NTNU
Innovation and Creativity

Attitudes to formal Quality Management Systems

An Empirical Study in Norwegian Software Industry

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Problem Description

This thesis is the continuation of the work performed in the depth study project in the fall of 2005, where a qualitative survey was performed among ten norwegian software developing companies. This thesis will elaborate the work, and there will be performed a quantitative survey based on the results of the former report.

Assignment given: 20. January 2006
Supervisor: Reidar Conradi, IDI

Abstract

Quality Management in software development is a topic that has become very important. A lot of resources and effort has been invested in making formal routines and process descriptions, which have resulted in extensive systems, so-called Quality Management Systems(QMS).

This thesis investigates attitudes towards such systems, seen from both software developers and quality managers points of view. During the fall of 2005, a student project in the subject Depth Study in Software Engineering TDT4735, in form of a qualitative empirical study was performed. Through interviews with developers and quality managers in different Norwegian software companies, it identified some interesting issues to further investigate. As an extension of that depth project, this Masters' Thesis goes further into the area of Quality Management Systems, by presenting a quantitative study.

The main research questions for this thesis are:

RQ1 Certification today, a must or just more work?

RQ2 Developers vs Managers. A battle for quality?

RQ3 How make a QMS work?

In addition to the main empirical study, the thesis also consists of a brief field study towards two of the largest ICT organisations in Norway, and describes what they consider to be the most interesting and challenging aspects of quality assurance and process improvement in Norwegian software industry. Originally, the thesis should also present results from a large internal study in EDB - Business Partner [Par], based on the work done this spring, but that survey has later been postponed until the fall of 2006.

Preface

This report is a Master's Thesis at the Department of Computer and Information Science (IDI) at the Norwegian University of Science and Technology (NTNU). It is a part of the Software Engineering group's work with Quality Assurance and Process Improvement, and is a continued work from a student depth project called *An Investigation in Attitudes to formal Quality Management Systems* [Ber] written in 2005.

I would like to thank my supervisor, professor Reidar Conradi, for help throughout my last year at NTNU, and for the help with defining the thesis. I would also like to thank professor Torbjørn Skramstad, professor Tor Stålhane, Ph.D. students Finn-Olav Bjørnson, Carl Fredrik Sørensen and Magne Syrstad, for help with the evaluation and development of the questionnaires and report.
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Trondheim, June 2006

Andreas Mathias Berg

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Chapter 1

Introduction

Software systems are getting more complex, and the need to ensure quality in the process of developing new software seems more important than ever. The last 10-15 years there has been a lot of focus on formalizing routines and processes in the software industry, which has resulted in extensive systems describing these in a formal matter, so-called Quality Management Systems (QMS). A variety of such systems exist, reaching from the rather informal guidelines, to very strict formal procedures with extensive descriptions. How do developers and managers who are using such systems react to them, and what are their attitudes towards formalizing their work?

1.1 Context for this thesis

This report presents some important theory on this subject, and also some previous work done in this field. During the fall of 2005, the author of this thesis delivered a student depth project at NTNU. That project consisted of a qualitative empirical study where quality managers and developers in a sample of Norwegian software development companies were interviewed. Some of the theory presented in this thesis is based on that study, and the results from that project is also the base for the Research Questions (5.1) presented in this thesis.

1.2 Thesis objective

To gain a better understanding of the work being done in the field of software industry with regard to quality assurance and process improvement. Perform a quantitative survey towards a range of software developing companies in Norway. Perform a large survey as an internal survey at EDB Business Partner in the spring of 2006. (This has later been postponed due to internal issues at EDB Business Partner)

1.3 Thesis structure

The structure of the report is as follows:

- Chapter 2 presents theory in the field of quality and quality management and also presents some of the previous work done in the area.
- Chapter 3 gives a brief presentation and summary of the research methods used for this thesis.
- Chapter 4 elaborates more about the context for the thesis, and a presents a small field study performed as a preparation for the main survey.
- Chapter 5 presents the main Research Questions for the thesis, and also the specific questions used in the survey.
- Chapter 6 is a presentation of the results from the survey, with discussion of the key findings and the Research Questions.
- Chapter 7 discusses four aspects validity for the study.
- Chapter 8 gives the conclusions for the thesis, and also proposes some future work that may be interesting to look into.
- Appendix A includes the questionnaires used in the survey.
- Appendix B includes the raw data plots made anonymous.

Chapter 2

Background Theory

This chapter gives a theoretical background for the thesis, and defines some of the most important expressions and areas that the thesis embrace. First we give some definitions of the term "Quality", since the wish for increased quality is the foundation for the whole thesis. The chapter then continues by defining the area of "Knowledge Management", an area which has had an important role in the development of "Quality Management" and "Quality Management Systems", which is explained in the following section. We then present some central, both traditional and more recent methods for developing software. These are not methods for quality management per se, but will still affect how both developers and managers work, and are therefore important for this thesis. "User participation" is a concept that the software industry have adopted, and these concepts are important for how QMS's are both implemented in the organisation, and for how they are updated, which will probably have an effect on the attitudes towards this.

Since people began working with formal routines and Quality Management Systems, there have been efforts trying to observe how these are used in the everyday work. Still, a lot has happened since this work was done, and there have been few efforts in observing how the formal routines are treated by both employers and employees the last five years. One would believe that the widespread use of web based tools may have increased the usage of such systems, since information now is a lot more available in the work situation. One could also believe that the stronger competition for market shares in the computer industry and software engineering industry would lead to the need of formal routines to ensure the quality and effectiveness of the companies. This section will look at some of the previous work done in this field in Norway, both in the software industry, and also in a couple of other areas.

2.1 Quality in General

The term **quality** is a term that almost everyone uses, in different ways and with different meaning. There have been many efforts trying to define the term, and one of the most widely accepted is the definition of the International Organization for Standardizations (ISO). The ISO 8402 standard states the following, which is the base for how the ISO 9000 series approaches the term:

> Quality: The totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs. (ISO 8402 [IOoS00])

The following subsections will give further descriptions of quality, and connect this with software and software development. It will also give a brief description of the ISO 9000 series, TickIT and the Capability Maturity Model (CMM), to give examples on ways of judging quality.

2.2 Knowledge Management

In this section we try to define what actually lies in the term knowledge, and give some ideas to why this is relevant when dealing with quality management and Quality Management Systems.

There exists different kinds of knowledge, and there exists different classifications. It is usual to operate with two different kinds of knowledge, namely *explicit* knowledge and *tacit* knowledge. The explicit knowledge is the formalized knowledge, and is typically what you will find in manuals, process descriptions or models. Tacit knowledge is skills that a person may have, but that may be difficult to share, and thus make explicit [NT95]. To gain new knowledge, there are several different methods one can use. These are illustrated in figure 2.2, and they are here described shortly.

Socialization in which often is considered to be the most important. It is direct contact between people, and will often include group activities where two or more people cooperate in a social interaction. This method is good for bringing tacit knowledge from one person to another, but usually still keeps the knowledge tacit.

Externalization which is a way to make tacit knowledge explicit. This may be done by observing and abstracting knowledge from socialization "events".

Combination is a when you combine different explicit knowledge to make or retrieve new knowledge. This may be done by combining different documents or sources of information, and then reasoning about this. An example may be to do a study and then write a report of this study.

Internalization is learning from explicit knowledge, and making this tacit. This is what is largely done when reading examples. It is often not exactly how things were done in that particular case, but rather to gather an understanding of the underlying mindset and way of thinking. Also, a learning by doing procedure is a way of internalization.

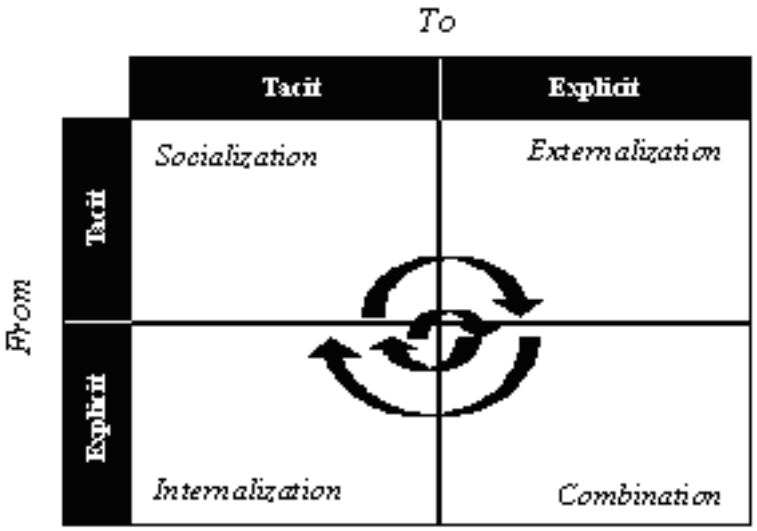

Figure 2.1: Different ways of transferring knowledge

For knowledge and experience to become useful in a company or an organization, they have to be available to the potential users. The availability is partly dependent of the direct costs needed to retrieve and use the knowledge, whether it is explicit in a document or tacit in someone's mind [LM88].

The reason why knowledge is important in the settings of this project, is that improving the process of learning in companies, and also securing that knowledge is available in the company, is seen as very important. This is also some of the underlying reasoning for making Quality Management Systems, which will be explained next.

2.3 Quality Management Systems - QMS

This section will deal with some of the basic concepts of a Quality Management System (QMS). It will connect this term to the ISO 9000-series, and explain some of the requirements for a QMS used in SD.

2.3.1 What is a QMS?

Quality Management Systems (QMS) is a collective term for methods and techniques developed to ensure the quality of products and processes in a company. It's usually represented as a formal set of process descriptions and routines that the company wants their employees to follow. A QMS can often be seen as existing of three parts that altogether makes up a complete QMS [Aun00]:

The documented QMS which means all documented routines in the company, job descriptions, quality handbooks etc.

The formalized QMS consists of both the documented QMS and other non-documented routines in the company. This may be internal meetings where quality issues are discussed, appraisal interviews and so on.

The practical QMS which contains the former two, but also includes the "how we do it"-aspect, which is non-documented and non-formal routines that may evolve in a company. This is the culture, norms and rituals that exists in the company, and therefore also a great part of what influences the quality of it's processes.

There are various different standards for making formalized QMSs, and each company has to perform an individual fitting of such a standard to support their development and production. In this thesis report, the focus will be on QMS made for software development, but all kinds of companies may introduce a QMS, independently of their business domain. For the rest of the report, when the abbreviation QMS is used, this will refer to the formal part of such a system, that is the documented part and the part that is implemented through formal methods. An interesting aspect to examine, which also was a part of the study performed by the author in the fall of 2005 [Ber] is whether there is a conflict between any of the parts of the QMS. How are the two first parts, the documented and formalized QMS, and the latter, the practical QMS compared to each other, and how much does the actual routines differ from those described in the QMS?

Why use a QMS?

There are many reasons for why companies develop and implement QMS for their development process. Some of the main reasons are:

- There may have been various methods used in different parts of the company.
- The company may have merged with another company, and wishes the different parts to follow the same standard.
- There may be a requirement from their customers that they can document their processes.

2.3.2 Quality and the IS0 9000 Series

The ISO 9000 is a series of standards for ensuring that all the specified requirements given by a customer is delivered. It consists of a range of standards that apply to all kinds of organizations in all areas. They give guidelines and requirements for implementing a Quality Management System in the organizations. ISO 9001:2000 (last revision 2000) gives the requirements, while ISO 9000 and ISO 9004 describes guidelines for how to implement the requirements. The revision that was carried out in 2000 was actually a merging of the former ISO 9001, 9002 and 9003. The new standard is considered to be more flexible, thus giving more freedom to the companies that use the standard. It also takes on a more customer oriented approach, and puts customer satisfaction as the overall goal. The ISO 9001:2000 standard consists of five parts with requirements. Analysis of the 9001:2000 standard has revealed that this contains 21 clauses, that each describes processes in a company that must be covered in a QMS to obtain an ISO certification [Lim]. Since a further comparison of these standards are beyond the scope of this thesis, the two lists of clauses are left for comparison.

21 clauses of the ISO 9001:2000
1. Quality Management Process
2.Resource Management Process
3. Regulatory Research Process
4. Market Research Process
5. Product Design Process
6. Purchasing Process
7. Production Process
8. Service Provision Process
9. Product Protection Process
10. Customer Needs Assessment Process
11. Customer Communications Process
12. Internal Communications Process
13. Document Control Process
14. Record Keeping Process
15. Planning Process
16. Training Process
17. Internal Audit Process
18. Management Review Process
19. Monitoring and Measuring Process
20. Nonconformance Management Process
21. Continual Improvement Process

All these processes must be covered in the QMS, and they should be documented both on account of design and implementation of the processes, as well as the monitoring, control and improving of these processes. Each process has input

and output, which connects them to each other [Lim]. After implementation of such a system, the organization may me certified by an auditor company licensed by the ISO-organisation. Thousands of companies and organizations around the world are certified after the ISO 9000 series, and in some business areas, certification is mandatory. In addition to these general standards, there are variations and specialized standards for different areas. The next subsection will introduce ISO 90003:2004 which is specially adapted for use in software development organisations [NT95]. The ISO 9001 standard has become a de facto standard for many industries, and it is the most widespread formal certification of Quality Management Systems.

Quality in Software Development - ISO 90003

The ISO 90003:2004 is a modification of the ISO 9001:2000 standard, so that it fits better applied to organizations dealing with the development of computer software. This standard contains special guidelines how to implement a QMS after the 9001:2000 standard, and is not intended to be an assessment criteria on it's own. It does not change the requirements from the full standard, but identifies important issues that should be addressed when implementing a QMS for software development. These issues are independent of both the technology platform and methodologies used [fSI].

TickIT

TickIT is a certification scheme made as a supplement to the ISO 9001-standard to support IT companies. It gives special guidelines to how such companies may adapt to the ISO 9001 standard, and how they should regard special issues connected to IT. A company may be certified according to this scheme, but it's main purpose is to aid auditing companies in their work when evaluating IT companies for ISO 9001-certification [BSI].

2.3.3 Capability Maturity Model - CMM

The Capability Maturity Model has it's origin from the Software Engineering Institute of Carnegie Mellon University. It is a framework that aims to make the software development process less chaotic and more standardized. It does this by defining five levels of maturity that a company may achieve for their development process. The five levels are shown in figure2.2. Each level gives requirements for the company, and builds a foundation for further development towards the next level [PCA+91].
The five levels are:
1) **Initial** - The software process is characterized as ad hoc, and occasionally even chaotic. Few processes are defined, and success depends on individual effort.

2) **Repeatable** - Basic project management processes are established to track cost, schedule, and functionality. The necessary process discipline is in place to repeat earlier successes on projects with similar applications.

3) **Defined** - The software process for both management and engineering activities is documented, standardized, and integrated into a standard software process for the organization. All projects use an approved, tailored version of the organization's standard software process for developing and maintaining software.

4) **Managed** - Detailed measures of the software process and product quality are collected. Both the software process and products are quantitatively understood and controlled.

