.3.5 Top Management Commitment

Research has shown that poor top management commitment and engagement can lead to failure in as many as 80% of organizations when initiating a change process (Jaehn 2000). The lack of quality management knowledge, frequent change of management and lack of communication are reasons for low commitment to quality management programs (e.g. Mosadeghrad 2005, Soltani & Gharneh 2005, Psychogios & Priporas 2007. If top management commits to the proposed quality initiative it provides credibility and assures it will be a continuous program. This will also reflect on the participants and committed leadership has shown to produce positive synergy effects on quality management programs (Sosik & Dionne 1997).

### 3.4.4 Strategy and Process – How to Implement?

During this part of the planning phase the intention is to decide which strategy to use during the implementation. What tasks that needs to be planned and assigned to which function of the implementation team. By making lists of these tasks the implementation team will have the opportunity to get an overview of the project and

will make it easier to apply the tasks to a timeframe and start delegating the tasks to different work groups (Chien 2012). The monitoring and documentation of the different tasks throughout the implementation will later serve as the foundation of the process evaluation (Rapp et al. 2010). The Monitoring, assignment of tasks, and documentation are also crucial tasks to ensure that the implementation is heading in the right direction (Durlak and DuPre 2008, Fixsen et al. 2005, Greenhalgh et al.)

### 3.4.5 Implementation Cost & Timeframe

A specific timeframe should be considered for each and every task and action during the implementation and these timeframes should be connected to the overall timeline of the project and the desired result. This will also make it easier to make a reliable estimation of the implementation cost (Durlak and DuPre 2008, Fixsen et al. 2005, Greenhalgh et al. 2004). Nanda (2005) stated some specific factors that influence the timeframe of an implementation project:

- **Implementation prerequisites** – How well is the organization prepared for an implementation project? If the prerequisites are not met the timeframe of the project will be substantially longer. Or if the organization cannot meet the prerequisites the project might end up failing before it even started.
- **Scope of the Quality Initiative and size of the organization** – The scope determines the number of functional areas that are involved of the implementation and in the end how extensive the implementation will be and therefore also the timeframe.
- **Current state of the system** – How far is the organization from the established goal, how big is the gap the implementation project needs to cover?

Cost varies depending on the organization. Since Alpha is a global ETO company with projects all over the world the expenses for a global implementation can easily end up very high. As a result of the uncertainty of the expenses it is hard to estimate the final cost of the implement. However, by identifying the different factors influencing the implementation and plan accordingly to the following factors it is easier to make an estimation of the final cost (Durlak and DuPre 2008).

- **Personnel costs** – This is a significant factor of costs when hiring, internal or external, experienced personnel to handle the implementation. Time for each task is also relevant to make a reliable estimation of the cost.
- **Tool and equipment costs** – Such as software, implementation documentation system, presentation material, posters, folders etc.
- **Training costs** – Budget for the number of employees to be trained, number of training courses required and if he course need to be conducted periodically.
- **Travel costs** – For the trainer to multiple sites to conduct the training
- **Employee recognition rewards** – A budget for incentives for employees to reach milestones and quality achievements.

(Nanda 2005)

To describe the implementation of TQM as a process Gunasekaran (1999) developed a conceptual model, figure 16. This model describes the process of implementation and is useful since it describes the content and where it belongs in the process. The model pays extra attention to the factors and why they are relevant during the process.

The model highlights people as enabling factors that converge in training, commitment and successful implementation. Gunasekaran's model is based on peoples satisfaction as the crucial factor that includes aspects of job satisfaction, communication, teamwork, cross-functional teams, empowerment, training and technological support (Dradjad 2005).

**An example of a conceptual model of implementation**

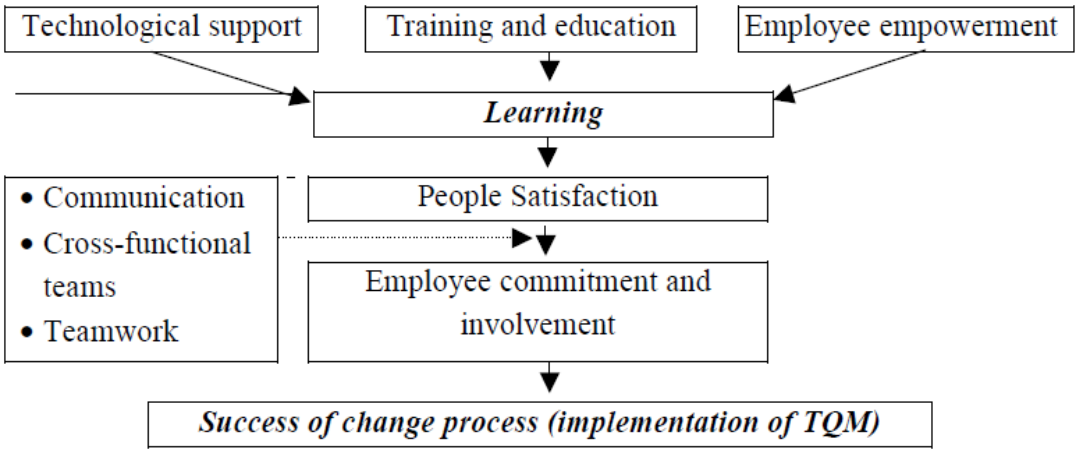


*Figure 16. Conceptual model of implementation, based on Gunasekaran 1999, pp 37*

## 3.5 Evaluation & Feedback of Implementation

The evaluation of a quality implementation initiative is natural part of the process and a necessary component of the implementation. Without an evaluation of the implementation process there is no way of knowing if the implementation met the desired results or defined standards and the final outcome would be unknown. Each of the following elements describes important measures that have been identified as important when evaluating an implementation project (Dane and Schneider 1998).

### 3.5.1 Areas of important measure

When performing evaluation of the success of the implementation there are some areas to focus on.

The fidelity of the Implementation means the quality initiatives baseline, core standards or specific syllabus. This syllabus represents then what will be measured when evaluating the fidelity of the implementation (Mowbray et al. 2003). The dosage of the implementation, which easures to what extent or how much of the quality initiative was actually delivered. Depending on the nature of the implemented quality initiative the dosage can be measured by time, length, frequency etc. (O'Donnell 2008).

The quality of the implemented initiative delivery, which means how the program was delivered, such as in the aspect of how the trainer was prepared, implementing personnel enthusiasm, leader attitude towards the quality initiative and training session effectiveness (Dane and Schneider 1998). The responsiveness of the participant to the implementation process means how involved the employees are to

the project. It measures to what extent the participants are engaged in the activities and content of the implemented quality initiative. One of the most important aspects are to what extent the quality initiative keeps the participants interests just as the responsiveness level of the participant (O'Donnell 2008).

The extent of program differentiation, which means how the quality initiative differentiate towards similar quality program in the organization. A comparison to one older version of a similar project can be useful to evaluate the degree of differentiation (Dane and Schneider 1998). Program reach corresponds to the proportion of the population of the targeted users who accepts the message of the implemented initiative and ultimately makes use of the quality initiative (Durlak 2010). One example of how to measure program reach is the actual number of targeted user who make use of the implemented quality initiative divided by the total number of targeted population (Dane and Schneider 1998).

Document all adaptations that are made to the innovation. Any kind of adjustment of the original quality initiative that was made in order to fit the setting in terms of resources, preferences or any other important characteristics that influence the original design of the project. Adoptions to local setting can in many cases be a way to enhance the chances of a successful implementation. It is important to document the adjustments and to make the adoptions traceable to others future advantage (Durlak and DuPre 2008).

### 3.5.2 Quality audits and employee satisfaction surveys

Good examples of how to evaluate these elements can be by conducting quality audits, measurements program and employee satisfaction surveys.

- **Quality audits**

All quality audits are performed to evaluate the correspondence to the determined requirements and to evaluate to what extent and effectiveness of the implemented quality initiative. Because of the nature of quality audits which contains interviews, document and record examinations and observation activities it reveals the competence level of the employees (Nanda 2005).

- **Measurements program**

The use of measurement can be helpful when deciding whether the actions taken where effective or not. One example is if one employee attended a training session on how to detect quality failures of a certain kind. It is expected that the number of detected quality issues of this particular kind will increase after in future peer reviews (Nanda 2005).

- **Employee satisfaction survey**

The information an employee satisfaction survey can be very valuable to the organization in order to understand how employees perceive the provided training session and how effective the actions that have been taken regarding their line of work (Nanda 2005).

## 3.6 Summarized conceptual theoretical framework

The development of a QCP Implementation framework is a consolidation of Gunasekaran's (1999) implementation framework and Mangino's (2001) QC activities. This is to give and conceptual image of the QCP content and the general necessary implementation activities.

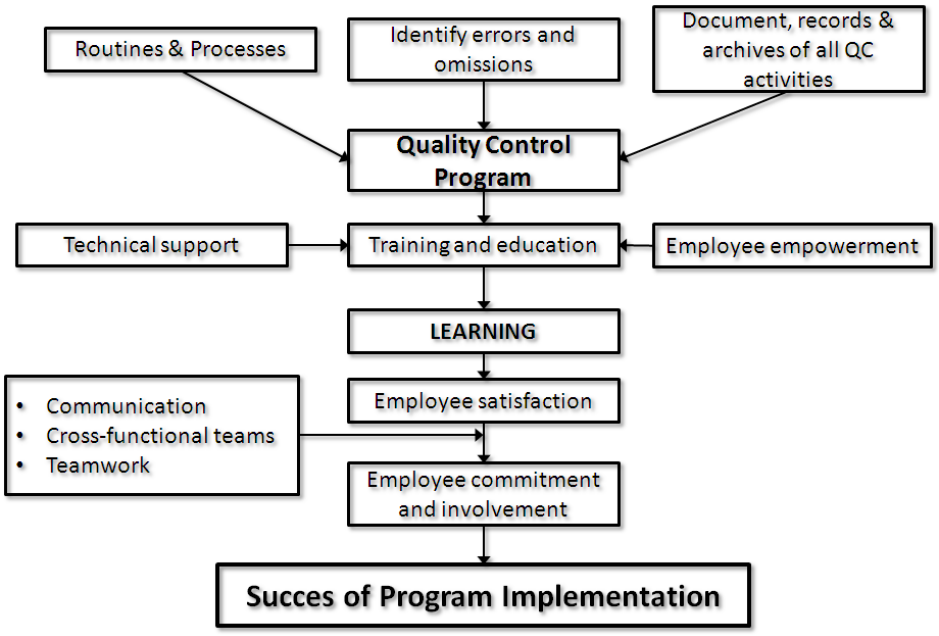


*Figure 17 Summarized conceptual theoretical framework*

Mangino's (2001) QCP framework is based on the type of action that needs to be performed in a QCP. The three main categories are "routines and processes", "identify errors and omissions" and "documentation, records of all QC activities". These need to be included in the program. These categories are all reflections of the QMS including QP, QA, and QI (Nanda 2005). The planning of new routines and standards of the program (QP), how to achieve quality assurance (QA) and how to ensure continuous QI all activities need to be recorded for other departments to take part of the learning (Wisegeek, 2013). Depending on the organization type, organizational structure and which department the QCP is applied the specific content can differ but the main QC framework is the same.