5) **Optimizing** - Continuous process improvement is enabled by quantitative feedback from the process and from piloting innovative ideas and technologies [fSE99].

The idea behind CMM is that there exists a best practice, and that one should find this, and make it repeatable for the development process. Since it's creation in the beginning of the 1990s, the model has had success in many software development companies around the world. There have also been critics claiming that this vision of "best practice" gives managers and executives false illusions, and that the theoretical basis for CMM is too weak [Bac94]. Further discussion of the CMM standard is beyond the scope of this project.

2.4 Methods for Developing Software

For some time, software development was seen as a more or less sequential process. Projects have been divided into phases, with a logical and strict chronological order. First there was the planning, then the requirements were collected and specified, before the system was designed and then implemented. Then testing was performed, and the final product was delivered. This linear method is often called the waterfall method as described by Royce [Roy70] in 1970. It has since been developed and expanded to include iterative variations, and "back-loops" to previous phases, but still, it remained pretty unchanged and the reigning standard for a long time. The last 10-15 years though, new methods for software development have erupted and to a large extent replaced this. This section presents some of these new methods and frameworks that have had most impact on how software are developed, and therefore also on how quality is maintained. The two methods presented are called eXtreme Programming (XP), and the Rational Unified Process (RUP).

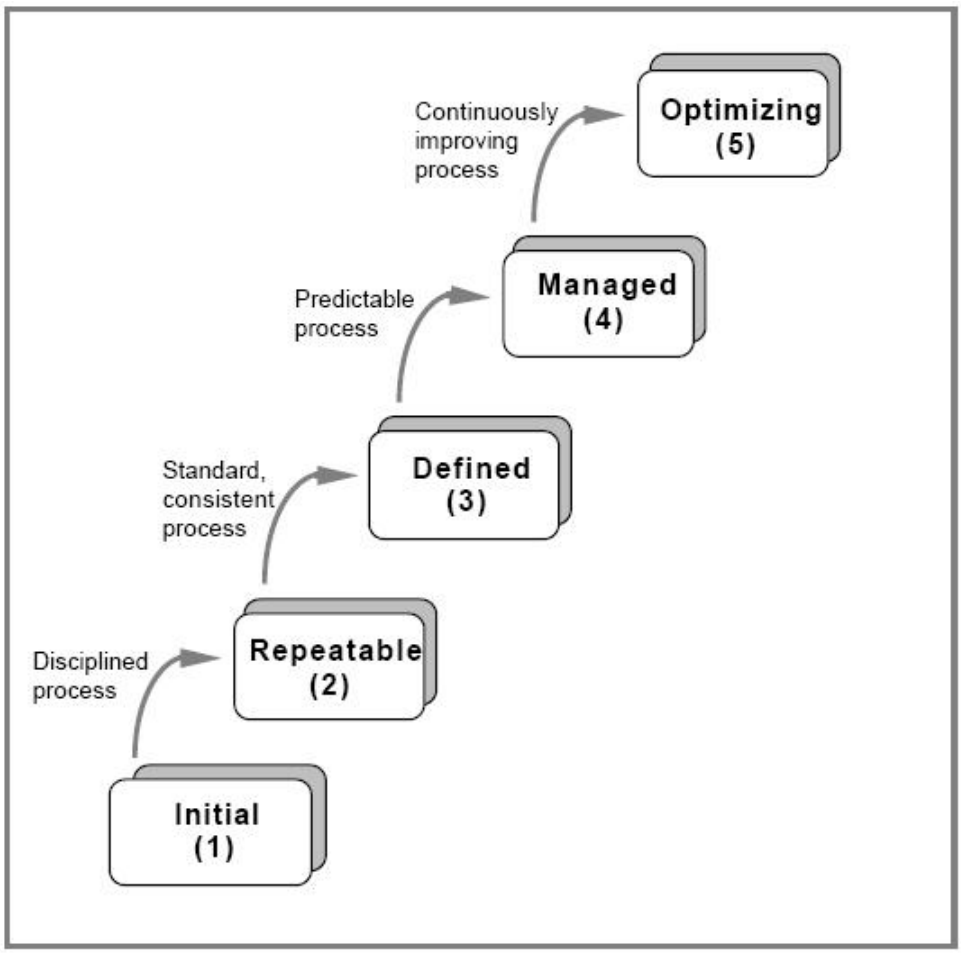

Figure 2.2: The five levels of the CMM framework

2.4.1 Agile Methods - eXtreme Programming (XP)

The last 5 years or so there has been an increasing focus on so-called agile methods, where the goal is to make the development process smoother and less formal. One of the most popular approaches to this, is the method called eXtreme Programming or just XP. It was first introduced in [xpe00] by Kent Beck, and has since had a growing popularity for it's way of thinking and doing things.

XP is based on four ground values: communication, simplicity, feedback and courage. They shall function as principles throughout the whole project, and is the foundation of the method. The values has been used to develop some techniques and practices that will be briefly explain under:

User Stories are short descriptions that a future user writes to describe a function from a users point of view. This is used as a base for implementation,

and is verified by the use of acceptance testing.

The planning game is a process to prioritize the user stories, and make a list of which stories to be implemented. In this process, the effort of implementing these shall also be estimated. Each story is broken down into tasks, and when the effort is calculated, and the tasks made, the customer will decide which stories that will be implemented.

Customer involvement is a crucial part of XP. The customer shall be involved in all decisions made, and shall be told of everything that is happening. This requires quite a lot of resources from the customer, but the idea is that close cooperation with the customer will improve the quality of the finished system. In his book [xpe00], Beck suggests using so called expert users as contact persons.

Planning for change is a sort of motto for XP. The claim is that changes will happen, and there is no reason not to be prepared for it. To plan for change, decision will not be taken until it's necessary, but will not be delayed when there is a need for such. By making every process simple and flexible, XP aims to allow this.

XP utilizes a test-first approach, which means that tests are written before the implementation, based on the user stories already described. There shall be written both unit tests, which tests technical functionality, and acceptance tests for user acceptance.

When programming, XP uses a technique called pair programming, where developers sit in pairs with a single computer, where one of them is programming, while the other continuously is checking the code for errors. This way, all code written will be reviewed immediately, and also, the learning process will be supported through the socialization factor. Claims have been made that this is an expensive practice, but [WKCJ00] refutes this by stating that this practice gives higher work satisfaction, and also increases quality. It also claims that this results in a higher development speed.

In addition to this, XP aims to support short release cycles and an iterative development process, where there are many smaller releases, instead of waiting until the whole product is finished. It also utilizes the possibility of using already existing components, so-called "commercial off-the-shelf" (COTS).

2.4.2 Rational Unified Process

The Rational Unified Process (RUP) is a framework developed by Rational. It's goal is to provide a flexible framework for iterative development of software sys-

tems. It is a product of Rational, and is based on the Unified Software Development Process [JR99]. Compared to the waterfall model mentioned above, RUP is cyclic, and there may be many iterations of each cycle. Each cycle is divided into four phases, which again may be divided into iterations. The four phases are:

Inception which may be compared to the first couple of phases of the waterfall model. Analysis of the business and requirements should be performed in this phase.

Elaboration is a further study of things discovered in the inception phase. One now performs detailed analysis and design, and also perform prototyping.

Construction is the phase where the actual implementation takes place. This phase is quite similar to the implementation phase of the waterfall model.

Transition is the last phase, which contains testing and release of the final product. This phase also contains debugging and the finishing of the product.

As mentioned, each phase may be divided into iterations, who's goal is to provide small increments along the projects, with feedback all the way through the process. The number of iterations will vary based on the size and complexity of the project. RUP also utilizes the Use Case Diagrams which is connected to the Unified Modelling Language [Fow00] as logical modeling blocks. The last five years, RUP has gained popularity for it's simplicity and freedom, and a lot of companies have adopted the framework as a replacement of the waterfall model.

2.4.3 Why these Methods are important

The reason why the methods mentioned in the two last sections are important for this thesis, is because they affect how developers work, and may also affect how the quality assurance issue is handled by the management. Both methods have measures in which aim is to ensure quality of some or all parts of the development process. They are, however not QMS', since the mentioned methods does not cover issues like knowledge transfer and aspects other than those directly connected with the development. As concluded in [Ber], it is not necessarily a conflict between such a method and a formal QMS, but how such a method is implemented with a QMS may become an issue.

2.5 User Participation

User participation is a concept that has long roots in Scandinavian industry, and workers influence over their own workplace is something that is seen as important for how the society works. In software development, this concept

is based on the assumption that choices made during design and implementation of new technology should be based on input from the people who is going to use it. The idea has it's origin in the workers unions, and the work done by Kristen Nygaard and his companions in the 1970s, and it have gained a lot of impact over the years. In the making of Quality Management Systems, this concept is also highly relevant. A system that will be giving details on how specific tasks should be performed, should also be shaped to some extent by the people who will be using the system later ([WE96]). Software developers are experts in their jobs, and as stated in [CD01], they are therefore also experts in how to improve their work. It is therefore reason to believe that having a high degree of employee interaction, both in the process of making the QMS, and updating it, will have a positive effect.

2.6 A study of Formal Routines for Knowledge Transfer

UNOPROS [CF99] (Norwegian acronym for survey about Process Improvement), was done as a project by two Software Engineering Master students the spring of 1999. They performed a study and a survey done as interviews towards five Norwegian software developers. Their aim was to explore how formal routines developed for software engineering were regarded by both developers and managers. They wanted to examine how formal routines were efficient as tools for knowledge exchange and knowledge transfer inside an organization. To do this, they studied different variations of knowledge, how these were defined by various experts in the field, and how this could be related to software engineering. They then explored some different standards and paradigms for how to judge quality and processes of quality assurance. Some of this theory is also explained in this report in Section 2.1.

The survey itself focused on four categories of questions. These were:

- Knowledge of routines
- Use of routines
- Updating routines
- Routines as tool for knowledge and experience transfer

The two students then analyzed the results of the interviews and categorized the responses.

On the account of knowledge about the formal routines, they experienced that both developers and the quality managers had good knowledge about the contents of these, and they were also united in their answers to why they had the formal

routines and how they were to be used. When questioned how the routines were introduced in the organization though, the developers and the managers had different views and understanding of how the routines had come. Most of the managers had a clear perception of how this was done, while just 50 percent of the developers had this knowledge. When asked how they felt about the routines, most of the managers were quite satisfied with the routines, while the developers were a bit more varied in their responses. One of the developers even said:

> "10% of the routines are sensible, while the rest just is nonsense."

There seemed to be a common understanding among the developers that the routines were time consuming and made their daily work ineffective.

When asked in the second category, how the routines were used, answers showed that the routines mostly were looked upon as a positive mean as to secure the quality of their work, but there were also some developers that didn't like routines at all. From the managers point of view, they regarded the routines as useful, but were also aware of the attitudes of some of the developers. When asked in what extent the potential of the routines were utilized, the interviews revealed, not surprisingly, that some of the formal routines seldom were used, but that in general, the use of routines were widespread in the organizations. The interviews also revealed that it was the recently employed developers that most frequently used the routines, while the more experienced developers tended to do things "their own way".

The availability of the formal routines varied a lot in the different companies involved in the survey based on what method or technology that was used. There were also quite distinct differences in how the use of routines were followed up by the management. When questioned, almost none of both the developers and the managers answered that the follow-up was varying inside this company, but when seen in the broader perspective, one may conclude that this indeed is the case.

The third category was how the routines were updated and revised. This category showed that many of the developers were unaware of how routines could be updated, and whether they themselves were allowed to suggest changes. Some of the quality managers also stated that they indeed had no procedures for this operations, but that they used project evaluations for this. Both developers and quality managers had the impression that all the involved parts of a project should participate in revision activities.

The final category that the UNOPROS project discusses is how the formal routines functions as a base for knowledge and experience transfer in the organization. This showed a gap between what the developers stated and what the quality

managers assumed. While most of the managers consider written formal routines as a good medium for knowledge transfer, the developers looked upon this form as bothersome and inefficient. When asked what kind of medium they considered to outdo the written routines, social arrangements and experience bases such as online newsgroups were suggested. When asked what they considered to be the most important barrier for effective knowledge transfer, some of the issues given were communication between employees, low priority from the managers, time and the organizational culture.

The project report ends with some suggestions for further work in the field. They suggest a study where the focus should be the effect of other factors that may increase the use of the formal routines. Such factors may be: perceived advantage, former experience with the use of formal routines, work habits and the culture in the organizations. In that way one should be able to map the most important factors, and thus the companies may have specific actions to implement in their organizations. The report also suggests performing a thorough investigation to determine why many developers consider formal routines useful in their daily work, but consider them less useful as a channel of knowledge transfer.

An article was written in 2001 as a result of the data analysis performed in UNOPROS [CF99] and the SPIQ [Con96] project. It was written by professor Reidar Conradi and Tore Dybå. This article may be seen as an extension of the student project, and one of the areas the students suggested for further work in their report [CF99]. The article focus on formal routines as a medium of knowledge transfer.

2.7 Study of Quality Systems in Different Industries

In 2002, a student group from NTNU performed a survey where they focused on the attitudes towards formal quality assurance systems in different industries. The survey was done as a project in the subject "Experts in Team", where students from different disciplines come together to solve a problem or perform a study in a particular area. The whole group, or "village" consisted of 21 students, and these were divided into four teams. Each team should do a survey towards one particular company in an industry. The goal of the project was divided into three sub goals or research questions:

- Investigate attitudes to formal quality assurance systems regarding age, seniority and position in the company. They should also investigate if they could find other parameters for that particular industry or company

- Reveal how participation in the process of implementing, maintaining and revising the quality system affects the attitudes that are observed towards the system.
- Examine whether each employee feels ownership towards the quality system, and observe how they experience this in their daily work.

The survey itself was performed both as a questionnaire that was sent to the different companies, and interviews performed at site. The conclusions for this project was that age and seniority was of little importance for how employees used the QMS. When regarding the second research question, the report was rather in-conclusive, and there were big differences between the different industries, and also within the certain industries. This, however, don't make it any less interesting to further investigate this aspect in this thesis. The last research question deals with how the employees feel about the formal QMS and if they have ownership to this. On this question, the report concludes with that most of the respondents felt ownership towards their own work, and that they felt that the QMS was a helpful tool in their work. Still, the report asks a question to whether the QMS is really an effective mean of securing quality, or if it has a larger unused potential.

2.8 Study of ISO 9000 Certification

This article [TS95] is written in 1995 by two employees of Det Norske Veritas (DNV), a Norwegian company specialized in different certifications and verifications. DNV were also amongst the first companies to provide ISO 9001 certification in Norway. The authors, Cecilie Løken and Torbjørn Skramstad, performed a study towards a variety of European ISO 9001 certified software developers. The study indicated that many of the companies experienced problems with some of the areas covered in the standard. These were mainly problems with management attention and motivation, and concerns with planning and administrative work. The study was performed by looking at reports from audits of the different companies, and statistical methods were applied. They distributed the nonconformance over the 20 clauses in the ISO9001:1994 shown in the list beneath.

1. Management responsibility
2. Quality System
3. Contract Review
4. Design Control
5. Document and data control
6. Purchasing
7. Control of customer-supplied product
8. Product identification and traceability

9. Process Control
10. Inspection and testing
11. Control of inspection, measuring and test equipment
12. Inspection and test status
13. Control on nonconforming product
14. Corrective and preventive action
15. Handling, storage, packaging, preservation and delivery
16. Control of quality records
17. Internal quality records
18. Training
19. Servicing
20. Statistical techniques

The studies showed that the major defects usually were most likely to appear among clause 1, 3, 4, 9 and 14, and some of this pattern was found also when tracing the minor defects, although these were more evenly distributed. The article also covers which of the clauses the companies found most difficult to implement and which was most/less useful for them. Not surprisingly, the ones with a high degree of defects, also scored high on difficulty, and also in what the companies considered to be most useful. Clause 14 is considered as one of the most important, but is also one of the clauses where they found the most nonconformance. As one can see, these 20 clauses are not the same as the 21 clauses found in ISO 9001:2000 described in 2, and are not as general in their form. As mentioned, making the standard more general, and that way also more flexible was one of the goals of the new revision.

2.9 Applying the Theory to this Thesis

This chapter have presented a lot of theory and earlier work done in the field of Quality Management Systems. First we defined some of the fundamental terms and expressions when talking about quality and quality management, before we gave an actual definition of what a QMS usually consists of. We then presented some of the most applied formal standards for such systems, such as the ISO9001 and the Capability Maturity Model. How software is developed does not just depend on the QMS, but to a large extent, this is also related to the development methods utilized by the company. Some of these were presented and discussed in this chapter. These were methods not necessarily directly connected with the QMS, but it will surely affect how the software is developed, and is therefore of importance to this thesis. Another thing which may affect how both developers and managers regard the QMS, is how the user, or here mainly developers are involved in both the design, implementation and revising of the QMS. This was

briefly discussed in Section 2.5. The chapter then continued by presenting some of the efforts which has been done in the field of QMS and attitudes to such in the past, which all are of great importance for this thesis. In the next chapter, we will further investigate the context for this thesis, by presenting a field study performed towards some of the central organisations for Norwegian software industry. Chapter 4 also presents main findings from the depth study done in 2005 [Ber].

Chapter 3

Relevant Research Methods

This chapter defines and explains some of the central concepts of this thesis. It gives some information about surveys and statistical methods that may be applied to the results of such empirical studies.

3.1 Survey

Surveys are a method of performing empirical studies, that often aims to generalize over the population where the sample was taken. There are different ways of conducting a survey, and different kinds of surveys. One often divides the motivation for surveys into three different categories ([Bab90]):

- Descriptive, which aims to determine certain properties in the population.
- Explanatory, which main goal is to understand why a distribution has become the way it is.
- Explorative, which often functions as a pre-study for a more thorough investigation. An example of this is the depth project performed by the author in the fall of 2005 [Ber].

Often, a survey is performed either by conducting interviews, or by using questionnaires. A combination of the two is also possible. A survey may be *q*ualitative or *q*uantitative, as described in the next subsections.

3.1.1 Qualitative Surveys

Often, a qualitative survey may be performed as an initial survey or a pre-study to a larger survey, where depth interviews are performed, and the results from this is used in the development of a larger quantitative survey. The questions used in a qualitative survey are often general, and not necessarily as well defined and admissible for statistical analysis.

3.1.2 Quantitative surveys

A quantitative survey generally focuses on more respondents, and questionnaires where the respondent are given defined options, often represented as multiple choice. This is very practical when we want statistical outcome, since such quantitative data is well suited for application of different statistical methods, some of them as mentioned in 3.2.

3.2 Statistical methods

In this section we present some of the statistical methods used in the analysis of the survey, including the T-test and ANOVA. These are both parametric tests, which assumes that some of the parameters involved in the test are normally distributed [WRH+00]. They also both operate with null hypotheses, and is based on calculating the average of data sets and comparison of these. To perform and present the results from these test, we will use Microsoft Excel 2003.

3.2.1 T-test

The T-test is used to compare two sets of data and to find if there are a significant difference between the two. This is done by using the average-values of the two samples. One then uses these averages and their variances to decide whether or not one may reject the null hypothesis. A T-test may be performed as a one-tailed or two-tailed test, where one-tailed may answer the question "Is one larger than another?", while two-tailed may answer "Are they different?" [WRH+00].
When performing a T-test, we form two hypothesis, H_0 and H_1, where the first is a null hypothesis in which we ideally wish to dismiss, and H_1 is our hypothesis that we want to say something about. By first finding the mean values of the two samples we want to compare, and then finding their variances. We may then calculate the so-called t-value by the formulas showed in Figure 3.1. Then we may found the probability (P-value) that our results are just a coincidence. We set a limit for this P-value to 0.05, which is also called the level of significance. If we get a P-value below 0.05, we may dismiss the null hypothesis. Microsoft Excel have a built in function for calculating the P-value based on the plotted data, and this is what we have used in this thesis.

3.2.2 ANOVA - ANalysis Of VAariance

This method may be used when there are more than two sets of data to be compared, and is pretty similar to the T-test. It uses the average values of the different data sets, and their variances to possibly reject the null hypothesis. Since we have not used this method in the thesis, due to lack of data, it is not

$$t_0 = \frac{\bar{x} - \bar{y}}{S_p \sqrt{\frac{1}{n} + \frac{1}{m}}},$$

$$S_p = \sqrt{\frac{(n-1)S_x^2 + (m-1)S_y^2}{n+m-2}}$$

Figure 3.1: Formulas used in T-test

described further, but is mentioned, as we planned to use it, had the number of responses been large enough.

3.3 Application of the Methods

This thesis presents a quantitative survey, where we have used T-tests for analysing some of the results. Unfortunately, the result set are smaller than we had anticipated , so the use of such statistical methods are rather limited. In the next chapter we will present more about the context for the thesis, and what is being done in the area of quality management and process improvement in today's Norwegian software industry.

Chapter 4

Research Context

This chapter gives a description of some of the work in that is being done in the field of Quality Management and Process Improvement in Norway today. This is done by presenting a small field study performed as a part of this Master's Thesis, where some central resources of Norwegian software development were interviewed about the subject of Quality Assurance and QMS. It also gives a brief presentation of the results found from the depth study performed by the author in the fall of 2005. Finally, this chapter presents briefly a planned internal survey in EDB Business Partner.

4.1 Field study - Norway

The last years the software industry has gone from a strictly competitive industry towards a more open and collaborative one. This may be seen in the Open Source movement that has had a great impact on the whole industry, but also from the evolving of trade and interest organisations where inter-company relations are made, and aspects of the trade discussed and developed. This also includes questions concerning software quality, quality assurance and process improvement. In Norway there are various such groups, and a part of the work with this thesis, was to see what work is being done in these groups, and to find what trends are reigning in the industry when talking about these issues. Beneath is a short description of the different organisations contacted.

4.1.1 The Norwegian Computer Society

The Norwegian Computer Society (Den Norske Dataforening) is maybe the oldest and most renowned of these organisations in Norway. Since the beginning of computer industry in Norway in the 1950s, they have existed and worked to maintain a network for IT professionals. They have nine regional unions that work locally and many national expert groups for the different areas within the

computer industry. Among these are the group most relevant for this work, namely the group for Software Quality Management or SQM.

4.1.2 ICT Norway (IKT-Norge)

ICT Norway is an organisation with more than 300 IT companies as their members. They work with connecting IT companies with each other through a trade network, where knowledge and experience will be available for more people. I addition to this, ICT Norway functions as a communication channel between the IT industry and other instances, such as the academic environment, central authorities and other industries. As a part of this work, ICT Norway have many projects that deals with various challenges for the industry. Among these, we find the project REFLEKS, which is an ongoing project directly aimed at process improvement within software companies, both to increase their customer relations, but also to improve the quality of their products. The project members are companies that make software for sale "Off-The-Shelf".

4.1.3 Questions for organisations

To gain a better understanding of some of the main challenges and focus areas in Norwegian software industry, we wanted to perform short interviews with people from the organisations mentioned above. The questions asked were general questions about what they regarded as the most important issues concerning quality assurance, and also about their organisations work.

FS1 What are the goals and visions for the group's work

FS2 What seem to be the greatest challenges for quality assurance and process improvement in Norwegian software industry?

FS3 In what way are the companies directly involved with the group's work?

FS4 In what way are you directly intervening in the companies' work?

FS5 Have the work changed during the last years, after the market collapse in 2001?

FS6 How have new technology like the Internet and better communication affected the group's work and the general work for improving quality?

FS7 What are your opinions on formal certifications and assessments like ISO, CMM, SPICE etc..?

FS8 What do you think will be the trends in the next years in this area?

In the next couple of subsections, their answers are presented without any further discussion. Then, both respondents' answers are discussed and compared briefly.

4.1.4 Answers from ICT Norway

Answers from Rolf Pettersen, project manager for ICT Norway's project REFLEKS for Norwegian software developing companies.

What are the goals and visions for the group's work?
The purpose of the project is awareness raising and experience transfer and to obtain actual improvements in software companies by practical process improvements.

What seem to be the greatest challenges for quality assurance and process improvement in Norwegian software industry?
The willingness and ability to give substantial priority and resources to these things in a very busy working day where important customer obligations, typical with a very short time horizon, must be solved. More long time improvement activities are suffering. - To handle principles of continuous improvements in parallel with and as an integrated part of primary business processes.

In what way are the companies directly involved with the group's work?
The companies are performing real life improvements projects in their companies as pilot projects in REFLEKS. They present their practical projects experiences afterwards in project meetings and on the web.

In what way are you directly intervening in the companies' work?
To a very low extent in the companies internal work . I contribute in the project descriptions at the time of establishing contract between ICT Norway and the company regarding participation in REFLEKS. Inform about relevant work done and relevant experiences from other companies.
Have the work changed during the last years, after the market collapse in 2001?
I don't think the process improvement work in companies has changed much. Perhaps the situation can be like this: In real bad times: Can't afford SPI-work. In very good times: Have not time for this. Must earn money while the market is high. So, maybe the best climate for SPI is in medium good times ? This fascinating conclusion is definitely not based on research, just on here and now feelings. Why not investigate it further?

How have new technology like the Internet and better communication affected the group's work and the general work for improving quality?
This is in general of great importance for experience transfer and knowledge management, both within companies and across companies.

What are your opinions on formal certifications and assessments like ISO, CMM, SPICE etc. ?
I think it will be more and more important. But simplifications and downscaling of the methods / frameworks are important, as well as removing misunderstandings about how complex these things have to be.

What do you think will be the trends in the next years in this area?
Se previous question.

4.1.5 Answers from the Norwegian Computer Society

These answers are from Jan Petter Hagberg, chairman in the group for Software Quality Management in the Norwegian Computer Society.
What are the goals and visions for the group's work?
To create software that will help the user, is easy to use and that makes your everyday workday easier and more fun.
To create a repeatable process that ensures a high quality for all software we make.

What seem to be the greatest challenges for quality assurance and process improvement in Norwegian software industry?
The problem as I see it is that we are mostly small companies with few people and because of that many persons have many roles. They work as a developer, architect, quality assurance (QA), process responsible etc. I think there are many people interested in and engaged in working with QA and process improvement in Norway, but they have to do this besides other tasks like development or project management. To bring the quality or process to a higher level they need to be able to commit working hour to these tasks. This is hard to do when you also have other responsibilities.

In what way are the companies directly involved with the group's work?
No answer

In what way are you directly intervening in the companies' work?
No Answer

Have the work changed during the last years, after the market collapse in 2001?
Not as I know of

How have new technology like the Internet and better communication affected the group's work and the general work for improving quality?

What people write on the internet about subjects like QA and process improvement is of great inspiration. Information on the internet is easy at hand. Communication with other offices is easier with MSN (we work a lot with Japan, Trondheim etc).

What are your opinions on formal certifications and assessments like ISO, CMM, SPICE etc. ?
Due to my answer above about people and many roles, I think that for Norwegian IT-workers/companies, these certifications and assessments demands to much. They work as an inspiration for what we should reach for. There are differences between consulting companies and in-house development/software houses. Consulting companies may have a customer that demands the use of CMM, ISO etc, while in-house development/software companies decides themselves how they will implement their quality routines/processes and because of that chooses a simpler or less time consuming approach.

What do you think will be the trends in the next years in this area?
It seems that focus on QA and process improvement are more important than ever before. While a developer 10-15 years ago could focus just on programming, (s)he should now be familiar with and have skills in QA and working methodology besides developing.

4.1.6 Discussion of results from the field study

As we may see, one thing that both respondents say, is that one of the main challenges is to get people to use of their time to think about quality assurance and process improvement. In a hectic and sometimes stressful industry, such tasks may easily be downgraded as being time consuming and not that important for progress. Hagberg points out that many developers today have many roles in the same company, which may clutter otherwise clear responsibilities. We also see that the two have quite different views concerning formal certifications, where Hagberg sees this as too demanding and not very helpful in actually functioning as intended, while Pettersen claims that such formalizations may become more and more important, though he also emphasizes the importance of downscaling and fitting such standards to the company in which it should be used. As concluded in the depth project in 2005 [Ber], Hagberg also makes out the difference between consulting companies and what he refers to as in-house development or software houses. Both respondents emphasize the importance of Internet, both for their own work and for general quality work.

4.2 Results from Depth Study - 2005

The project performed in the fall of 2005 was a qualitative empirical study based on the three following research questions:

R1 Are developers negative to routines and formalities in the QMS?

R2 Are there conflicts between the different parts of the QMS?

R3 Do formal certifications increase quality?

By conducting interviews with a small selection of developers and quality managers, the author found the following observations, which makes some of the base for this thesis:

4.2.1 R1 - Are developers negative to routines and formalities in the QMS?

Most interviewees reported that they thought of the system as too cumbersome to use in the daily work situation. The developers reported that they were positive to the training they received in the use of the QMS, while the quality managers interviewed said that it was not good enough. Whether a better training would increase the use of the QMS or not is difficult to say, but is an interesting area that will be further investigated in later in this thesis

In general, developers working in consultancy agencies were more positive to the QMS, and they also reported using the QMS more often than developers in the other companies. This might have to do with their work being more focused on customer relations and working with shorter projects. A closer look at these aspects are therefore also a part of this thesis.

A thing that was reported was that developers seldom were strongly involved in the updating of the QMS, something which clearly will affect how they feel about it, and also their interest in using it.

4.2.2 R2 - Are there conflicts between the different parts of the QMS

As mentioned in Section 2.2 about knowledge, it is possible to separate between the different parts of the QMS. The interviews performed in 2005 revealed that developers seldom do direct lookups in the formal documented part of the QMS, which may imply that there are conflicts between the different parts. This may be connected to how knowledge are transferred in the company as mentioned in

2.2.

This question showed to be difficult to further investigate, and thus it is not a central part of this thesis.