To ensure a successful implementation Gunasekaran (1999) conceptual framework is helpful. It provides knowledge of crucial content not to forget when planning and executing an implementation. It will not give you the directive how to perform the training or create the training material but it will provide the information of what not to forget, such as technical support and embrace employee empowerment during the training (Dradjad 2005). Providing this together with training will lead to learning.

Training and education provide employee involvement is good to increase employee's satisfaction (Nutt 1986). By communicating the benefits and need of the new QCP the implementation will be enforced and will increase the commitment to the new QCP by the employees. Using cross-functional teams during the training and implementation will not only increase the credibility of the program but also increase the informal communication after the training is over which will enforce the united commitment to the program as well (Davidoff 2008, Chien 2012).

# 4. Results

*This chapter will describe the results based on the interviews, surveys and brainstorming session conducted at Alpha into detail. Firstly the different elements of importance are presented. Furthermore, the connection between the QCP elements and the implementation theory will be explained.*

## 4.1 Quality Control Survey

The survey was conducted to get an overview of the current quality situation and the attitude among the employees about QC. In the beginning it starts with some general question about Alphas quality strategy and resource management, to get deeper into detail about QC processes the in the end. The following categories were identified to represent the general picture of quality issues at Alpha:

- Resources
- Performance
- Knowledge
- Responsibility
- Communication

These categories are not solely built upon the quantified results from the surveys but the comments fields in the questions are also taken into account. The analyzed categories will later be used to build a framework for the new QCP. All the questions do not have a corresponding graph since the data from the graph might not be as significant as the comments from the questions. The entire questionnaire is to be found in appendix 10.1.

### 4.1.1 Resources

As can be seen in graph 18 below, the general opinion of the employees is that Alpha fulfills the contractual requirements. No one of the personnel or management strongly disagrees to the statement but the opinion is that there is room for improvements. There are no examples when Alpha has not been able to comply with the contract due to quality issues.

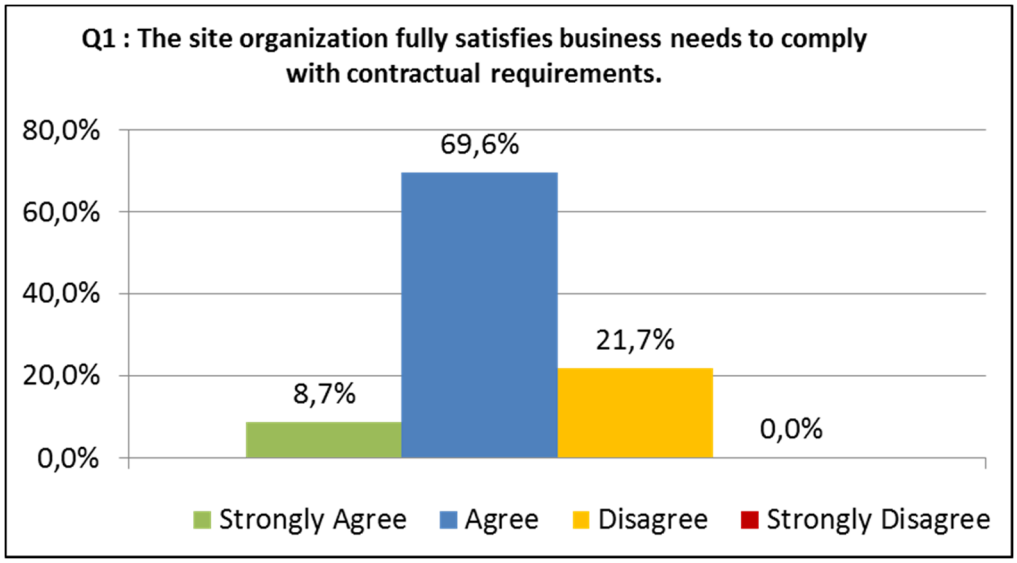


*Figure 18 Results of Question 1*

The lack of resources reflects on the QC at site and there is clearly a group of employees that are of the strong opinion that more manpower is needed at site to ensure the QC. This is something that needs to be covered by the budgets and manager decisions, nothing that was handled in the thesis but it is interesting to keep in mind since that can create frustration and be reflected in the rest of the survey as well. It is important to reflect on the distribution of "strongly disagree" and "strongly agree" which in Q1 reflects that the company complies with the contractual requirements. In Q2 the distribution is not as obvious.

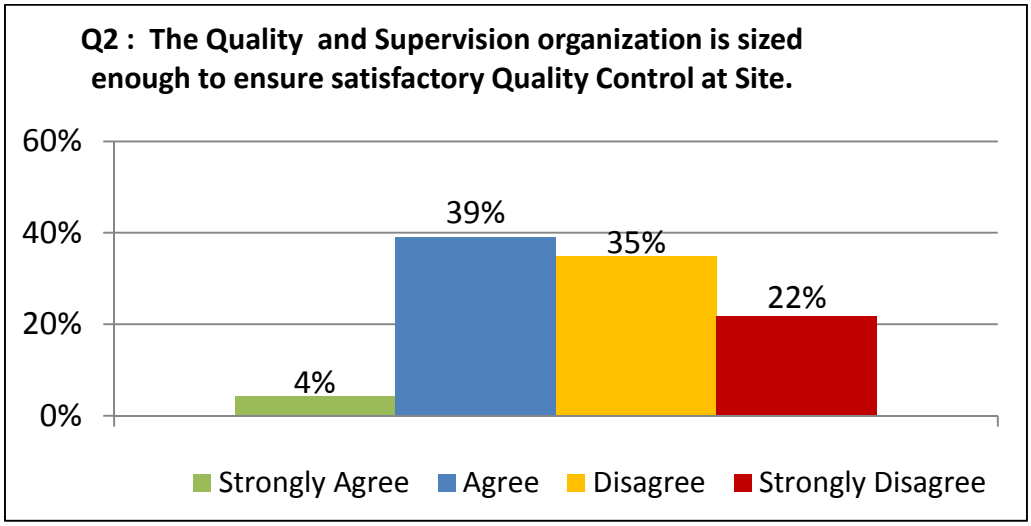


*Figure 19 Results of Question 2*

The overall opinion in Alpha is that there are not enough resources allocated for QC activities, see figure 19. Whether it concerns number of employees, knowledge, time or communication is not as clear. The comments show that there are not enough resources to support the specific QC activities.

### 4.1.2 Performance

The performance is a crucial category which is important to maintain and ensure high quality. The question is relevant out of the perspective of the employee perception of the performance and not the measured performance. The opinion is that the overall QMS is not efficient enough. Whether this means that the personnel have high expectations on the QC or if it just is poorly performed does not come out of the data.

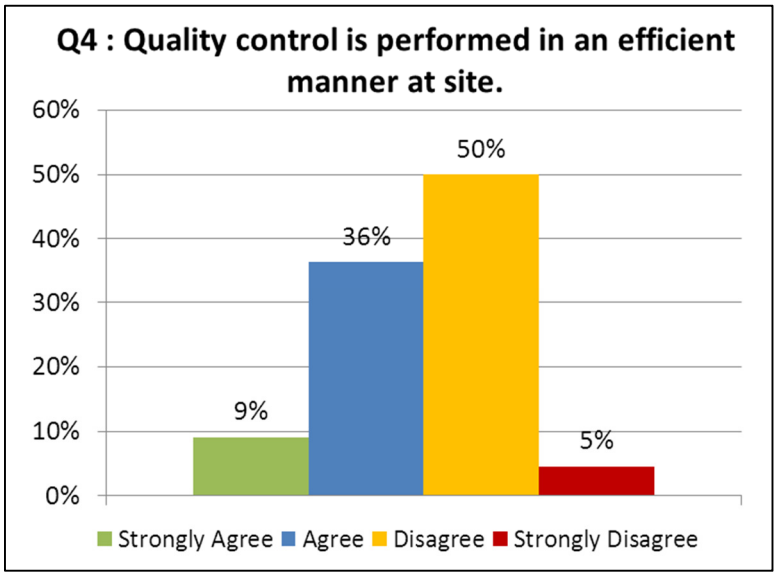


*Figure 20 Results of Question 4*

The results of the survey show, figure 20, that the performance can be increased. It is however not as critical as the lack of resources but comments from the surveys shows however that employees lack the motivation to perform their tasks in an efficient manner.

### 4.1.3 Knowledge

The overall impression is that the knowledge at site is more than sufficient and available at site even though it is not evenly distributed. Right knowledge for the right people is very important. The quality of any performed activity depends on the employee's experience and training and it is important to maintain that knowledge.

The authority plays a role in this as well. According to additional comments in the survey the quality manager at site need to have more authority to address when work does not fulfill the requirements. This also overlaps to the next category of responsibility.

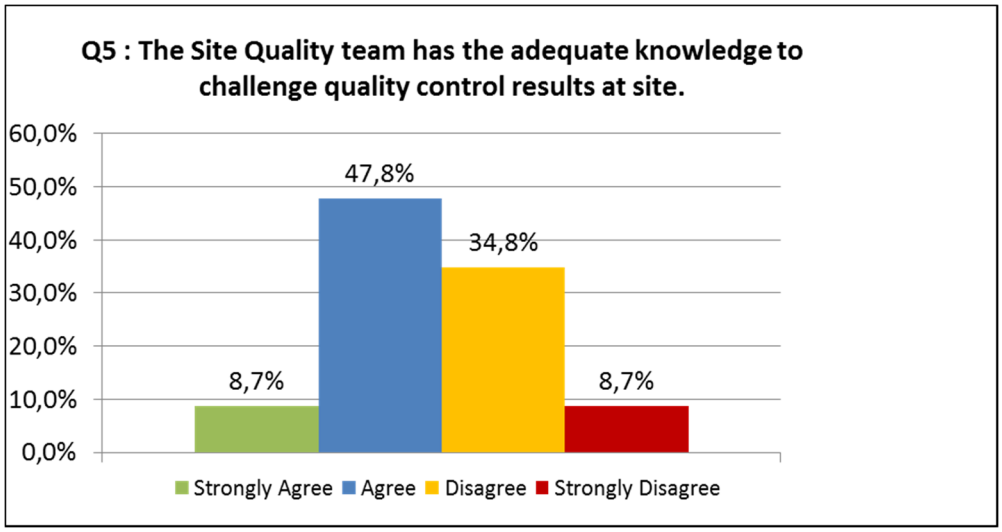


*Figure 21 Results of Question 5*

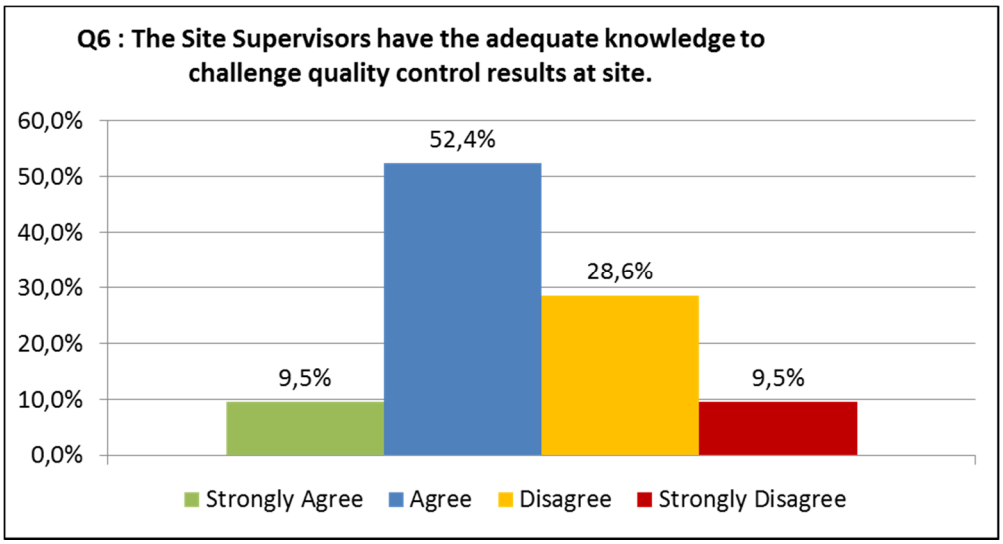


*Figure 22 Results of Question 6*

The combined result from the questions in this category shows that the knowledge is adequate all together at site. So the actual training of how to conduct QC is not the issue. However this does not imply that organization should stop the training of QC, rather quite the opposite. Rather the opposite, the surveys shows that employees have a desire for continuous training and development to for their personal growth rather than what is required to perform their daily tasks, figure 21 & 22.

### 4.1.4 Responsibility

To make sure that the right person, with the right knowledge, are performing the assigned tasks it is important to that each role is distinguished before beginning any activities. The surveys reveal that this can be hard especially when the team is small. The quality team was in some examples overwhelmed with administrative tasks rather than actually ensuring that QC was performed. The survey also reveals that the QC responsibility is not well defined whereas both following statements where to be found:

- "Currently the QC work at site is done only by Supervisor"
  And
- "QC is everyone's responsibility, not only the site quality team."

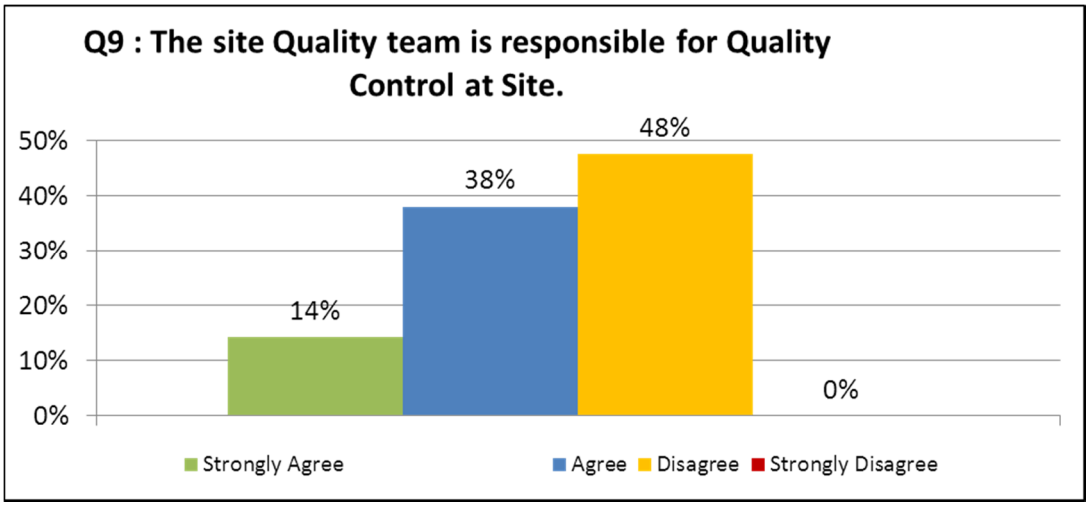


*Figure 23 Results of Question 9*

The results above show that the responsible for QC at site is vague. Since both comments and the statistical results show contradictions that shows that there is a need to clarify who the roles, standardize the routines and make sure that there is no way to misinterpret job descriptions.

### 4.1.5 Communication

The survey shows that the communication within the company is established and most employees are aware of the QC requirements, which means that the requirements do not need to be reformulated and communicated in a new communication package but enforced when implementing a new QCP.

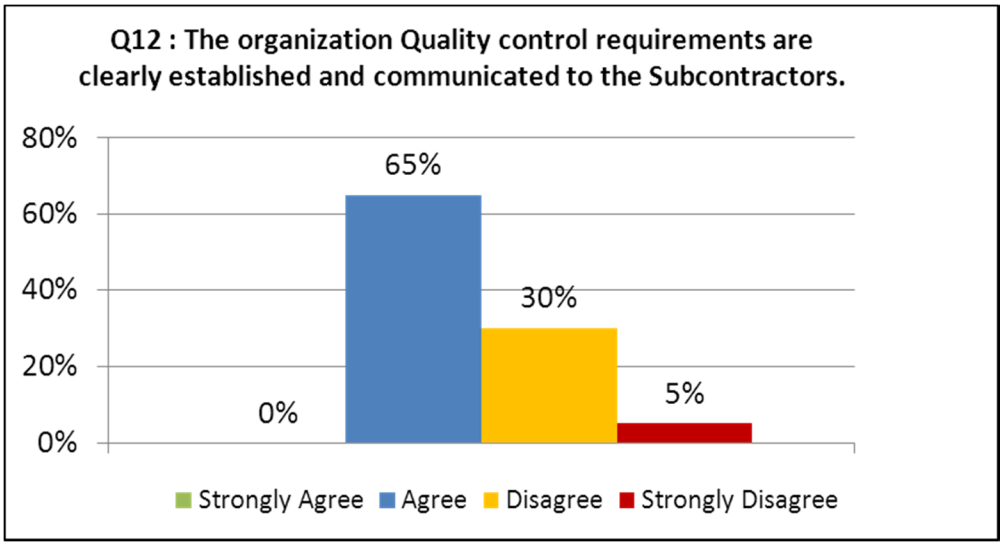


*Figure 24 Results of Question 12*

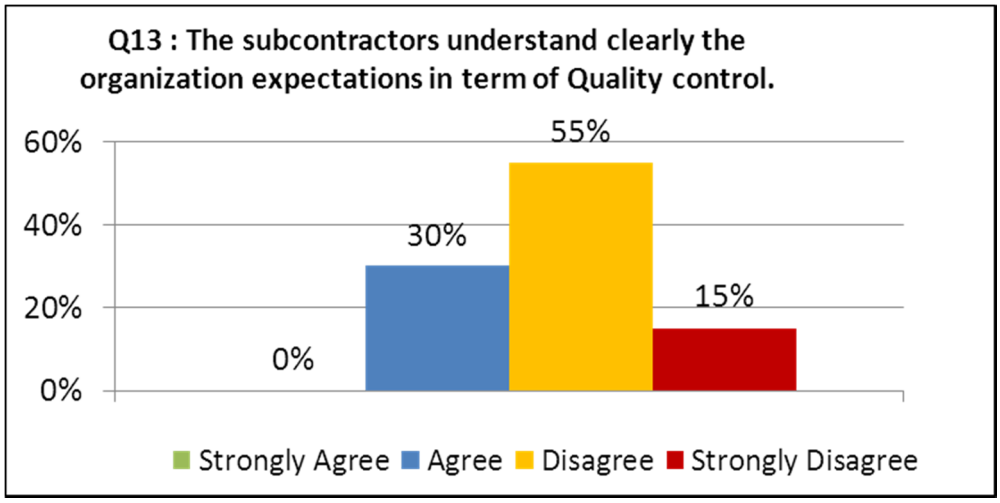


*Figure 25 Results of Question 13*

The requirements are established within the organization but as question number 13 reveals; there is a gap between the established QC requirements and the subcontractor's enforcement of these requirements. The survey and especially the comments in the survey revealed that the quality requirements are clearly stated and formulated but the communication of the requirements are not adequate which reflects on poor understanding of the QC expectations by the personnel, sub-contractors and costumer.