4.2.3 R3 - Do formal certifications increase quality?

While earlier studies have shown that certification after formal quality standards were popular in the 1990s ([TS95], [CF99]), the report from 2005 concluded otherwise. Of the 10 companies visited, only three were certified. All of these were consulting companies, which also supports some of the trends noted in the two previous sections. It seemed that consulting companies in general are more concerned about the formalities, which may be related to their special relations with their customers.

The consulting companies that were certified all reported that the certification was very important to ensure the quality of their work, and that they relied on them. This was true both for developers and managers in these companies. Still, a low percentage of the contacted companies were certified, and it is interesting to find out more about the trends of certification issues.

If it really is a difference between consulting companies and other software producing companies when it comes to the benefits of having a formal certification for the QMS is therefore also something this thesis will try to examine.

4.3 Planned internal survey in EDB Business Partner

As a part of an internal restructuring of their Quality Management System, the Norwegian consulting company, EDB Business Partner [Par] wanted to execute an internal survey of their system. IDI at NTNU was contacted, and it was decided that there was to be performed a gap analysis (developed by Professor Tor Stålhane), and a survey based on questionnaires, founded on the questions in this thesis. In this survey, all of EDB's software developers, around 800 in total, were going to participate. After doing a lot of preparations for this study, it was decided to postpone the execution of the study and analysis until the fall of 2006, and therefore, there are no results from the survey or gap analysis in this thesis.

Chapter 5

Design of the Study

This chapter presents the research questions for this thesis in detail, and explains some of the underlying questions for the survey to be performed. It also presents the questions used in the survey, and what methods were used in the preparation and execution of the survey.

5.1 Research Questions

In the pre-study project performed in 2005, we used the following research questions as a base for the study.

R1 Are developers negative to routines and formalities in the QMS?

R2 Are there conflicts between the different parts of the QMS?

R3 Do formal certifications increase quality?

With the results from that study, these research questions have been refined into the following main research questions which makes the framework for this thesis:

RQ1 Certification today, a must or just more work?

RQ2 Developers vs Managers. A battle for quality?

RQ3 How make a QMS work?

5.1.1 RQ1 - Certification today, a must or just more work?

Many companies use a lot of resources on achieving certifications like ISO 9001, CMM, SPICE etc. Is this a necessity in today's industry, and do such formalizations actually improve the quality of the final products? Won't such strict procedures and routine descriptions just hinder developers and others in their

creative work, and thereby make the company lose money? These questions is a central part of this thesis, and the foundation for R1. Is it still a trend that more and more companies get certifications, or are there other solutions to assuring that routines and processes are satisfactorily implemented?

5.1.2 RQ2 - Developers vs Managers. A battle for quality?

Previous work done in the field of process improvement and quality assurance have shown that there existed a gap between managers and developers in how they thought quality issues should be handled. Is this gap still there, and does a formalization of routines in Quality Management Systems help to decrease this gap? Are managers per definition more positive to formality, and do they have an unrealistic view of how developers actually work?

5.1.3 RQ3 - How make a QMS work?

Why do some companies seem satisfied with their solution, while others have problems with making the QMS work like it's intended? Does employee participation increase the use of the QMS, or will a system made only by the management give the best results? How often should routines and process descriptions be updated, and who should be responsible for these operations? How are developers trained in the use and the content of the QMS? Are they aware of which parts of their daily work that may be included in the system?

5.2 Questions used in the survey

Based on the three research questions, four categories of questions were made for the survey, as shown in Table 5.1. These categories are logically connected by their context regarding the Quality Management Systems, and questions from different categories may all apply to the same research question. Since the survey should be performed on two sets of participants, one which were **quality managers** (or similar role), and the other, **software developers**, two separate questionnaires or sets of questions were developed, with some different questions, and some questions that matched each others to get a base for comparison and analysis. Since the questions also were intended for use in an internal survey at EDB Business Partner (4.3), the questionnaires were in Norwegian. The Norwegian questions are appended in Appendix A.

5.2.1 Refining questions and options

The importance of having precise and clear questions for a survey is very essential for gaining good results. To ensure the quality of the questions a lot of work was

C1	**Knowledge about the QMS**
C2	**Use of the QMS**
C3	**Implementation of the QMS**
C4	**Updating of the QMS**

Table 5.1: Four categories of questions used in the survey

put down in the making and development of these.

Since this thesis is an extension of the depth study from the fall of 2005, we already had some results from some of the questions, and also some experience in how subjects would respond. Still, the study performed in 2005 was qualitative and based on longer interviews, while this thesis is based on shorter interviews with quantitative properties. Therefore, the questions should also be fitted to this purpose. One way to do this is to make the questions more like a questionnaire with more defined answers and checkboxes where the respondents may check the options that suit their answers. This raises a new challenge, namely to find the plausible answers. In this work we have gained a lot valuable input from the interviews performed in 2005, and these have been the foundation for most of the questions and options.

The questions themselves are very much connected with the Research Questions (5.1) and therefore they should also be clearly connected to these. They should also be put in the right order, to make the progression of the interview best possible. In addition the answer options for each questions should cover the most usual answers expected, while still not leading the respondent into answering one specific. The first thing we did was to further analyze both the results and questions used in the depth study. We found that since the survey should be performed on both quality managers and software developers, but we also wanted to separate these two groups, we should make to separate groups of questions for these. It was then important to, while keeping the similarities between these groups for easier analysis and comparison, it was vital that both managers and developers received questions suited for their situation. A draft for a questionnaire was made for each of the groups, and then we performed internal testing of the questions on Ph.D. researchers and professors with an extensive experience from conducting surveys. Their input was very helpful, and after some rounds of improvement, the finalized questionnaires were ready. This process was very helpful, but also required a lot of time. Since the questionnaires also were intended for internal use in EDB Business Partner, the questions were translated from English into Norwegian early in this review process, and it is the Norwegian questionnaires that have been used in the survey. These questionnaires are available in Appendix A.

5.3 Selection of interview subjects

The selection of participating companies for this study is based on a Quota Sampling [WRH+00] of Norwegian companies who develops software, either for internal use, or for sale. This resulted in three main categories of participating companies:
Software producing companies who produces products for sale (Commercial off the shelf, COTS)]
Consulting companies with custom made solutions for each customer
Companies with extensive IT departments with development of internal software

A list of companies, sorted after these categories were made, based on several sources. A convenience sampling were then applied to the list of companies. One of the research questions for this thesis is concerned with how formal certifications such as ISO 9001 affects the Quality Assurance process. Because of this, we also want to ensure that some of the companies participating are certified after such standards, so in addition to the categories above, companies who are ISO 9001-certified according to Kvalex [Kva] were contacted.

5.4 Contacting companies

After making a pretty extensive list of companies, these were contacted via e-mail. Here, the thesis objectives were described, and also the report from the depth study were appended. Some companies responded directly to this e-mail, but most of the companies were contacted a few days later by telephone for better communication. We then arranged the rest of the survey, and in most cases the questionnaires were sent via e-mail to respondents, and then a telephone interview were conducted within a few days. Some companies preferred to answer the questionnaires themselves and then return them. The effort to get hold of respondents were harder than expected, and a lot of time was used getting contact with the right people. This phase was also postponed a bit due to the work done in connection with the internal survey for EDB (4.3). A standard which helped finding companies was the NACE-standard, where Software Developing Companies are registered under NACE 72. Many of the companies contacted were registered under this standard. Finally, we had a list of about 70 companies, which were contacted.

5.5 Questions for Developers

This section presents the questions intended for developers. It does not however present the different answer options. The questionnaires are attached in their

original Norwegian form in Appendix A. For each question there is a description of how this question fits into the thesis, and also a reference to what research question it covers. An overview over which questions are related to which research question is shown in Table 5.2.

Question	RQ1	RQ2	RQ3
C1 - Knowledge about QMS			
DQ1	X		
DQ2		X	X
DQ3		X	X
DQ4			X
C2 - Use of the QMS			
DQ5			X
DQ6		X	X
DQ7		X	X
DQ8		X	
DQ9	X		X
DQ10			X
DQ11		X	X
DQ12		X	
C3 - Implementation of the QMS			
DQ13		X	X
C4 - Updating the QMS			
DQ14	X		X
DQ15		X	X

Table 5.2: Questions for developers, with reference to Research Questions

C1 - Knowledge about the company's QMS

DQ1 **Do you know if the company is certified or assessed by some quality or process framework?**
As an introduction, we wanted to know whether or not the developers were aware of any certifications or assessments the company may have. This relates to RQ1, concerning whether an awareness of a certification is something that affects a developer's attitudes towards the QMS.

DQ2 **What do you think are the main reasons for having a QMS?**
What does the developers regard as the main motivation for having a QMS? Does it have any affection on how developers feel towards the QMS? This question relates to both RQ2 and RQ3, but mostly it applies to RQ3,

since motivational issues may be the very important as to how a QMS may function properly.

DQ3 **Which parts of the development process does the QMS cover?**
Again, we want to examine how much the developers know about the QMS, and there is also a matching question of this sort for the managers, so we more easily may see any difference between developers' ideas and the managers'. This question relates both to RQ2 and RQ3.

DQ4 **Which part in DQ3 is the most relevant for you as a developer?**
As a developer, which part of the QMS is most important? Some of the parts introduced in DQ3 does in fact extend what is normally seen as developers' tasks, but are developers today just focused on traditional roles, or are they more versatile? Of the research questions, this question is closest related to RQ3.

C2 - Use of the QMS

DQ5 **Have you had any training or introduction in the use of the QMS?**
When employed in a company, learning the internal routines and how they work, may be crucial for seeing the possible benefits of a QMS. This question is related to RQ3.

5.a **If any training. In what parts of the system?**
It is interesting to see which parts of the system developers get training in, and whether this training matches the answers given in DQ4. May also be related to RQ3.

DQ6 **Would you have liked more training or instruction how to use the QMS when joining the company?**
Is the training received by the newly employed sufficient, or would they have wanted more? This question is related to RQ3, but also somewhat to RQ2. There is also a matching question for the managers, to show if there are any difference between what the developers experience, and what the managers think is the situation.

DQ7 **What would you recommend should be done in the future for new employees?**
This question gives the opportunity for developers to suggest improvements on their own on what ought to be done better when regarding the training. It may be related both to RQ2 and RQ3.

DQ8 **How do you find the QMS in terms of usability?**
RQ2, how to make a QMS work, also includes issues of usability and availability of information. This question aims to see how developers regard these issues.

DQ9 **How often do you use the QMS?**
A QMS may be intented for frequent usage, but is this the case? How often do developers find use of the QMS, and is it a part of their daily work? Covered by RQ3, but may also be connected with RQ1, since it sheds light to if formal routines are important for the assurance of quality.

9.a **If no more than a couple of times a month, what is the reason for this?**
Why, if so, don't the developers use the system more often? Is it because the QMS itself is insufficient for finding information, or are there other reasons?

DQ10 **How useful for your own work do you find the QMS?**
Relates directly to the previous question, but gives another perspective. If you have long experience working with a process, maybe one becomes less dependant on the information found in the QMS. Still, it may also be that the QMS is not useful, just because the information you need is lacking. This question relates to the latter. It is also closely linked to RQ3.

DQ11 **Do you think you use the QMS more or less than what is average for developers in this company?**
How will a developer regard it's own use of the QMS, compared with other developers in the same company? Related to RQ2 and RQ3.

DQ12 **In comparison with how routines and processes is formally represented in the QMS, how are the actual work processes?**
This question is relates closest to RQ2. It is represented by a matrix, consisting of the different phases, and options ranging from "very similar" to "totally different". It may show if there are any specific parts of a QMS that are more difficult to implement than others, and if there are any significant differences between how developers and managers regard the QMS, since there is also a matching question MQ14 for this question.

C3 - Implementation of the QMS

DQ13 **Were you an employee in this company at the time when the QMS was implemented?**
Since this may have an impact on their attitudes towards the system, and

also further categorize the developers, we want this question included. It's not directly connected to any of the research questions, but it's subquestions are.

If Yes (employee at the time of introduction):

13.a **Were you involved in the development of the QMS?**
This question is related to RQ3. It may say something about what works and what doesn't when regarding user involvement.

If Yes (involved in the development of the QMS):

13.a.1 **How were you involved?**
In what way were developers involved with the development and implementation of the QMS? Were they consulted about their work processes, or were there held meetings with the developers. This may be related both to RQ2 and RQ3.

13.b **Would you have liked being more involved with the development of the QMS?**
Would the developer have wanted more influence on the making of the QMS? This relates to RQ2, but also to RQ3.

C4 - Updating the QMS

DQ14 **How often are routines and descriptions in the QMS updated?**
Relates directly to RQ3 and also somewhat to RQ1, since some certifications require updates on a regularly basis. If a developer in a certified company reports that the system is updated seldomly, this may be something to look into.

DQ15 **Are you directly involved in the updating?**
To what extent are developers directly involved in the updating of process descriptions and routines in the QMS? This question is connected to RQ3.

If Yes (Involved in the updating):

15.a **How are you involved in the updates?**
There are different ways of involving developers in the process of updating the QMS, which may affect how they look at the system, and their interest of using it. This question may, in comparison with others, give some understanding of what ways of involvement which are the most effective. It relates both to RQ2 and RQ3.

5.6 Questions for Quality Managers

This section presents the actual questions for the quality managers, named MQ1 etc. It does not, however present the answer options on each questions. These are available in Appendix in Norwegian. For each question there is a short description of the purpose for this question, and also which *research question* it aims to answer. If a question for the managers has a matching question for the developers, this is also mentioned. As for the questions for the developers, an overview of which questions are related to which research questions are showed in Table 5.3.

Question	RQ1	RQ2	RQ3
C1 - Knowledge about QMS			
MQ1			
MQ2	X		X
MQ3	X		
MQ4			
MQ5			X
MQ6		X	
MQ7			X
MQ8			
C2 - Use of the QMS			
MQ9		X	X
MQ10		X	X
MQ11		X	X
MQ12		X	X
MQ13			X
MQ14		X	
C3 - Implementation of the QMS			
MQ15			X
MQ16		X	X
C4 - Updating the QMS			
MQ17			X
MQ18			X
MQ19		X	
MQ20			X

Table 5.3: Questions for quality managers, with reference to Research Questions

C1 - Knowledge about QMS

MQ1 **What kind of company is this?**
This question is to get a definition of what kind of company this is. Is it a consultancy agency, a software developing company for commercial off the shelf-products or an internal software development unit in a larger corporation? This question is not interesting in itself considering the research questions, but will be used in the discussion of the results (6) to separate between the different kinds of companies.

MQ2 **Is your company part of a larger mother company with a central QMS?**
This question brings may give light to why this company have a QMS, since it may be a result of an internal policy in the mother company. It relates to RQ1 and RQ3, concerning both certification, which traditionally is something larger corporations use, and what makes a QMS function in the organisation. Is it a good thing to be part of a larger setting when working with quality assurance and process improvement, or does this clutter the responsbibilities?

MQ3 **Is your company certified or assessed after any quality frameworks?**
This question relates directly to research question RQ1 and certification. There are a range of quality frameworks as mentioned in Chapter 2, and this question will find out if any of them are more widely acknowledged by the industry than others. The question also matches question DQ1 from the developers' questions, to see if developers also are aware of any such assertions or certifications. If the company is certified:

3.a **Why are you certified?**
There may be different reasons for why a company is certified, both a demand from their customers, internal policy or decision made by a possible mother company. This question also relates to research question RQ1.

3.b **How long have you been certified?**
If the company is certified, how long has it been certified? A follow-up question to the previous, and therefore also connected with RQ1.

If the company is not certified:

3.c **Has this been considered?**
If the company is not certified, have they ever considered getting such a certification?

If yes (It has been considered):

3.c.1 **Why did your company decide not go through with it?**
If the company considered getting a formal certification, but decided not to, why was this? Also related to RQ1.

MQ4 **There are several IT-related professional organisations. Is your company represented in any of these?**
This question does not directly relate to any of the research questions, but relates to the field study described in Chapter 4.1 and may be used as a reference for the results from this study.

MQ5 **How is the QMS represented?**
How the QMS is represented may differ from company to company, and this may also affect the use of and attitudes towards the system. It may also affect how often the system is updated, and other aspects of the QMS that may become apparent when analysing the results. This questions relates to RQ3.

MQ6 **What are the management's primary goals for having a QMS?**
There may be various motivations for introducing av formal QMS into the company, and this question, which is connected with RQ2, aims to uncover these reasons. This question shows what the reasons are seen from a managers' point of view, and matches question DQ2, which is similar, but from the developers.

MQ7 **Which parts of the development process is covered by the QMS?**
This question is connected with RQ3, and gives a pointer to what phases of the development process that is normal to have covered by a QMS. This question matches question DQ3 for the developers.

MQ8 **Which part of the QMS do you regard as the most important for the company?**
Not a multiple choice-question, but aims to find what part that acknowledged as the most useful for the company seen from a managers point of view.

C2 - Use of the QMS

MQ9 **How is training in the QMS performed?**
This question is mostly connected with RQ3, but since it also concerns developers, a matching question DQ5 was made, which also connects these questions with RQ2.

MQ10 **Do you have enough resources to perform training and motivational activities?**

This question may reveal if there is a general problem with lack of resources for managers who want to give a better training programme for employees. It relates to both RQ2 and RQ3, but mostly the latter, since training in the use and possibilites of the QMS may be crucial for a good implementation of such.

MQ11 **How often do you personally use the QMS?**
A QMS should also be a tool for those i leading positions, and therefore it's interesting to see how their use of the system is in comparison with the developers. A matching question, DQ9, represents the developers' point of view. It relates to both RQ2 and RQ3.

MQ12 **How often do you think developers use the QMS?**
This is a follow up question to the previous, and also matches the developers' question DQ9. It, too relates to RQ2 and RQ3.

MQ13 **How useful do you find the QMS for your role as a manager?**
Since a QMS often is intended just as much for the managers to use as for the developers, we want to examine whether the managers themselves find the system useful for their work. This question matches question DQ10 and relates mostly to RQ3.

13.a **Which parts of the QMS do you find the most useful?**
Follow up question to the previous, which let's the respondent elaborate what part it uses most frequently, or finds the most useful.

MQ14 **In comparison with how routines and processes is formally represented in the QMS, how are the actual work processes?**
This question is connected to RQ2. It is represented by a matrix, consisting of the different phases, and options ranging from "very similar" to "totally different". Matching the developers' question DQ12, and will be analyzed together with this.

C3 - Implementation of the QMS

By implementation we mean making and encoding process descriptions and disseminating these by internal training etc

MQ15 **Who were responsible for making the QMS?**
We want to know if the making of the QMS was something handled internally, or if this was something external consultants or others made on specifications or standards. This relates closely to RQ3.

MQ16 **Were developers or other users of the QMS involved when it was implemented?**
This relates both to RQ2 and RQ3, and is also matched with DQa. We want to know if the developers were part of the process of implementing the QMS.

If Yes (developers were involved):

16.a **How were they involved?**

In what ways were the developers involved? Did they have an active or a passive role? Matches question DQ13a1 and relates to both RQ2 and RQ3.

C4 - Updating of the QMS

MQ17 **How often are routines and process descriptions updated?**
When reviewing RQ3, it's interesting so see how often changes are done in the QMS, and how this may affect the attitudes the user have towards the system. Matches question DQ14.

MQ18 **Who is responsible for the updates?**
It may vary from company to company who is in charge of the updates of the QMS. Is this something done internally, or is external expertise or resouces used? Relates to RQ3.

MQ19 **Are developers involved in updating the QMS?**
Just as it is interesting to see whether developers are involved in the making of QMS, it may also be interesting to see if they are involved when the system is updated. Matches question DQ15, and is related to RQ2.

MQ20 **Does it exist a systematic collection of experiences which is used when updating the QMS?**
How does the system get updates? Are information and experiences gathered continously, or are there no such system? When reviewing the results of this question with some of the others, this may bring light to some issues concerning RQ3.

Chapter 6

Results and Key Findings

This chapter presents the results from the survey, with some discussion and comparison. First, the answers from both developers and managers are presented, and where there are coinciding questions, these are presented in a common diagram or representation. Then, some of the key findings are discussed, related with the Research Questions. Finally, this chapter presents some of the negative responses and experiences we had when performing the study.

6.1 About the execution of the survey

This section gives some data about the execution of the survey, and also some information about how the results are presented. When contacting the possible companies about their participation in the survey, it became clear some of them either did not have time or the manpower to lend resources to the project. It also became clear that some of the companies on the list did not have a formal QMS in place, because they regarded themselves as too small, and did not see the use of having such strict routines. As shown in Table 6.1, a total of 72 companies were contacted, either by phone, e-mail or both. Out of these, we got a definitive answer from 49, but just 7 companies had the opportunity to participate in the survey. Some of the reasons for why so many could not participate is discussed in Section 6.5. Of those contacted, 29 of these were consulting companies which makes software "on demand" for their customers, and not for ordinary sale. Out of the 29 companies contacted, we got a response from 19, but only 3 companies participated in the survey. Of the companies which develop software for COTS (Commercial-Off-The-Shelf), 35 were contacted, 17 responded, but only 3 could participate. Of internal software departments, 8 were contacted, but out of the 4 that we got an answer from, only one could answer the survey. Out of the 7 companies that participated in the survey, 4 of these were certified after the ISO9001 standard for QMS. This is a pretty high percentage, when we consider that only 14 of the companies that were contacted were certified, according to

the Kvalex Internet site([Kva]). Since we didn't achieve contact with all the companies contacted, it's difficult to say how many that did not have a QMS in total, but 9 companies reported that they did not have any, and therefore couldn't participate. In the following sections, we go through the answers from the survey. The sections are divided into subsections based on the categories in the questionnaires. We first present the results from the developers, and then the managers. Where questions for the developers and managers are matched, and clearly belong together, both results will be presented together. In Appendix **??**, the spreadsheets with the results are appended, but the names of companies and persons are removed.

Company type	Contacted	Response	Participated
Consulting	29	19	3
COTS	35	17	3
Internal	8	4	1
Total	72	49	7
ISO 9001	14	9	4
No QMS	N/A	9	0

Table 6.1: Data about the companies contacted

6.2 Answers from developers

We wanted to get answers from two developers from each company, to get a broader result set. In total we got 13 participating developers from 7 companies. In the following subsections we present the results, and give brief discussions of some of the key findings. In the diagrams and discussions that follow, N_D will represent the number of developers. N_M will represent the number of managers where this is relevant. Questions in which have a matching question for the managers will be presented in this section, if the results are of such character that they may be compared.

6.2.1 C1 Knowledge about the QMS

The questions in this category handles how much developers know about their companies' QMS. Question DQ2 and DQ3 have matching questions for the managers, and the results for both are therefore discussed together.

DQ1 - Do you know if the company is certified or assessed by some quality or process framework?

All of the developers who were in companies with ISO9001 certifications, were aware of this. Those who were in companies not certified did not answer this question, except for one, who was not sure whether the company was certified or not. The manager from this company specified in her answer that they were not certified after any quality framework, but that they utilized method frameworks such as RUP(2.4.2) and other. It seems that developers generally are aware of their companies' certifications.

DQ2 - What do you think are the main reasons for having a QMS?

Figure 6.1 shows how both the developers and managers answered to this question. As we may see, all of the managers said that "Productivity" was a main reason for having a QMS, while just about 40% of the developers shared that belief. This may imply that many developers does not see that having the QMS will improve their productivity, while this is clearly one of the goals for the managers. This finding is interesting, though not very surprising. A common statement that has been said about QMS is that they bring a lot of documentation. When regarding the "Productivity" point, and adding the point of "Documenting for later use", we see that generally, the developers (70%) of them believe this is one of the main reasons for maintaining a QMS, while only about 40% of the managers share their view. This may lead us to assume that developers in general does not see how productivity can be improved, by using a lot of time documenting what they do, while managers may not agree. As we see, developers also, to a higher degree, assume that a reason for having a QMS is to meet some external standards demands. We also see that almost all of the developers, and all managers see Customer satisfaction and customer demand as an important reason for having the QMS, which may imply that they also see how a QMS may affect this aspect.

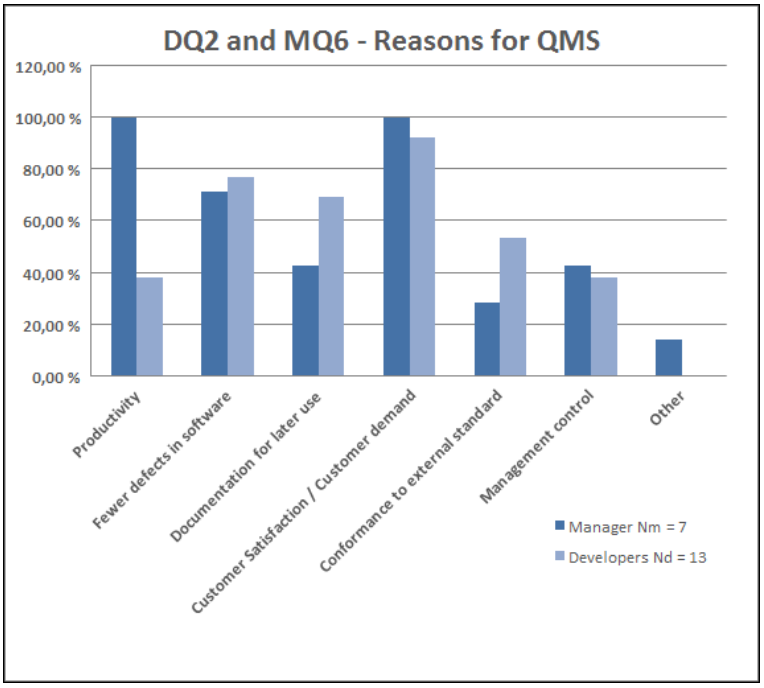

Figure 6.1: DQ2 and MQ6 - Main reasons for having QMS.

DQ3 and MQ7 - Which parts of the development process does the QMS cover?

As Figure 6.2 shows, all phases are covered by almost all of the QMSs in question, and this view is shared by both developers and managers. It is interesting to see though, that two developers, employed in the same company, had quite a different knowledge about what the QMS actually covered. One of them believed that their QMS did only cover the four phases from Requirements Specification to Testing, while the other believed it covered all the phases mentioned. The quality manager from this company also stated that the QMS did indeed cover all phases. This may show that even though a system may contain a lot of information about all phases of the development process, it does not necessarily mean that all developers are aware of this. This may also be a natural effect, since not all phases are equally important for all people in their work.

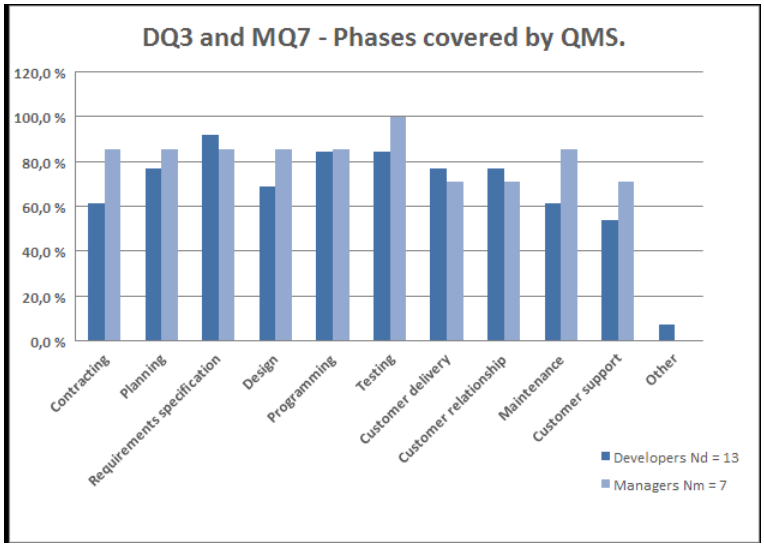

Figure 6.2: DQ3 and MQ7 - Phases covered by the QMS

DQ4 - Which part in DQ3 is the most relevant for you as a developer?

This question was meant to make the developers choose one part of the QMS, but clearly, this was not specified good enough, because almost all of the developers checked more than one option. It is therefore difficult to say anything particular about the results for this question, since we have different answers. In any case, we may still se, as shown in Figure 6.3 that it is the same four phases; requirements specification, design, programming and testing, which receives the highest score. Also, among the developers who only answered one of the options, these were all among these four phases.

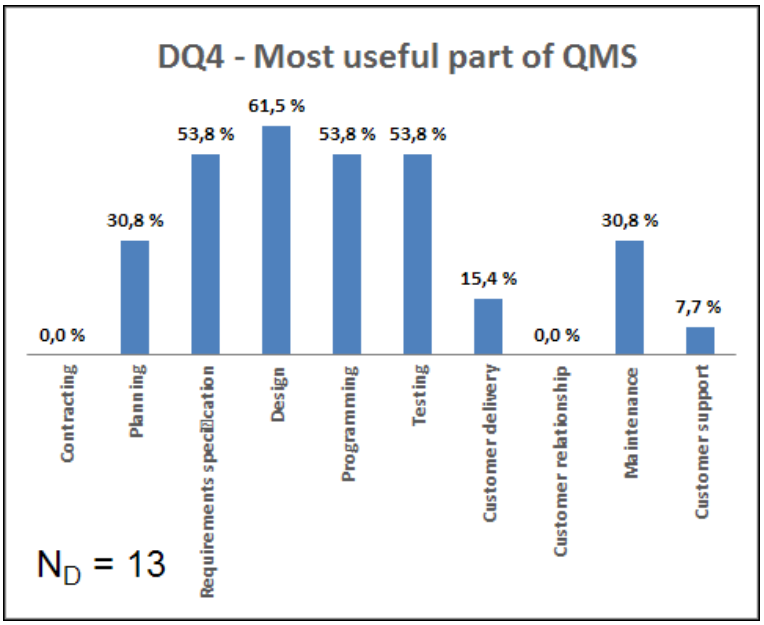

Figure 6.3: DQ4 - Most relevant parts for developers.