### 4.1.6 Follow-up study about category importance

Furthermore was a follow-up study to allocate the importance of the different categories among the employees that participated in the survey. The study was performed on the comments from each question. The number on comments under each question was counted and categorized. Some categories got more comments then other which then led to the result below. In this study the two categories "knowledge" and "performance" where merged into one which is explained further in the analysis chapter.

| Category | Percent |
|---|---|
| Resources | 22.5% |
| Knowledge & Performance | 20.0% |
| Responsibility | 30.0% |
| Communication | 27.5% |

*Figure 26 Category prioritizing list*

The result in figure 26 reflects the fact that the personnel thought that it was more important to clarify the responsibility than to resolve the problem with lack of resources etc.

## 4.2 Interviews & Discussions

*Interviews and informal discussions were conducted and used as one data collection method in order to compile and evaluate data. They were also used to confirm and reject theories that appeared in the construction process of the new QCP. Brief discussions were also used to check the validity of the concepts and conclusions that ultimately had to be checked before they could be considered reliable. The interviews and discussions were conducted continuously during the project and were all of the unstructured kind. The interviews are summarized and evaluated and the insights have been used throughout the whole thesis to support and guide the project. The interviews did not follow any special structure but the interviewer was trying to cover the same base as during the internal QC Survey (Resources, Performance, Knowledge, Responsibility and Communication).*

### 4.2.1 Resources

There is a common understanding that there is a lack of resources in general to follow the stated QC requirements. Site personnel are especially asking for more employees dedicated to QC specific tasks. While main office personnel are asking for more time to perform their tasks. The subject of resources is however not getting that much attention as other subjects. The lack of resources can be considered an issue in all departments and project since there are always limits to how much resources that will be spent in a projects, see chapter 3.1.1. The lack of resources also seem depend on the fact that the staff are not quite sure or have the knowledge of who is responsible for respective tasks.

### 4.2.2 Performance

The performance level is considered to be high at the office respectively on site. However, that did not mean that the site personnel are of the opinion that office

management performance are adequate or vice versa that office management were of the opinion that site personnel performance are sufficient. There are some concerns that the site personnel are careless or do not follow up on the QC requirements and procedures, especially when documentations of incidents are formalized. The low performance level has been connected to the low engagement, which also was confirmed by the external survey performed at the company earlier that year (Kannexa 2013). It was also addressed by management that there were no complaints of the level of performance but highlighted that it could get better.

### 4.2.3 Knowledge

It was clear that there was a desire for more and continuous education, on- and off-site. Each employee was of the opinion that they had the knowledge to perform their tasks but addressed at the same time that there was room for improvement and development. This could in the end lead to improved engagement as well, if employees feel that the organization is investing in the employees. This corresponds to the results from the survey.

### 4.2.4 Responsibility

This was clearly one of the bigger concerns in the surveys which the interviews confirm as well. There is an obvious need to clarify the different roles when implementing the new QCP. It seems that the specific job descriptions which are defined by the Alpha are not sufficient to support the workers in the QC perspective. The interviews revealed that the training for the new QCP needs to focus on the delegation of responsibility and the standardization of roles of specific QC tasks. There should be no uncertainties of which tasks that are assigned to who no matter if it is on- or off-site, something that was highlighted by personnel at site.

The responsibility issue is something that managers have been allocated as a problem that affects the motivation as well. As one example when there is a tasks that need action, such as quality inspection, but there is no one assigned to that particular task. Then, no one feel obligated to do the inspection. Furthermore since it will take time from the employee's normal assignments and there is no incentive connected to perform the inspection there is no one but the supervisor that has the responsibility to ensure that the inspection is performed. That is one example why it is important that every task and action is assigned that came up in the interviews with one manager at site.

### 4.2.5 Communication

Something that management, at site in particular, where missing was the communication between site personnel and management at the office. One example that came up was if management in the main office were providing more information to site people of the process of projects, even though it might not directly affect the personnel at site, it can create a feeling of participation and thereby increase the engagement. By involving the personnel in the process and enhance the opportunities to influence, the site personnel will feel more engaged.

### 4.2.6 Need assessment

One subject that appeared during the interviews that have not been touched much before in the research is a need assessment, which was addressed by the head of the quality and managers at the main office as important for the implementation phase. The team developing the new QCP was unanimous that it is crucial to promote the need of the new QCP. Using concrete example as the increasing numbers of NCR and the direct and indirect cost of rework to emphasize that there is an actual need of a new QCP. Due to the directives from the company during the interviews, this category was added to be one part of the analysis.

To be able to communicate the importance of the new QCP to Alpha and that there was an actual need to implement it some data from the database was gathered. The graph below shows the number of NCR raised per month since 2009 which has dramatically increased the last couple of years.

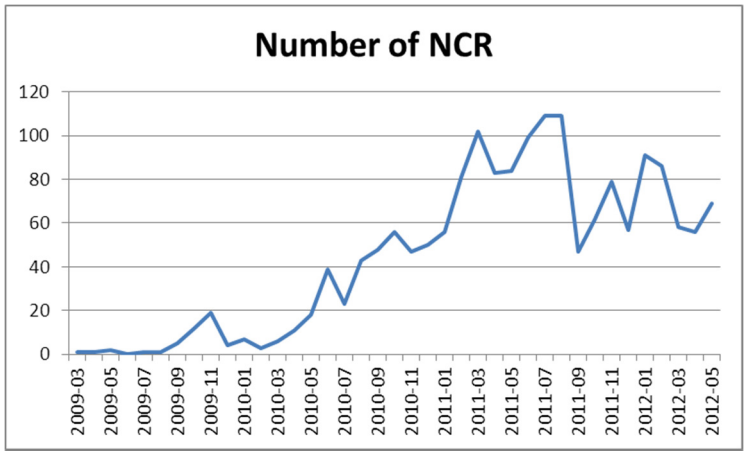


*Figure 27 Average number of NCR per site from Alphas data base*

Figure 27 gives an overview of how the number of NCR increased over the years but does not provide any detailed information of the costs it causes.

To break it down and make it more clear what impact NCR's and rework has on the organization a more detailed figured was made, see figure 28. The statistic is gathered from the database of Alpha and summarized to show the results of poor QC. In the first cone the number of NCR's are shown and on the rest going to the right the respectively cost to customer and Alpha is presented and in the end the number of days it causes.

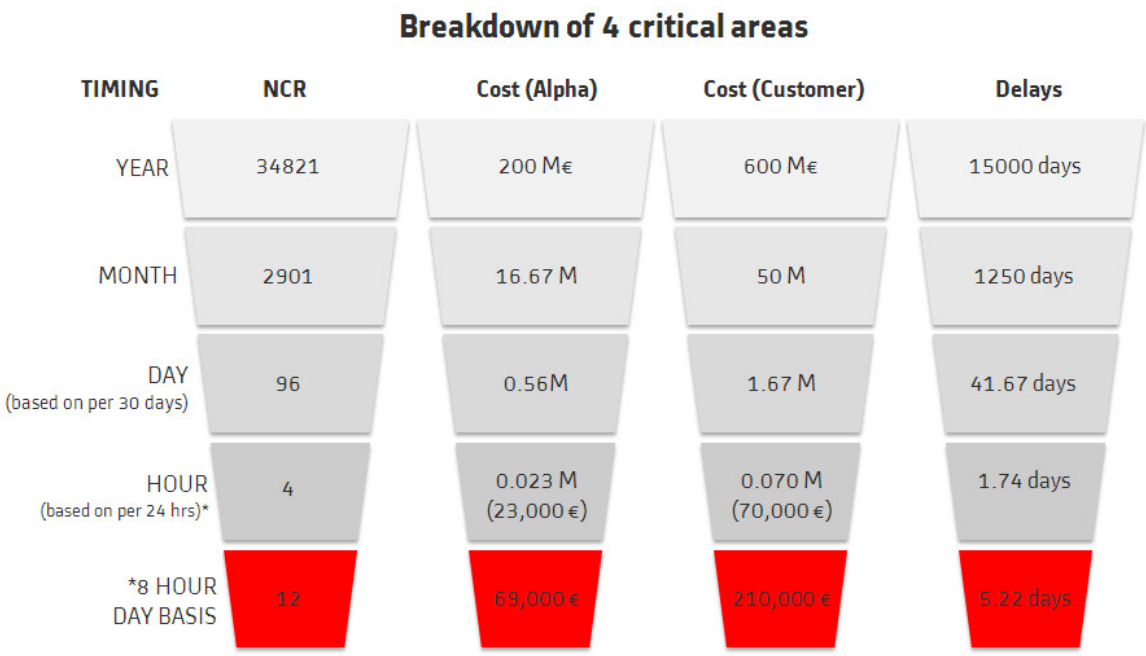


*Figure 28 Alphas and costumer costs because of NCR (2012)*

There is however more points that the managers want to address as reasons why the QCP is needed:

- Increased quality will enhance the reputation which also can be used as a selling point
- There is a wish to connect quality to the former EHS initiative
- Increase the communication with the subcontractors
- Institute a strong quality program that make quality into a habit for the employees and increase the engagement through inspiring training and education

## 4.3 Brainstorming session

The Brainstorming session was initiated to understand the underlying reason of the results of the external survey (Kannexa 2013) which addressed that the employees at Alpha showed low engagement to the organization and their job. The group consisted of 20-25 persons in total from different departments at Alpha. The group was divided up in smaller groups by 4-5 persons from different department. During the brainstorming session some of the topics were highlighted by the head of the department which was of most concern to the department:

- We set clear performance standards for product/service quality
- The people I work with cooperate to get the job done
- I receive the training I need to perform my current job effectively

These three topics had a big discrepancy towards the global norm, according to the external survey (Kannexa 2013), and was prioritized in the organization overall. These were also very interesting when implementing the new QCP. If the results can have an effect on the engagement of the personnel then that should be considered when designing and implementing the new QCP.