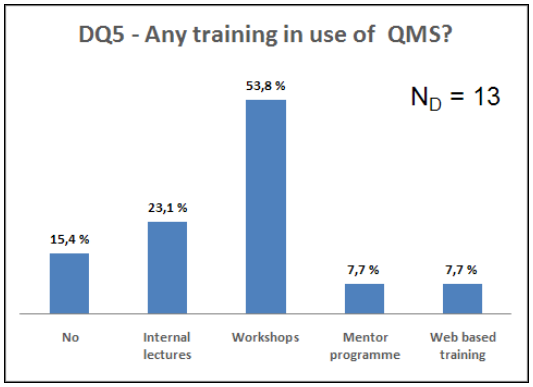

Figure 6.4: DQ5 - Any training?

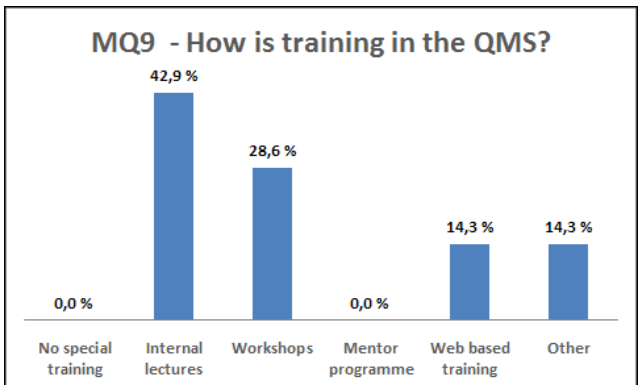

Figure 6.5: MQ9 - What kind of training?

6.2.2 C2 Use of the QMS

The following subsections presents questions about the use of the QMS.

DQ5 - Have you had any training or introduction in the use of the QMS?

As shown by Figure 6.4, all but two developers had been through training of some sort in the use of the QMS. It is clear that workshops is the most usual way of doing this. As we see in Figure 6.5, for the managers' matching question, we see a higher degree of Internal Lectures than we see of Workshops, which may imply that the question formulation and the options given were not as clear as they should have been. Clearly, the difference between workshops and lectures are not as distinct in "the real world" as it is in a student's (the author's) reality. As a sub-question, the developers were asked in which parts of the QMS they had received training. The answers shows that the same four phases as the developers mentioned in DQ4, is where they also were trained, in addition to the Planning phase, which also about half of the developers said that they had received training in.

DQ6 - Would you have liked more training or instruction how to use the QMS when joining the company?

On this question, most of the developers answered that the training they had received was sufficient, as we may also see from Figure 6.6. Still, almost 25% of the developers would have liked more training, which also means that quite a large share of the developers interviewed were not satisfied.

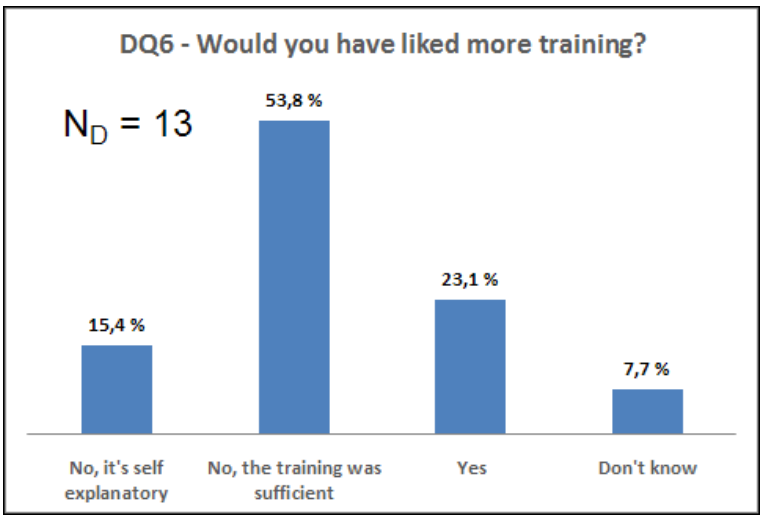

Figure 6.6: DQ6 - Would developers like more training?

DQ7 - What would you recommend should be done in the future for new employees?

Most of the developers (60%) recommended giving either more training, better training or better mentoring for the newly employed. About 40% had no special recommendations. This may seem a bit strange since about 75% answered that the training they had received was sufficient or that the QMS was self explanatory. However, it is not surprising that even though they were satisfied with their training, they see issues about the process that could be made better. Figure 6.7 shows the distribution.

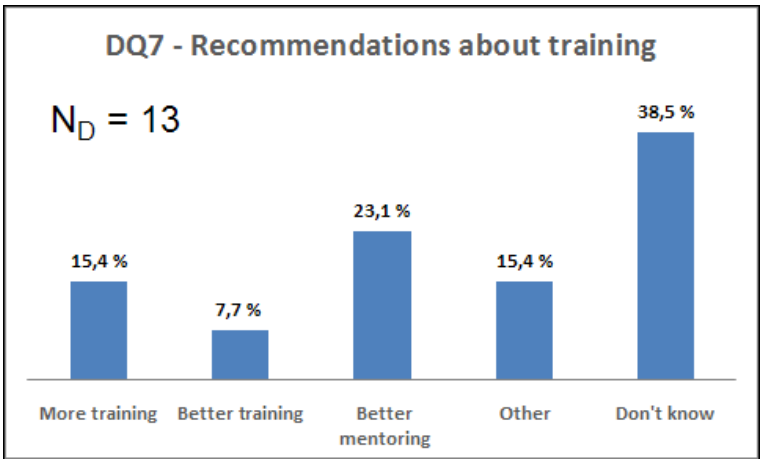

Figure 6.7: DQ7 - Recommendation for the future about training.

DQ8 - How do you find the QMS in terms of usability?

When asked to rank the system in terms of usability, most of the developers were positive, and only 30% thought the QMS to be cumbersome to use. This may be related to how the QMS is implemented and represented, as we will examine closer in Section 6.3.

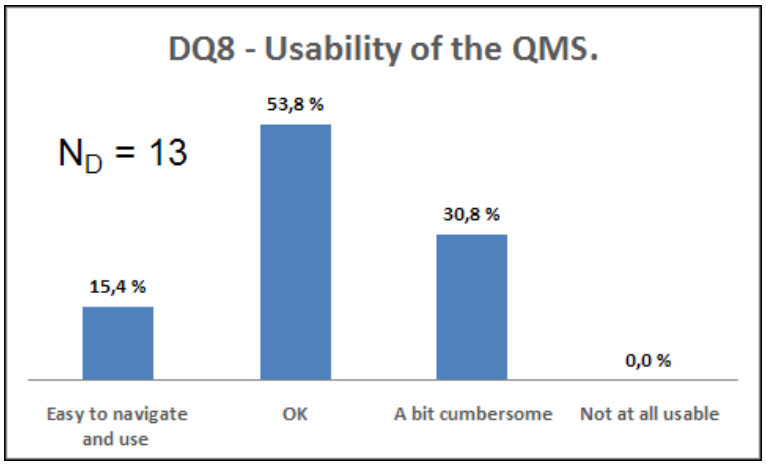

Figure 6.8: DQ8 - QMS in terms of usability?

DQ9 - How often do you use the QMS?

Most developers use the QMS from "a couple of times a month" (39%) to "a couple of times a week" (39%). This may mean that they have confidence in the QMS for having the information they seek, even though this is difficult to say without a larger data set.

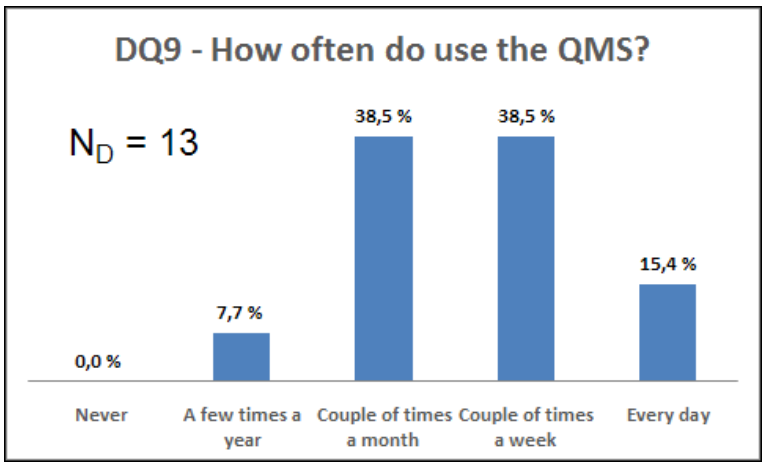

Figure 6.9: DQ9 - How often do developers use the QMS?

DQ10 - How useful for your own work do you find the QMS?

Not surprisingly, most developers found the QMS "useful sometimes", which we also assumed, from the results from DQ9. Figure 6.10 shows that all developers think that the system is useful sometimes, or very useful.

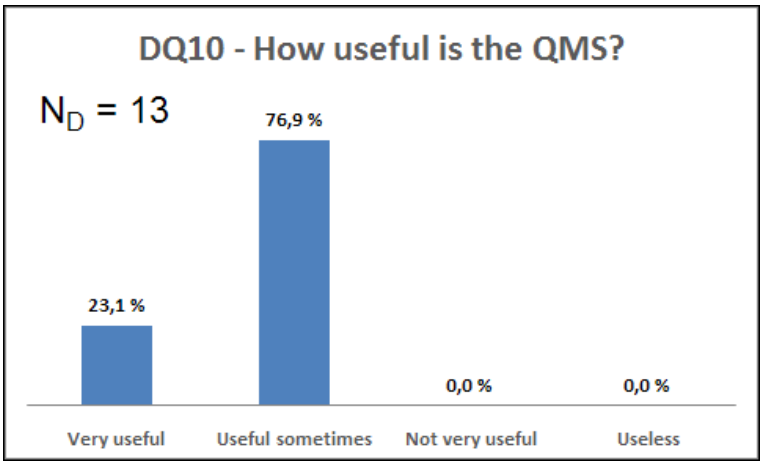

Figure 6.10: DQ10 - How useful is the QMS?

DQ11 - Do you think you use the QMS more or less than what is average for developers in this company?

As one may assume when doing such a survey, few people are eager to answer something that differs from what seems like the average. In this case we might have an example of such a fear for extremes, since all but one developer have answered that they use the QMS about the same as other developers in the company as shown in Figure 6.11. Only one developer admitted to use the QMS less than the average. Unfortunately, this answers does not differentiate the developers, and is therefore of little practical use for further analysis.

DQ12 - In comparison with how routines and processes is formally represented in the QMS, how are the actual work processes.

This question resulted in a Table 6.2 as shown below. From this table we may see similarities with earlier questions, where the developers in general have had a positive approach towards the QMS. If we look at the table, the phases that the developers earlier answered that they used the most, is also the phases in which they have actual work processes closest to the QMS. In those phases where they in general had not had any special training however, the results are more varied, but a majority of them have answered "Don't know" to this question. It is interesting to see that the two phases where the actual processes do differ

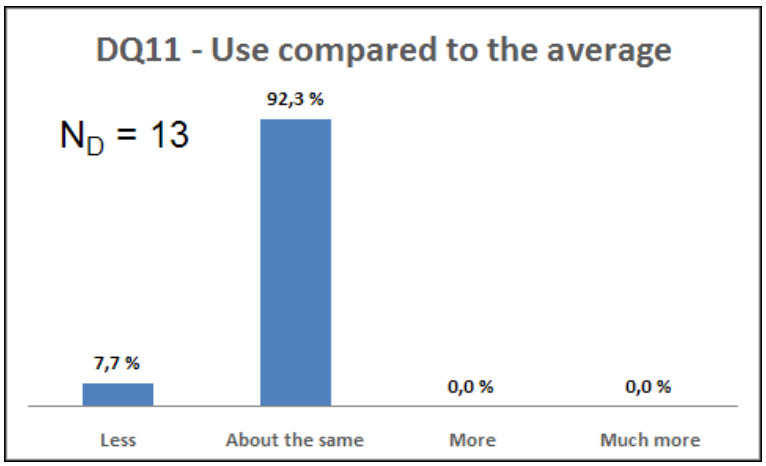

Figure 6.11: DQ11 - Developers usage of the QMS compared to other developers.

somewhat, is the planning phase and the testing phase. This may be connected to the fact that many developers in a planning phase are eager to get on to the phases with design and implementation. When regarding the test-phase, this may often be a phase where the lack of time may become more obvious, and therefore it may be tempting to skip some of the formalities. This may relate to the findings in the depth study performed in 2005 ([Ber]), where managers expressed that the test-phase was something they regarded as very important for overall quality, and something they therefore tried to focus and use resources on.

Part of project	(4) Very similar	(3)Similar	(2)Different	(1)Tot. different	Don't know
Contracting	7,7%	7,7%	0,0%	0,0%	76,9%
Planning	7,7 %	38,5 %	23,1 %	0,0 %	23,1 %
Requirements specification	15,4 %	69,2 %	0,0 %	0,0 %	7,7 %
Design	7,7 %	69,2 %	7,7 %	0,0 %	15,4 %
Programming	15,4 %	53,8 %	7,7 %	7,7 %	7,7 %
Testing	23,1 %	46,2 %	23,1 %	0,0 %	0,0 %
Customer delivery	30,8 %	15,4 %	0,0 %	0,0 %	46,2 %
Customer relationship	7,7 %	15,4 %	0,0 %	0,0 %	61,5 %
Maintenance	7,7 %	46,2 %	0,0 %	0,0 %	30,8 %
Customer support	7,7 %	23,1 %	7,7 %	0,0 %	46,2 %

Table 6.2: DQ12 - Actual processes compared to those described in the QMS.

6.2.3 C3 Implementation of the QMS

By implementation we mean making and encoding process descriptions and disseminating these in the company.

DQ13 - Were you an employee in this company at the time when the QMS was implemented?

A simple Yes/No question, which yielded the result showed in Figure 6.12, to introduce some sub questions for this category. Of the 46% that was employed at the time of introduction of the QMS, more than 80% of these were to some extension involved in the implementation. Those who participated in the process, contributed with knowledge about how their actual routines and processes, and some were able to suggest changes to the routines that was being made. The fact that so many of the developers were directly involved in the implementation of the QMS is interesting, since this may be an explanation to why the developers who participated in the study generally were positive to the QMS. This relates to what has been said about user participation, as described in 2.5.

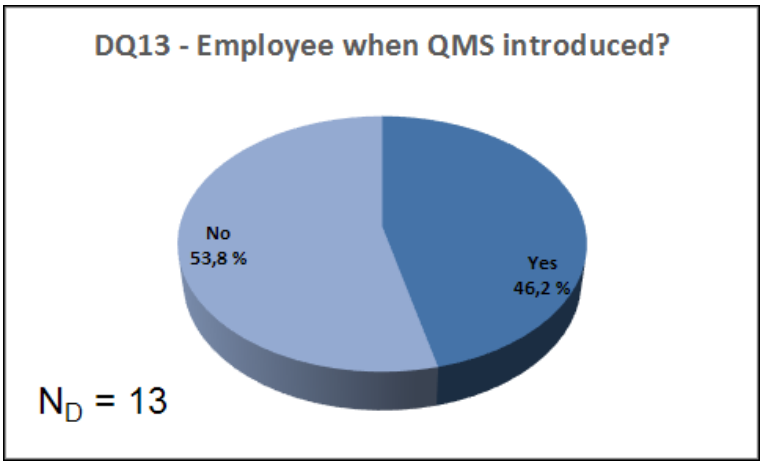

Figure 6.12: DQ13 - Employed when QMS was implemented?