The smaller groups were assigned one of the highlighted topics. They were then to discuss and try to address the root cause. Ishikawa diagrams were used to help the groups during the discussion to come to some conclusions.

The results of the brainstorming session were strikingly similar to the results from the QC survey. Except the contradiction of training, in the survey it was said that the training was enough, while in this brainstorming session it was summarized that more training was needed. The results from the brainstorming session are summarized according to the six defined categories.

### 4.3.1 Resources

One of the first things mentioned as one possible root cause to the lack of training was the lack of resources. The timing of the training was not always right. The employees needed all their time to perform their daily tasks and did get time specially allocated to participate in training and internal courses.

The lack of resources was not reflected too much in the question of performance standard for product quality more than that the introduction plan for new employees was not extensive enough, but the employees needed to start working with their specific task too fast instead of getting to know the standard routines, company culture and values.

### 4.3.2 Performance

There was not much spontaneously mentioned during the brainstorming session about the performance. However, when the head of the department gave the directives to discuss the subject it was surfaced that the engagement was low to achieve high performance in quality activities. The quality of the performed work was not highly prioritized as well as QC activities.

### 4.3.3 Knowledge

The need for more theoretical education and training was brought up as one example where there were discrepancies. The absence of a continuous training program or internal learning process was also mentioned as something that caused low engagement. There are an internal company University at Alpha, but there is no plan or goals on how many courses every employee should participate in each year. It was highlighted by the employees that this could be used as an incentive for higher performance and to be more engaged in the long run. It was also mentioned that there was too much self-training and not enough supervised training.

Reluctance towards the training was considered a problem when conducting training and education that was not of relevance to the employees. It was addressed that when the material was of a generic nature and not tailored to the receiver some employees had a tendency to become more reluctant to the training material.
As one of the employees addressed it:
-"If the trainer put in the effort to tailor the program for us, the specific receiver, the employees feel more engaged and more interested in the material."
What the employees mean is that since each training session will be directed to different work forces, managers, constructions workers, welders, supervisors, QC

personnel etc. and if the material is tailored to each group of employees that particular group will feel more engaged since the training material is related to their specific tasks.

#### 4.3.4 Responsibility

Just as was mentioned in the surveys, there are some issues about how specific tasks are assigned. The roles at different positions are currently well defined but the problem where the responsibility lies for some specific tasks, e.g. who is responsible for QC at site, who is responsible that QC is performed and who is responsible that the requirements are met for example. The answer is easy for the quality team designing the QCP but this has not been clarified and communicated to the employees using it before.

When discussing the subject "The people I work with cooperate to get the job done" it is revealed that if the different tasks are not properly delegated since before it is harder to ensure a good cooperation between coworkers.

#### 4.3.5 Communication

It seem like when connecting the communication category to the three major subjects in the brainstorming session some ideas of how to improve the communication was brought up, for example

- More informal meetings opportunities,
- Functional meetings between departments with common goal (quality and construction as one example)
- Forum to set standards
- Personal 1-1 feedback meetings
- More interactive communication

The initiatives are good examples of what to take into account when creating a new QCP but also give a hint of where to start new initiative to increase the engagement.

#### 4.3.6 Need assessment

The need of a new QCP was not covered in the brainstorming session as one of the direct headlines. But the results from all the categories above show that there is a lack of several different elements in each of the categories. In the end a discussion of possible solutions to the issues were listed. Then a voting procedure was performed to highlight which of the solutions was most crucial to focus on.

| Discussed as potential solutions |
|---|
| Team building activities (not necassary big events) |
| Presentations cross departments/functions |
| Increase informal communication possibilities |
| Improve positive reinforcement |
| Focus on bigger picture |
| Proper communication of expectation and added value |
| Mentoring Program |
| Longer introduction plan |
| People (office based) preperation and planning checklist |

*Figure 29 List of possible solutions from brainstorming session*

By doing a quick closed voting in the group, the circled two solutions was found to be the most important to highlight when taking actions to increase the engagement and implement the new QCP.

Managers also addressed the need of the QCP to be connected to competiveness, cost & safety. With higher overall quality, the reputation of alphas products will stand out in the competition which will attract more customers. Reduced cost because of less reworks will increase the company's profit and less delays and lower costs because of EHS issues or even failures will also be selling points to attract more customers. The overall winning perspective for the employees in the end is that if each of these points is improved, even just a little bit, it helps to secure the future of the company and the employee's job in the end. This is extra crucial these days since the market is getting tougher and Alpha have already applied several austerity packages to ensure the future of the company.

# 5. Analysis

*The analysis is based on the theoretical and empirical findings and is built upon the five categories that were found during the data collection. These categories are analyzed individually and decided to be covered in the QCP training.*

Combining the information from the survey, interviews and the brainstorming session resulted in vast amount of data. The data was categorized in order to interpret the result and to make the analysis easier but also to measure the importance of the different contents in the QCP and to the implementation.

## 5.1 Developed conceptual model of theoretical framework

The development of the conceptual QCP implementation framework is based on the summarized theoretical framework from the literature study (chapter 3.6) and the results from the case study. The developed version is adjusted to fit the context of Alpha and the results from the case study. The adjustments were mainly needed due to the findings in the results where the most crucial categories (resources, knowledge & performance, responsibility, communication and need assessment) were not highlighted enough. These categories however are crucial to Alpha and fit well in the conceptual framework. It was however not obvious from the first survey where the categories belong in the implementation process. Analyzing the results from the interviews and brainstorming session and comparing the results from the comments in the survey the categories was used when developing the conceptual model of theoretical framework for Alpha, figure 31.

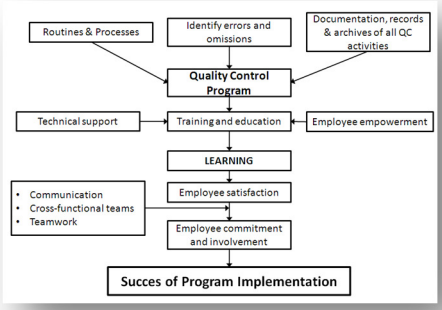


*Figure 30 Theoretical conceptual model*

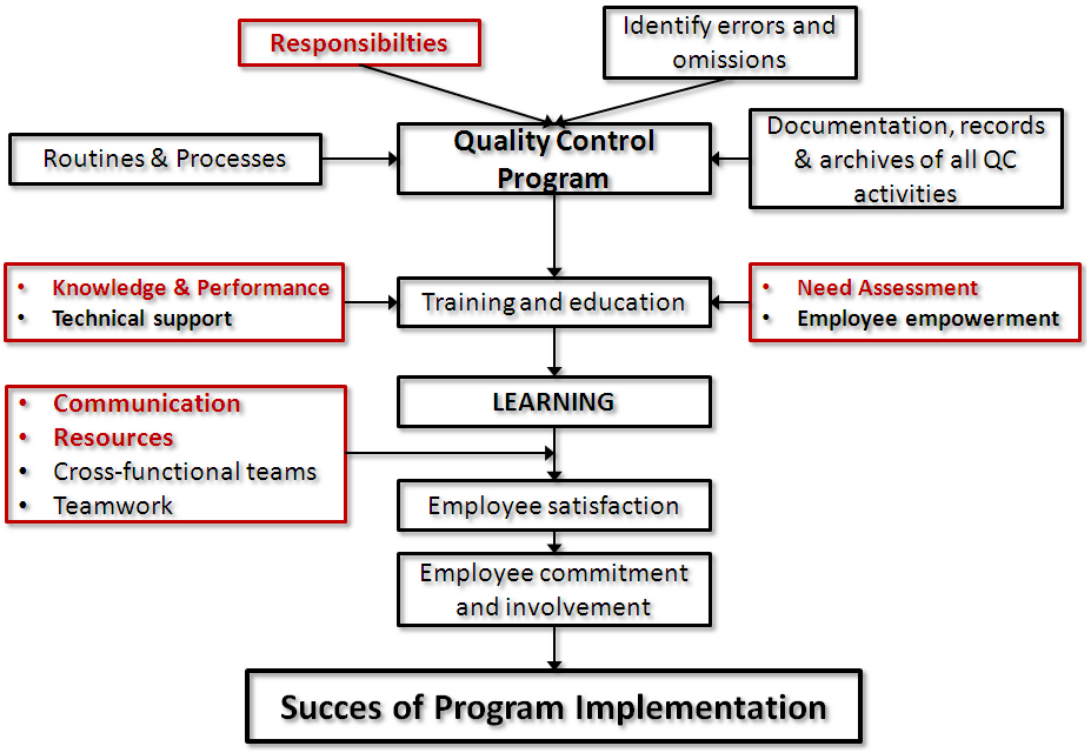


*Figure 31 Conceptual QCP Implementation framework*

There are other categories in the framework to consider as well but these are not exclusive in the context for Alpha. The ones highlighted in the conceptual framework is the most important to the employees and to ensure that no details of the QCP is missed out during the implementation. One obstacle when identifying the categories was to decide where in the process the category was to be enforced to be a part of the QCP. The implementation process can be divided into three phases; before training, during training and after training session of the QCP. By comparing the QIT & QIF and the results from interviews and brainstorming session, the location was chosen in collaboration with the head of quality at main office at Alpha.

## 5.2 Resources

As in most businesses, resources can be scarce depending on the nature of project. Quality projects are often initiated to decrease cost and to gain competitive advantage (Garvin 1988), why it is important to have the support in terms of resources by the managers when implementing a new QCP. During the survey and interviews the need of resources to perform QC has been highlighted by the employees. It is important for the implementation team to ensure that the resources are allocated and to ensure that the QCP has adequate administrative and management support when starting the planning of the implementation (Chien 2012).

The analysis in the matter of resources also shows that that the current QC works but need improvements. The support from the quality team on- and of-site works and the QC requirements are aligned with the customer but still need some clarifications. This means that there is no need to create a brand new QCP. The previous QCP is working but has not been communicated and enforced in the organization. The fact that the new QCP can be a renewed version of the previous QCP means that there are resources to be saved. A tailored QCP also have a greater chance to be successful adopted by the organization (Nanda 2004).

The strategy to use a tailored QCP rather than a prepared set of QC tools can be used when deciding the implementation strategy as well. Recent research have shown that the influence of the organizational context in practice have a severe impact on the results of the implementation This is why the implementation plan should tailored to fit Alpha's organization. The planning in general is absolutely crucial when estimating the resources for the QCP and its implementation (Durlak and DuPre 2008, Fixsen et al. 2005, Greenhalgh et al. 2004).

However the resources is most important to be present after the training in the implementation process, to show that there are resources that support the QCP while the employees are actually applying the QCP. This will enforce the program and make the user more committed to use it in the future.

## 5.3 Knowledge & Performance

It was found during analysis of the categories, knowledge and performance, that a separation of these two categories of QCP was redundant and difficult because they are that strongly associated. The question "What to do?" is connected to "knowledge and "How to do it?" is connected to knowledge and performance (Sousa & Voss 2001). Why these two categories were merged to be handled together.

The results show that the knowledge is adequate of how to perform the QC in a manner that fulfills the requirements. However, that does not mean that no training is needed. Rather the opposite, the surveys shows that employees have a desire for continuous training and development to for their personal growth rather than what is required to perform their daily tasks. By having employees to participate in training they feel appreciated and that the organization is investing in them and become more engaged (McGehee & Thayer 1961) which affects the working performance and the level of quality in the end. QC can also involve evaluating employees and co-workers and their performances. If the employees do not possess the proper skills or knowledge it might harm the quality and furthermore the company reputation (Mangino 2001).

This category fulfils its purpose during the training phase and it is important that the members of the implementation group have all the necessary knowledge about the QCP and implementation science and process evaluation. Since they are performing all the training they need to have the contextual knowledge about the organization, hierarchies and the decision-making (Chien et al. 2012). As mentioned in the resources section a whole new training program seems to be redundant. Some comments recommended a more tailored training program depending on the specific task and responsibility of the employee participating in the QC training.

To foster a good environment to change and implementation is important to avoid the personnel to be reluctant to learning about the new QCP. This can be hard since the external study (Kannexa 2013) already shows low engagement, it can be hard to change their behavior to be more positive about the new QCP and commit to a working environment they already have a low engagement to. Some actions in the pre-implementation phase can be taken to improve the climate before the implementation (Chien 2012), e.g. establish routines that reduce the resistance to change, create policies that support shared decision-making and effective communication.

However, it is important to address that there were no implications that the organization were performing bad or careless, but there signal both from the interviews and the survey that there was a gap to achieve high performance. Whether this means that the personnel have high expectations on the QC or if it just poorly performed is not revealed by the data. What is known through the study is that the engagement need to be increased which will lead to better performance in the end (Durlak and DuPre 2008)

Latham & Locke (2006) stated the advantage of having clear, stated and common team goals to enhance team performance. This has also been addressed in the interviews, that to be able to work better as a team there should be clear stated common goals, especially when it comes to people on-and of-site. For them to have common goals can connect the employees and make them understand each other better. It is important to have specific task incentives but to bring people together and work together in teams it is important to have shared visions and goals. This should be stated in the very beginning of the development of the QCP and communicated throughout the implementation process.

## 5.4 Responsibility

During the study the issues of responsibility seem to be one of the biggest. The results from all collected data showed that there was a lack of defining the QC responsibilities. Both the statistical results show contradictions as well as comments during the interviews shows that there is a need to clarify the roles, standardize the routines and make sure that there is no way to misinterpret job descriptions and QC responsibilities. These should be defined in the beginning of the development of the QCP development. It is important to remember that this can also be bias to that hierarchy can cause internal issues between manager and worker and when personnel and manager has problems on a personal level this can reflect in the results as well. However, the responsibilities need to be assigned early in the new QCP. There cannot be any uncertainties about who is responsible about the quality in any activities on- or off-sit.

One prerequisite before starting making plans for an implementation is to set up an implementation team. This team is responsible for the whole implementation process and should consist of a cross-functional team with representative from different departments (Nanda 2005). The team needs a quality manager which should have prior experience in quality initiatives and preferably implementations as well. In general, a qualified manager at office understands the process as a whole and is more equipped with good multitasking and delegation skills while the supervisors at site are more responsible for reviewing the quality process, and facilitating training activities. (Fanslau & Young 2008). These roles do exist at Alpha right now but the job description does not clarify the QC responsibility.

It is also crucial to involve the employees in an early stage since they are the one that are using the program when it is implemented and executes the processes. They will also be the first one to will be able to provide feedback of the program. Employee participating in the implementation will also help to reduce the resistance to change and make personal barriers less problematic. (Nutt 1986).

Prior to the start of the implementation of the QCP it is an advantage to have the training sessions planned and syllabus defined and assigned who is responsible for what during the training. The first evaluation of the training session will serve as a foundation and help to improve the future training (Wandersman et al. 2012). The monitoring and documentation are also crucial tasks to ensure that the implementation is heading in the right direction and to be able to trace possible errors and improvement of the implementation process (Durlak and DuPre 2008, Fixsen et al. 2005, Greenhalgh et al. 2004).

## 5.5 Communication

The quality requirements at Alpha are established and communicated but not enforced enough to reach the sub-contractors which reveal the need for the new QCP training. The training can cover that gap of knowledge between Alpha personnel and sub-contractors that exists at the moment.

Other QC problems could be avoided early if smooth communication between managers at office and supervisors at site or other members in the team is guaranteed. For instance, the NCR to the engineering specification could be assured at the early stage, such as incoming material rating. To avoid QC problems down the line, QC need to work in close cooperation with the personnel at site (Dimitris & Chorafas, 2013).This has to be communicated to enhance the QC at site and improve the overall quality mindset in the organization. If all stakeholders are aware of the necessity of QC and the quality requirements the chances of a continuous improvement of quality is substantially higher. When implementing the new QCP it is important to state who is responsible to communicate the quality requirements and how to communicate these goals to the subcontractors.

By improving the overall communication between the main offices to site people, even though it might not directly affect the personnel at site, it can create a feeling of participation and thereby increase the engagement. By involving the personnel in the process and enhance the opportunities to influence, the site personnel will feel more engaged (Chien 2012). This was also lifted as a possible solution from the brainstorming by creating more informal communication channels. The increase in communication is something that will be enhanced over time and is an ongoing process that will need to stretch over departments to be successful.

## 5.6 Need assessment

This was a category which was solely an initiative from the quality managers which on the other hand is in line with several researchers about fostering a supporting climate to the implementation such as Davidoff 2008, Chien 2012, Klein & Sorra 1996.

The research states that it is easier to achieve a successful implementation and to overcome barriers to change (Mosadeghrad 2005) if the organization is aware of the need for the implementation. A need assessment is therefore a possible way to enforce the QCP and to increase the chances of the program to be adopted by the personnel and to achieve the long term goal of quality awareness and making the QCP a habit among all personnel.

There are some specific points to address to make the implementation of the new QCP reasonable for the employees which are:

- Increased quality will enhance the reputation of the company
- Decrease the costs due to reworks and low quality
- Increase the communication with the subcontractors
- Increased safety and no severe injuries due to quality
- Decrease time loss due to low work performance
- Increase the engagement through inspiring training and education
- Team effort between departments to ensure quality on site
- Develop recognition and reward linked to Quality Control achievements

All these points are crucial to communicate to build a trust and understanding why the new QCP is needed. This should work as a support during the training session.

# 6. Discussion

## 6.1 Theoretical Implications

Theoretical contribution of the research is the fact that the normal statistical methods used during QC cannot be used in normal manner when applying QC in an ETO company but have to be adjusted to each particular project. During the thesis there where about 15 projects running which were all in different countries and under different set-ups. This makes the statistics between the different projects hard to compare due to many reasons e.g. measurable KPI's might differ in different projects, responsibility differences between projects etc.

Most QC literature and articles concerns the statistical analysis and control performed in different research applications such as medicine trials or psychological studies (e.g. Dimitris 2013, Thomas 1989 & Nanda 2005). These set of tools and guidelines can be hard to apply to an ETO company as Alpha. The statistical control methods could certainly also been used in some way but the QC discussed in this thesis is visual inspection and assurances that certain tasks been performed before proceeding in the ETO process.

One more contribution from the research is that even though there are QCP templates and models available, as QIT, none of them can guarantee a quality improvement, but the chances do increase if the QCP are tailored to the organizations context. The research also confirms Benson et al. (1991) theory that the organization context has a big impact to ensure quality improvement initiative in QMS. It also shows that the adoption of new quality initiatives is enhanced when the QCP is tailored, as Osayawe also claims (2013).

Research which is primarily based on combination of accepted theories is considered more valid. There are however a wide range of theories in the area of the research whereas the researchers have a tendency to choose the ones that support the research in the particular thesis. The experts from Alpha played an important role to verify the logic reasoning and provide input how to go about the next steps in the thesis and to verify that the reasoning is applicable at Alpha. There are however always a risk of misinterpretations when the reasoning is based on a subjective judgment.

One way to get around the risk of misinterpretations is to test the hypothesis in pilot cases to validate the reasoning. This could evaluate all logical reasoning in the given environment and how it affects the outcome of the implementation of the QCP. This would be very time consuming and unnecessary assuming the conclusion in the thesis is correct. With wide range of different sources of data and information and the collaboration between these sources a fairly trustworthy conclusion can be made within a reasonable timeframe.

The depth of the study is also a risk to the validity of the study. Preferably should the research be complemented with a deeper study of the exact interactions of the different elements of the QMS and how it affects the final quality of the product. The extent of that kind of study would require time and resources beyond the limits of this thesis. However, since the objective of the study was not to identify new reasons for

poor quality but to investigate how to design and how to implement a QCP. A study that identified more reasons of poor quality would presumably increase the quality the study and the interactions within a QMS. But this would not fall within the directives of this study.