Figure 6.13 shows how both developers and managers responded to this question. We may see that the managers to a large extent agreed with the developers in the view of participation.

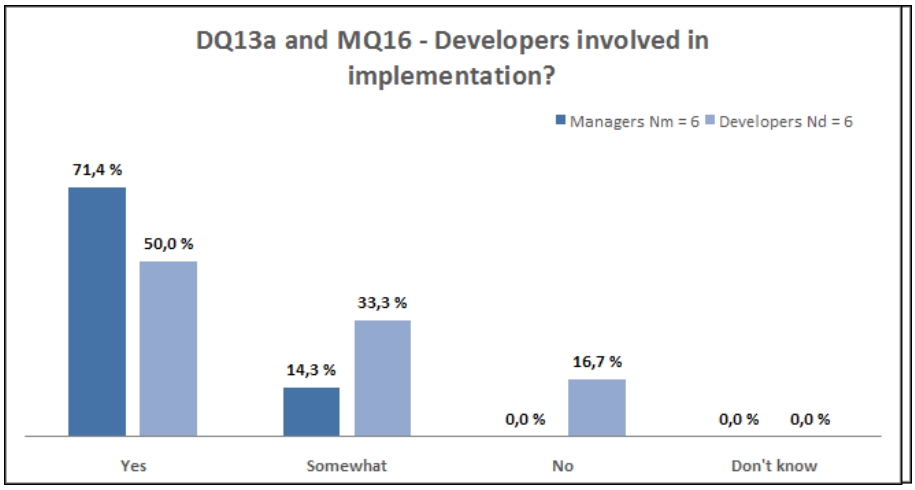

Figure 6.13: DQ13a and MQ16 - Were developers involved in the implementation?

6.2.4 C4 Updating of the QMS

The following subsections present the questions concerning the updating of the QMS.

DQ14 - How often are routines and descriptions in the QMS updated?

This question was asked to see how aware developers were of the updates that is being done in the QMS, and if they had any perception of how often these were done. Figure 6.14 shows how both developers and managers answered this question. As we may see, a majority of the developers believed that updates were pretty often, while most of the managers stated that it was rather seldom. This may be connected to how involved the developers are in the updating, and also how often they use the system.

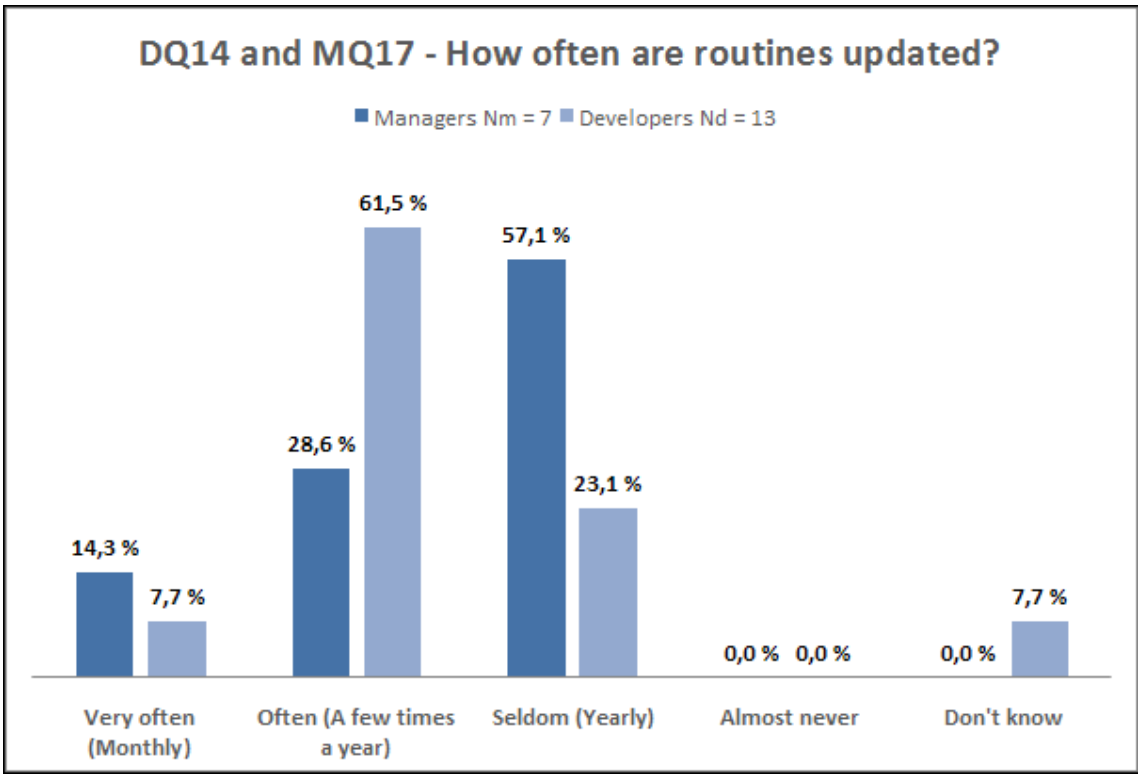

Figure 6.14: DQ14 and MQ17 - How often are routines in the QMS updated?

DQ15 - Are you directly involved in the updating?

Again, the issue of user participation is of interest, but this time whether or not developers are actively involved in the updating of routine and process descriptions in the QMS. Figure 6.15 shows that about 70% of the asked developers

are involved. As we shall see later, all the managers stated that developers were involved in this process. For this question it also exist a sub-question, where we asked how the developers were involved. Most of the developers (70%) answered that they were involved by suggesting changes and updates, while some (30%) told that the management arranged workshops or meetings with the developers in this process.

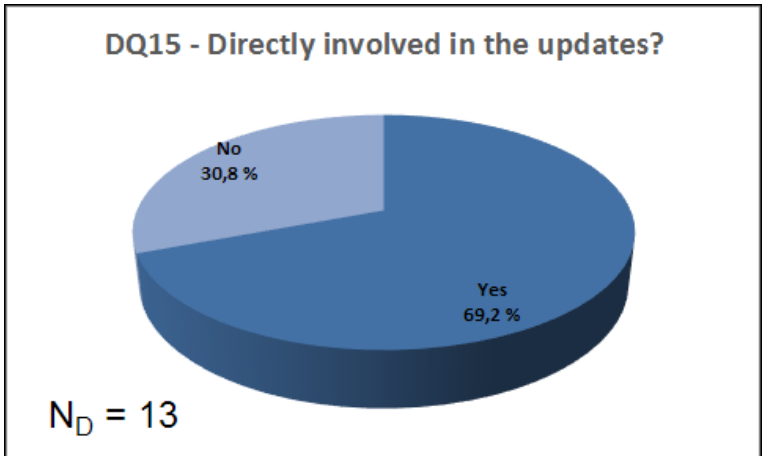

Figure 6.15: DQ15 - Developers involved in the updates?

6.3 Answers from managers

We wanted to get one quality manager or a person with a similar role from each of the companies. Since the number of responding companies were so low, we only got 7 managers. This is a very low number to apply any statistical methods, but where it's feasible, some comparing is done. Some of the answers from the managers are already discussed in the previous section, together with the matching question for the developers, but other than that, all the results and key findings from the managers are presented here. Since some of the data sets are so small, diagrams are not always there to illustrate distributions, but the results are then described in the text.

6.3.1 C1 Knowledge about the QMS

MQ1 - What kind of company is this?

This question was mainly to get a classification of the companies, according to type, and to maybe use this classification in the analysis. Since we ended up with such a limited amount of companies, this classification is not that relevant, but the distribution within the three categories are shown in Figure 6.16.

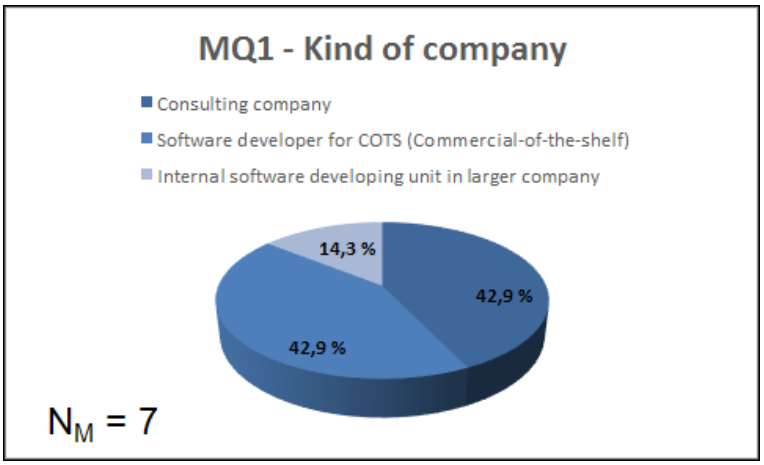

Figure 6.16: MQ1 - Distribution of Companies

MQ2 - Is your company part of a larger mother company with a central QMS?

Whether the company is owned by a larger company with its own QMS, may be relevant for how both managers and developers think about the QMS. 3 of the 7 companies were in this situation, and this may be used for later analysis and discussion, if it seems like this is significant.

MQ3 - Is your company certified or assessed after any quality frameworks?

Of the 7 companies, four of these were certified according to the ISO9001 standard. One company had considered this, but had found it to be too expensive and extensive. Of those certified, three of them had been certified between 2 and 10 years, while the last had been certified longer. How long was not specified.

MQ4 - There are several IT-related professional organisations. Is your company represented in any of these?

4 of the 7 companies were members of the Norwegian Computer Society, while one of them also was a member of ICT Norway. As presented in the theory in Chapter 4.1, those organisations do extensive work concerning quality assurance and process improvement.

MQ5 - How is the QMS represented?

Figure 6.17 shows how the companies represent their QMS. Not very surprisingly, a majority of the companies have a web based system. As the two respondents from the field study also stated, the evolution of the web have lead to immense opportunities concerning communication and availability of information, something which clearly will affect the possibilities in a QMS. Some of the companies also have their QMS represented as a collection of documents, and one company have their QMS mostly as an integrated part of their development tools.

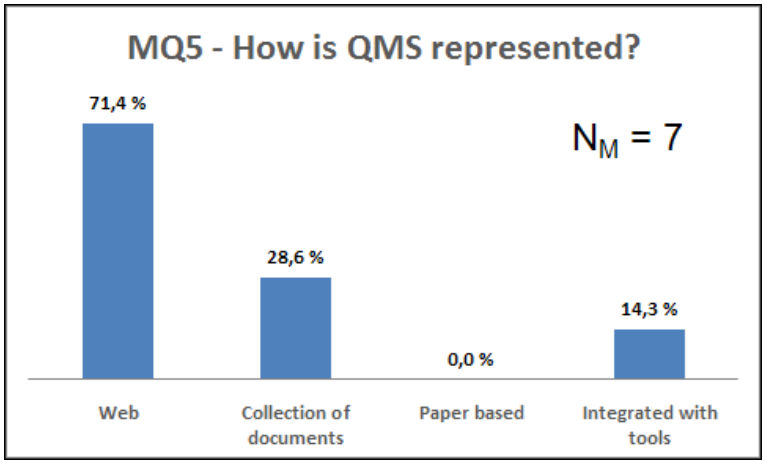

Figure 6.17: MQ5 - How is the QMS represented?

MQ6 - What are the management's primary goals for having a QMS?

See Section 6.2.1 for a comparison of these results with the answers from the developers.

MQ7 - Which parts of the development process is covered by the QMS?

See Section 6.2.1 for a comparison of these results with the answers from the developers.

MQ8 - Which part of the QMS do you regard as the most important for the company?

On this question, which was not a multiple choice question, but a question where the managers could write their own answer, most of the managers answered that all the parts of the QMS were equally important, and that they could not separate out one of the parts as more important than another. A couple of the companies did however, and they pointed out "Customer satisfaction" and "Requirements specification" and tracking of the requirements all throughout the development process as central parts of their QMS.

6.3.2 C2 Use of the QMS

MQ9 - How is training in the QMS performed?

This question and its answers are presented together with the matching question for the developers in Section 6.2.2.

MQ10 - Do you have enough resources to perform training and motivational activities?

A little surprisingly, Figure 6.18 shows that more than half of the managers questioned said that they had enough resources to perform a satisfying training program for their employees in the use of the QMS. This fits good with how the developers answered, which also in general were positive to the training they had received. Still, not all managers were satisfied with the resources they receive to perform the training, which probably will affect how both those managers, and the developers in those companies react to and use the QMS.

MQ11 - How often do you personally use the QMS?

Where the developers reported to use the QMS a couple of times a week or a couple of times a month, a majority of the managers reported that they used it every day. Figure 6.19 also shows that one of the managers almost never used the QMS. The reason for this we may only speculate in, but one possibility is

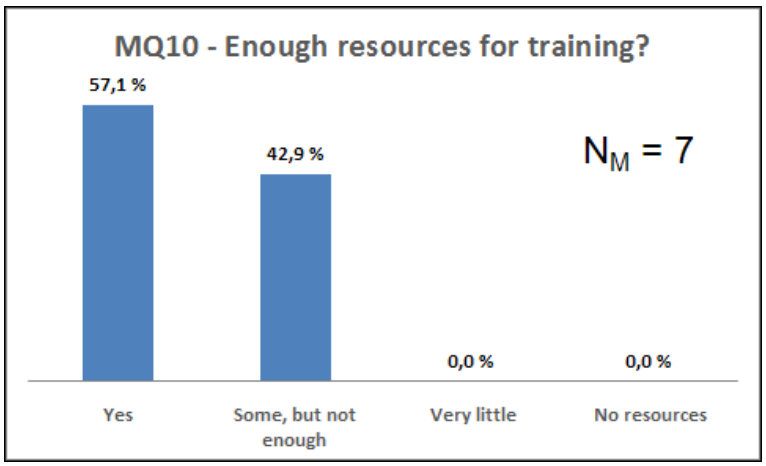

Figure 6.18: MQ10 - Enough resources for training?

that this manager is not very involved with the development of software, but has a more administrative role in the company. In any case, such a distance to the QMS seems strange when we review the motivations the managers have reported.