One reason that the focus was on implementation rather than the design of the QCP was due to the administration knew fairly quick after the results was presented what they wanted to focus on. No deeper analysis was needed after the categories wer indicated. The quality management that is used most of the research such as surveys and interviews to support those already putative theories. This can cause the researcher to miss some details and becomes blind to other factors that might affect the implementation process as well. The use of comments in the surveys can cover this potential risk.

Often a simple method can be adopted and a simple solution found. It must be stressed that not one single method should be used in isolation but a mix and match approach should be adopted. It should be remembered that each process and industry is different and what works in one situation may not work in another. Therefore a full understanding of the process, linked to careful selection of the most suitable techniques, is very important (Taguchi 1989).

## 6.2 Managerial Implications

The assumption was that there was a distinction between the content of the QCP and the critical elements of the implementation. That assumption was wrong. There is an evident connection between the results from the survey and the implementation elements identified in the literature study. The analysis shows that the five categories lines up quite well with the five most critical elements of the implementation see figure 16.

| QCP categories | Implementation elements |
|---|---|
| Need Assessment | Need Assessment & Implementation Goal |
| Resources | Defining, Collection & Analyzing Data<br>Program planning & create a supportive climate for implementation |
| Responsibility | |
| Knowledge & Performance | |
| Communication | Program Implementation |
| | Summative Evaluation |

*Figure 32 QCP content VS Implementation elements*

This might make it hard to make it hard to distinguish between the categories versus the elements in the conclusion.

The QIT model was very useful when developing the QCP but it is important to understand that when tailoring the program the context of the organization is crucial. The QIT-model could have been used as is but would lead to a lot of unnecessary work instead of just tailor the QIT to the context of the particular organization.

Challenges during the implementation of TQM or QCP are hard to discover when planning an implementation but is easier revealed during training of the program. It is important to be observant during this phase and try to register the problems and try to resolve these for future success of the program. This is however very unique for each site and project. Depending on the structure and culture on each site these challenges can be different for each project. This thesis does only cover challenges mentioned in the results from the surveys and interview. But the feedback from the actual implementation is more realistic to base the actual challenges on. A pilot project could be a good way to cover this issue.

The fact that ETO companies always work in bigger projects and that each usually project are at a different location in the world with different culture, team structure and economical support etc. is something that has to be considered when adjusting the content and the implementation.

# 7. Conclusions

The purpose of the thesis was to investigate the various contents of a QCP and identify the critical elements that support the implementation of a QCP in an ETO company. The outcome of this thesis will be used when creating training materials for Alpha's new QCP and to plan the implementation.

**Research Question 1:** What are the contents of a Quality Control Program in an Engineering-to-Order company?

**Research Question 2:** What are the elements that support the implementation of a Quality Control Program?

## 7.1 Research Question 1:

There are essential elements that a QCP needs to cover when developing a new program. These elements are however dependent on the context and the organization where it is implemented. Any quality initiative needs to be tailored to fit the organizational context, especially since the QCP is not an organizational framework but a process to ensure that a product or services attain the required quality level. This means that the instructions should be more concrete and straight forward in order to attain the desired quality goal.

The content of the QCP should be connected to the goal of the initiative and be in line with the company overall strategy. There are some specific elements that are important in the training material and important for the QCP team to transfer to the users of the program. First of all the new routines and processes have to be standardized, that they are performed the same every time, at every site. The responsibilities have to be defined early and are crucial, especially for Alpha, to be stated clear and should not leave room for any doubt who is responsible for which action or task. The content must involve how to perform the QC and how to identify errors and omissions. Lastly the QCP should include the importance of making records and documentation of the performed QC to ensure that the actions are traceable and to enable other departments of teams to learn of each other.
The summarized important content in a QCP is:

1. Need Assessment
2. Resources
3. Responsibility
4. Knowledge & Performance
5. Communication

## 7.2 Research Question 2:

The implementation is dependent on the content of the training of the QCP in the implementation phase. The planned implementation of a QCP for an ETO company should follow a tailored implementation framework based on a framework similar to the QIT depending on the baseline of the program, such as the framework in figure 33.

The survey revealed that it is important to emphasize these five elements in an ETO organization while QCP programs for other organizations might emphasize differently.

*Figure 33 The Implementation process for an ETO company*

In order to start an implementation the need of the program must be outlined. What is the desired outcome? To set an S.M.A.R.T goal is a typical way of defining the desired outcome and makes it easy to evaluate the program in the end. The goal should be connected to the QCP's goal as well. To ensure a successful implementation it is crucial to communicate the need and benefits of the program.

In collaboration with the goal an investigating phase should take place. Conducting research about the current state and what is needed to be implemented. Basically collected background data to understand what in the current QC process is wrong at the moment and where to focus the training in order to generate higher quality awareness in the company.

Based on the fact from the analyzed background data a QCP training program can be planned and developed. During this element it is important ensure there is a positive climate to the implementation and that the need from the first phase has been communicated to all employees and the implementation does not come as a surprise.

The QCP is transferred to the employees and are now in the hands of the users. The QCP implementation team has to be observant to opinions and issues that might come up during the training that could improve the training and the training material.

Lastly, the evaluation is performed after the first training session of the new QCP has been completed. This evaluation of the whole project is important to see how the new QCP actually been adopted by the employees. The planning, training process, training material and content should all be evaluated in order to capture any failure in the communication of the new QCP. If the goal of the program was well defined the final measure to see if the desired outcome was met would be fairly evident. Any flaws need to be corrected to keep improving the program.

## 7.3 Future Research

This case study is based on one single ETO-company. In order to be able to make a generalization of the implementation of a QCP it need to be tested on more companies in similar contexts. The thesis is also focused on the human aspects of how the QCP would become accepted and how the implementation would be conducted to be successful among the employees. More research on how QA routines and processes should be conducted to make a greater impact on quality would be interesting. Then a comparison of the impact on quality between QA & QC could be performed.

# 8. Recommendation

*The recommendations are based on the result, analysis and conclusions of the thesis. These are specifically designed to fit Alphas need and how they should use the thesis to improve the quality in the organization.*

## 8.1 Quality Control Program development

There are finished QCP templates ready to be implemented directly into the organization which can work. However together with the quality department on Alpha a tailored QCP was created which should fit the values of the company and the specific need to achieve a higher quality. This program should be in line with other previous quality improvement initiative and the company vision.
First a contract should are created to stipulate the foundation of the new QCP were the main points are formulated that are directly connected to the five categories and should work as guidelines during the continuous improvement of the QCP.

A pilot program should be set up to try the program and evaluate it to see what need to be adjusted and changed in order to ensure that the program will be accepted among the employees. If the pilot program is a success then the QCP can be implemented on a full scale into the whole organization.

### 8.1.1 The Quality Control training material

The training material during the implementation has to correspond to the stipulated twelve points. The content should follow the five categories and the categories which were prioritized by the personnel should be emphasized.

1. Need assessment
2. Responsibility
3. Communication
4. Resources
5. Knowledge & Performance

| Category | Percent |
|---|---|
| Responsibility | 30.0% |
| Communication | 27.5% |
| Resources | 22.5% |
| Knowledge & Performance | 20.0% |

The different chapters of the training material in the QCP should be built upon the data the personnel emphasized in the results or theoretical information of QC that is consider to be missed out during the case study of the current situation in Alpha. The QM has a clear agenda of what was crucial content in the new QCP.

**Need assessment**
The reason of the initiative of the new QCP is to increase the quality; but why?
Bullet-point the reason and arguments in the training material and make it obvious to the receiver why it is important for the company to implement the QCP but especially why it is important to the personnel, e.g.

- Increased quality will enhance the reputation of the company
- Decrease the costs due to reworks and low quality
- Increase the communication with the subcontractors

- Increased safety and no severe injuries due to quality
- Decrease time loss due to low work performance
- Increase the engagement through inspiring training and education
- Team effort between departments to ensure quality on site
- Develop recognition and reward linked to Quality Control achievements

**Responsibility**

Make it clear that everybody is responsible to achieve high quality. The different roles and definition of specific tasks is defined along the way. When initiating the implementation of the QCP all the job description and task should be defined by the QCP implementation team.

**Communication**

How the communication should work before, during, and after the implementation should also be defined early in the process before the training program has started. During the training session all these processes are presented. Several different proposals to increase the informal communication should also be presented to enhance the collaboration between different function in the organization. And use the opportunity to ask the personnel if they have any ideas how to increase the communication while performing the training to make the training more interactive and make the personnel feel more involved in the program.

**Resources**

What resources are allocated for the new QCP should also be presented to convince the personnel that this program has a solid foundation and has the support of the GM and the global quality management. Explain and show detailed information that the financial, time, manpower and theoretical resources exist to implement the QCP.

**Program Implementation Plan**

As a natural part of the training material the time frame should be communicated to all personnel. The proposed implementation plan should look as the following and was created in corporation of with the quality department at the main office and the QM in charge of the implementation:

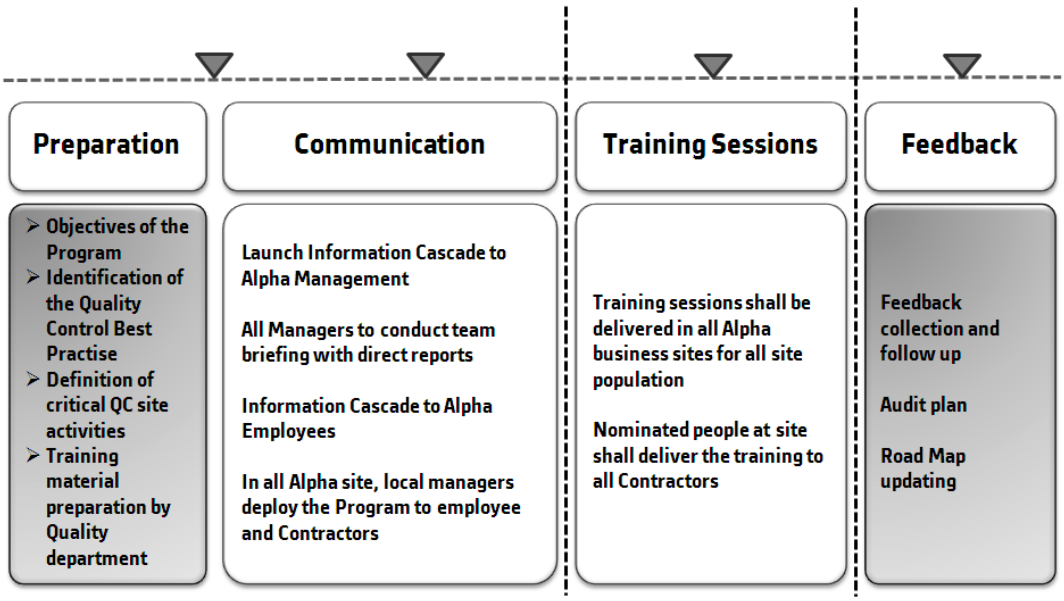


*Figure 34 QCP Implementation plan*

It is also important to communicate that the QCP is not a single event. The program is supposed to become a natural part of the everyday working tasks. And the program it-self has the same framework as the PDCA-cycle. After the feedback, the quality team takes the critics into account to improve the program for the next planned training session.

## 8.2 Implementation

As for the actual implementation it is strictly connected to the content which is planned to be implemented, the QCP in Alphas case. To answer Sousa & Voss (2001) questions of implementation the results from surveys, brainstorming and interviews are used. The two questions are:

- What to do? – What is the *content* and to what extent of different practices should be used.

- How to do it? Which process is going to be used to conduct the implementation of the new QM

### 8.2.1 What to do

As Nanda (2005) explains about implementation it is important to have clear set implementation goals. By following the S.M.A.R.T. model (Kovac 2005) when setting the goals in combination with the information from the collected data about what is desired to achieve a proper the defined goal was:

> *The goal with the new QCP is to institute a proactive habit of quality awareness among employees to achieve high quality products, service and deliveries. By the end of April 2014 the program should be ready to be evaluated where the goal is to reduce the number of NCR's by 50%, make sure no EHS-related incidents occurs due to poor quality, decrease number of delays and reduced costs due to rework. Furthermore, the*

*quality team should have communicated the new QCP to all sites and start seeing the results by the beginning of the last quarter of 2014.*

The new QCP is well defined in the previous chapter and the content should follow those logical steps. It is important to highlight every step of the program and to communicate the need of the new QCP.

### 8.2.2 How to do it

The preconditions as that need to be achieved are that an implementation and training team need to be allocated. There has to be an organizational climate that the organization is ready for a change. A well-defined strategy, plans and processes of the implementation and there has to have the economical and administrative support from the managers before starting the implementation. If the preconditions are fulfilled there is a better chance for a successful implementation.

The Implementation at Alpha should follow the tailored combination of the QIT and QIF where the focus should lean at some specific step. For Alpha these steps are considered to be the most important:

- planning for implementation and create supportive organizational climate
- real-time monitoring of implementation
- evaluating the implementation

Some of the other steps in the QIT will be found redundant when applying the QIT to implement Alphas QCP. Like some of the planning steps which was already done, figure 34.

The QIT is designed to add value to the final outcome with an explicit dedication on the implementation process. It is recommended using the tool within a comprehensive framework like Durlak's or the PDCA-cycle. If the QIT is used within the right context it could be very useful and easy to apply as it is, but how to know the right context? However, it is easier to adjust the QIT program to the context than adjusting the context to the QIT.

Finally, in April it is important to perform an evaluation of the implementation to see the impact of the new QCP. This evaluation can then be used as a base for improvement of the program and to develop it for further implementations of similar quality initiative.

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# 10. Appendix

10.1

**Components of quality implementation and their associated action steps**

| Component | Action steps |
|---|---|
| **1. Develop an implementation team** | 1.1 Decide on structure of team overseeing implementation (e.g., steering committee, advisory board, community coalition, workgroups, etc.) |
| | 1.2 Identify an implementation team leader |
| | 1.3 Identify and recruit content area specialists as team members |
| | 1.4 Identify and recruit other agencies and/or community members such as family members, youth, clergy, and business leaders as team members |
| | 1.5 Assign team members roles, processes, and responsibilities |
| | |
| **2. Foster supportive organizational/communitywide climate and conditions** | 2.1 Identify and foster a relationship with a champion for the innovation |
| | 2.2 Communicate the perceived need for the innovation within the organization/community |
| | 2.3 Communicate the perceived benefit of the innovation within the organization/community |
| | 2.4 Establish practices that counterbalance stakeholder resistance to change |
| | 2.5 Create policies that enhance accountability |
| | 2.6 Create policies that foster shared decision-making and effective communication |
| | 2.7 Ensure that the program has adequate administrative support |
| | |
| **3. Develop an implementation plan** | 3.1 List tasks required for implementation |
| | 3.2 Establish a timeline for implementation tasks |
| | 3.3 Assign implementation tasks to specific stakeholders |
| | |
| **4. Receive training and technical assistance (TA)** | 4.1 Determine specific needs for training and/or TA |
| | 4.2 Identify and foster relationship with a trainer(s) and/or TA provider(s) |
| | 4.3 Ensure that trainer(s) and/or TA provider(s) have sufficient knowledge about theorganization/community's needs and resources |
| | 4.4 Ensure that trainer(s) and/or TA provider(s) have sufficient knowledge about the organization/community's goals and objectives |
| | 4.5 Work with TA providers to implement the innovation |
| | |
| **5. Practitioner–developer collaboration in implementation** | 5.1 Collaborate with expert developers (e.g., researchers) about factors impacting quality of implementation in the organization/community |
| | 5.2 Engage in problem solving |
| | |
| **6. Evaluate the effectiveness of the implementation** | 6.1 Measure fidelity of implementation (i.e., adherence, integrity) |
| | 6.2 Measure dosage of the innovation—how much of the innovation was actually delivered |
| | 6.3 Measure quality of the innovation's delivery—qualitative aspects of program delivery (e.g., implementer enthusiasm, leader preparedness, global estimates of session effectiveness, leader attitudes towards the innovation) |
| | 6.4 Measure participant responsiveness to the implementation process—degree to which participants are engaged in the activities and content of the innovation |
| | 6.5 Measure degree of program differentiation—extent to which the targeted innovation differs from other innovations in the organization/community. |
| | 6.6 Measure program reach—extent to which the innovation is delivered to the people it was designed to reach |
| | 6.7 Document all adaptations that are made to the innovation—extent to which adjustments were made to the original innovation or program in order to fit the host setting's needs,resources, preferences, or other important characteristics |

## 10.2 Internal Quality Survey

**Survey on QC people required at site- Questionnaire**
**Note: this is not a individual assessment of people but of the overall organisation**
**Check the answer that you find fits the best**

| # | Description | Strongly agree | Agree | Disagree | Strongly Disagree | Comments |
|---|---|---|---|---|---|---|
| 1 | The Company site organisation fully satisfies business needs to comply with the contractual requirements | | | | | |
| 2 | The Quality and Supervision organisation is sized enough to ensure satisfactory Quality Control at Site | | | | | |
| 3 | The support provided by the Quality team is satisfactory to control Quality matters at site | | | | | |
| 4 | Quality control is performed in an efficient manner at site | | | | | |
| 5 | The Site Quality team has the adequate knowledge to challenge quality control results at site | | | | | |
| 6 | The Site Supervisors have the adequate knowledge to challenge quality control results at site | | | | | |
| 7 | Whenever welding issues arise from site (Welder performance, welds rejection and reworks), the primary cause of these issues could have been eliminated via the presence of additional Quality Control Supervisors / Welding Inspectors. | | | | | |
| 8 | The workload of the site Quality personnel is well balanced against the responsibilities and tasks they have assigned | | | | | |
| 9 | The site Quality team is responsible for Quality Control at Site | | | | | |
| 10 | The discipline supervisors are responsible for the quality control at site | | | | | |
| 11 | The organisations management system is adapated for efficient quality control at site | | | | | |
| 12 | The organisations Quality control requirements are clearly established and communicated to the Subcontractors | | | | | |
| 13 | The subcontractors understand clearly the organisation expectations in term of Quality control | | | | | |
| 14 | The customer and the organisation Quality control requirements are aligned | | | | | |
| 15 | In your opinion, what could be the main issues with Quality Control at site ? | | | | | |
| 16 | What are the weaknesses of the organisation in controlling Quality at site ? | | | | | |
| 17 | Which improvement would you suggest to have an efficient and satisfactory Quality Control on site ? | | | | | |

10.3 Brainstorming session headlines and answers:

| **Did you receive appropriate training for your present job?** |
|---|
| •Theory is not enough |
| •Training is not in right time |
| •Lack of preperations for new comers |
| •Too much self training |
| •Training not customized for job function |
| •Lack of time & money |

| **We set clear performance standards for product/service quality** |
|---|
| •Not all services have clear standards |
| •Missing clear objectives for the individuals |
| •Disconnection between Alstoms standard and Sub-contractor standards |
| •Forum to set standards |
| •Longer introduction plan |
| •Functional in a meeting |
| •Personal in 1-1 |
| •More interactive |

| **The people I work with cooperate to get the job done** |
|---|
| •Bad perception of others |
| •Bad processes for cooperations |
| •Low trurst in co-workers |
| •Efficency & quick respons to issues |
| •Quality of work |
| •Silo apporach |
| •Reluctant to changes |
| •Conflicts of interest |
| •Too many changes |

| **Discussed as potential solutions** |
|---|
| Team building activities (not necassary big events) |
| Presentations cross departments/functions |
| Increase informal communication possibilities |
| Improve positive reinforcement |
| Focus on bigger picture |
| Proper communication of expectation and added value |
| Mentoring Program |
| Longer introduction plan |
| People (office based) preperation and planning checklist |