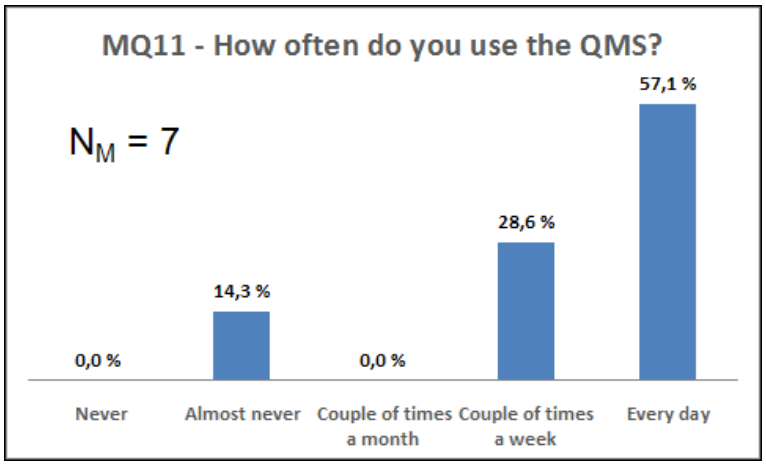

Figure 6.19: MQ11 - How often does managers use the QMS?

MQ12 - How often do you think developers use the QMS?

All developers thought that the developers used the QMS either a couple of times a month, or on a weekly basis. None of them believed that the developers used the system every day, and none thought that the developers used it more seldom. When comparing this with how the developers answered the same question, Figure 6.9, this seems like a good estimate from the managers, since it conforms quite good with how the developers answered. How often a developer needs to

use the QMS depends on a lot of factors, such as how long they have been in the company, what is their main responsibilities and so on.

MQ13 - How useful do you find the QMS for your role as a manager?

To this question, 5 of the 7 managers answered that the QMS was very useful for them in their role, while the 2 remaining answered that is was useful sometimes.

MQ14 - In comparison with how routines and processes is formally represented in the QMS, how are the actual work processes.

This same question was asked to the developers, and if we analyse Table 6.3, we see that in general, managers report that the way they work is closer to the processes described in the QMS than what the developers reported. We may also see that more managers are uncertain about the development phases where the developers had their focus, such as design, programming and testing. This is not surprising, since they are managers with other responsibilities, and not developers per se.

Part of project	(4) Very similar	(3)Similar	(2)Different	(1)Tot. different	Don't know
Contracting	42,9 %	14,3 %	14,3 %	0,0 %	14,3 %
Planning	42,9 %	28,6 %	0,0 %	0,0 %	14,3 %
Requirements specification	57,1 %	14,3 %	0,0 %	0,0 %	14,3 %
Design	42,9 %	28,6 %	0,0 %	0,0 %	28,6 %
Programming	14,3 %	28,6 %	0,0 %	0,0 %	42,9 %
Testing	14,3 %	28,6 %	0,0 %	0,0 %	42,9 %
Customer delivery	28,6 %	14,3 %	14,3 %	0,0 %	28,6 %
Customer relationship	28,6 %	28,6 %	0,0 %	0,0 %	0,0 %
Maintenance	28,6 %	28,6 %	0,0 %	0,0 %	0,0 %
Customer support	28,6 %	14,3 %	0,0 %	0,0 %	14,3 %

Table 6.3: MQ14 - Actual processes compared to those described in the QMS.

6.3.3 C3 Implementation of the QMS

MQ15 - Who were responsible for making the QMS?

To this question, the managers could check more than one answer, and therefore we see from Figure 6.20, that the count of answers here is 16, even though the number of respondents are only 7. We see that the responsibility for implementing the QMS is divided between top management, project management and the quality managers, but also that the developers are regarded as responsible for this process.

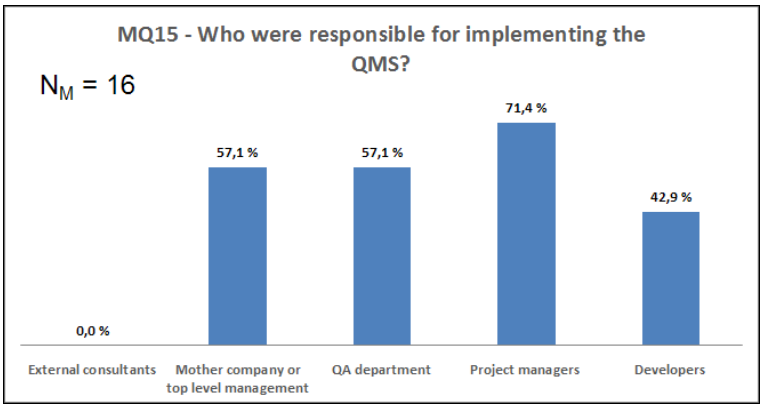

Figure 6.20: MQ15 - Responsible for making the QMS?

MQ16 - Were developers or other users of the QMS involved when it was implemented?

This question is presented in Section 6.2.3.

6.3.4 C4 Updating of the QMS

MQ17 - How often are routines and process descriptions updated?

This question is presented in Section 6.2.4.

MQ18 - Who is responsible for the updates?

On this question, almost all of the managers reported that the responsibility was divided between the project managers, the quality management and the developers.

MQ19 - Are developers involved in updating the QMS?

As we see of Figure 6.21, the managers' answers fits quite good with how the developers answered to this question, even though the managers report a higher degree of involvement than what the developers did. It seems like though, that all companies have user participation as an important aspect of their work with the QMS.

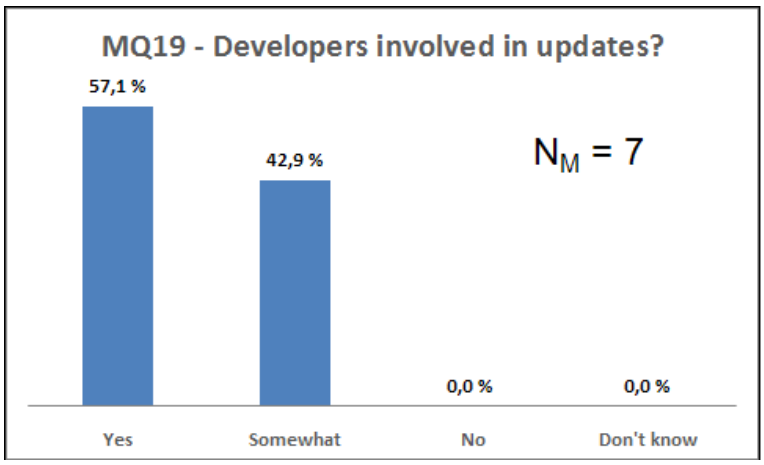

Figure 6.21: MQ19 - Developers involved in the updating of the QMS?

MQ20 - Does it exist a systematic collection of experiences which is used when updating the QMS?

In addition to user participation, one way to gather useful information for the updating and maintenance of the QMS, is to have an experience base that systematically is being used to extract central point about the processes and routines in the company. As we see out of Figure 6.22, this was not something most companies had, but may still be a good way to keep the QMS up to date and best possible fit for the company.

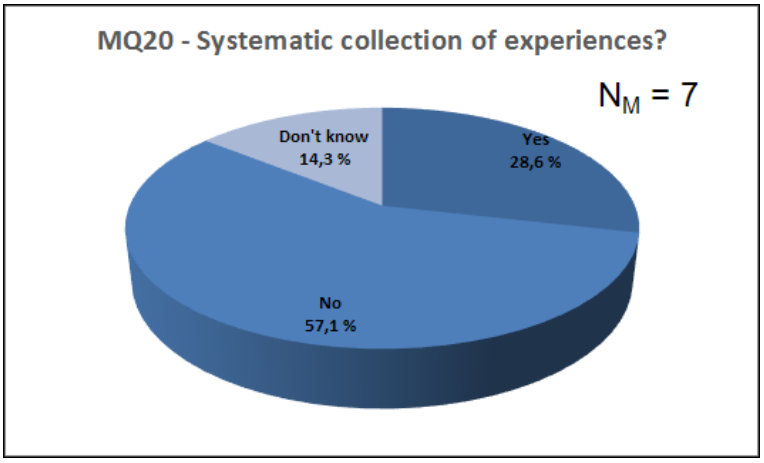

Figure 6.22: MQ20 - Systematic collection of experiences?

6.4 Key findings

In this section we present the key findings for each of the Research Questions. We try to combine the answers from different questions and give a more thorough discussion of the main elements and objectives for the study. For some of the questions we also perform some statistical analysis. The different questions DQ1-15 and MQ1-20 are distributed among the Research Questions according to Table 5.2 and Table 5.3 in Chapter 5.

6.4.1 RQ1 - Certification today, a must or just more work?

Of the seven companies we have results from, four of these are certified according to the ISO9001-standard. This would suggest that such formal certifications are very popular among software companies, but our search on the Kvalex homepage [Kva], revealed that there are just about 15 companies in Norway registered within software development that have such certifications. It's then remarking that we get answers from so many. This may be an implication of that certified companies

in general are more willing to participate in studies of their QMS than other companies, but this is just speculations, and thus beyond what we will discuss further here. When reviewing the answers from questions MQ2 and MQ3, we see that only one of the companies are both certified and owned by a larger company. From this it's not possible to say if companies owned by a larger corporation with a central QMS, in general are certified, or if this makes the QMS better or more efficient. If the number of responses had been higher, we could have used some statistical methods to further analyze this Research Question, such as an ANOVA-comparison of the three types of companies, or companies sorted by size, but unfortunately, the number of companies are too low for such methods to apply.

6.4.2 RQ2 - Developers vs Managers. A battle for quality?

To discuss this Research Question, we will use the questions DQ12 and MQ14, where the respondents should rate how their actual work processes was, compared to those described in the QMS. Ranging from "Very Similar", which gives the value 4, to "Totally Different" which gives the value 1, the subjects were asked to rate how similar each of the phases in the QMS matched. Since some of the developers did not have any opinions on some of the non-development phases, and some of the managers did not know that much about phases that was typically development heavy, some of them had answered "Don't Know", which we may see from Table 6.2 and Table 6.3. Due to this, not all phases would yield satisfying values, but for those where there were 5 or more managers, we have performed one-tailed T-tests (3.2.1) with a level of significance at 0.05. In the next paragraphs we will present and discuss the results from these tests.

DQ12 and MQ14 - Planning

It is reason to believe that managers in general are more positive to a formal approach to the planning phase than what is the case for developers. We may therefore make the following hypotheses about this:

> H_0: Managers and reporters have the same impression of how the formal processes concerning planning are described in the QMS, and what is the actual processes. ($p \geq 0.05$)
>
> H_1: Managers report a closer match between the processes concerning planning described in the QMS and the actual processes. ($p < 0.05$)

As Figure 6.23 shows, when running a T-test on the results, we get a P-value which is smaller than 0.05, and we may therefore reject the null hypothesis H_0. As we mentioned when presenting the results earlier, it's not very surprising that managers may be more positive to the formal descriptions of such early phases.

Planning	Developers	Managers
Mean	2,778	3,6
Variance	0,444	0,3
Observations	9	5
Hypothesized Mean Difference	0	
df	10	
t Stat	-2,486	
P(T<=t) one-tail	0,016	
t Critical one-tail	1,812	

Figure 6.23: Results from T-test of DQ12 and MQ14 - Planning

DQ12 and MQ14 - Requirements Specification

When it comes to this phase, it is maybe one of the most critical phases of a development project, since the requirements are what lays the foundation for the final product's functions and features. Still, we suspect that also this phase is characterized by a more appraising attitude from the managers than from the developers. We suspect that the developers are more interested in a hands on approach to this phase than following a set of given formal process descriptions. We form the hypotheses:

> H_0: Managers and reporters are equal in their view of how formal processes about requirements specification and their actual work processes match. ($p \geq 0.05$)
>
> H_1: Managers report a closer match between the processes concerning requirements specification described in the QMS and the actual processes. ($p < 0.05$)

Again, by examining the results from the T-test displayed in Figure 6.24, we find that a P-value of $P = 0.017$ is smaller than 0.05, and yet again the difference between managers and developers is statistical significant, and we may reject the null hypothesis H_0.

DQ12 and MQ14 - Design

The design phase is the last phase before the implementation and programming begins, and we would like to find if also this phase have differences between managers and developers in how they regard the routines and processes described in the QMS versus the actual work processes. Again, we would like to perform a T-test, and form the hypotheses:

Requirements Specification	***Developers***	***Managers***
Mean	3,182	3,8
Variance	0,164	0,2
Observations	11	5
Hypothesized Mean Difference	0	
df	7	
t Stat	-2,639	
P(T<=t) one-tail	0,017	
t Critical one-tail	1,895	

Figure 6.24: Results from T-test of DQ12 and MQ14 - Requirements Specification

> H_0: When regarding the design phase, managers and developers share the view of how actual processes are compared to the ones described in the QMS . ($p \geq 0.05$)
>
> H_1: Managers report a closer match between the design processes described in the QMS and the actual design processes. ($p < 0.05$)

Once more, we see from Figure 6.25, that the results of the T-test gives a P-value lower than our level of significance 0.05, which leads us to reject the null hypothesis, and conclude that there is a high probability that Managers in general report higher conformance between the processes about design described in the QMS, and what is being executed in the company on a daily basis.

Design	***Developers***	***Managers***
Mean	3,000	3,6
Variance	0,200	0,3
Observations	11	5
Hypothesized Mean Difference	0	
df	7	
t Stat	-2,146	
P(T<=t) one-tail	0,035	
t Critical one-tail	1,895	

Figure 6.25: Results from T-test of DQ12 and MQ14 - Design

Summary of RQ2

As all the three tests we have executed have shows us, there is reason to believe that managers in general are more positive and thinks higher of the formal descriptions in the QMS than does the developers, and that they also believe that these are being followed on a more regular basis. Unfortunately, we don't have enough data to perform more statistical analysis on this subject, and it is therefore impossible to conclude anything one way or the other on this matter.

What we may say though, is that all results points in the direction of there being a general variation in the attitudes of managers and developers when regarding formal procedures and issues concerning quality assurance. It does not however, like some have suggested, seem to be a huge gap between them, and in general the ones that we have been in contact with, have all been fairly positive to the concept of formalization.

6.4.3 RQ3 - How make a QMS work?

This Research Question is fairly general, but is also very interesting. Our survey showed that most developers were positive to the QMS, but also that there were issues where they were not satisfied. If we should try to identify three main factors for making a QMS work, the following three would be highly relevant:

- Good training, performed as a combination of workshops and mentor programmes.
- User participation in all phases of implementation and updating of the QMS.
- Frequent updates of the routines and process descriptions.

Again, since we have so few answers in our survey, it is very difficult to prove anything about this, but if we look at the answers have gotten, they all point to that all three factors are pretty well taken care of in the companies we contacted. Questions DQ5 and MQ9, showed that internal lectures and workshops are widely used, while mentoring is less frequently used. DQ6 also shows that most of the developers are satisfied with the training they received.

When regarding the factor of user participation, developers also reported a rather high degree of involvement in both the implementation and updating of the QMS, even though a comparison between DQ15 and MQ19 shows that managers generally were under the impression that developers were more involved in the updating than what the developers reported.
For the last factor, how frequent updates of the QMS are done, this clearly depends on various other factors, such as the structural changes of the company, size of current projects and other. How often changes and updates should be done is difficult to say, but all the respondents answered that the routines were updated with regular intervals.

6.5 Negative responses

After a while of contacting companies asking for their participation in the survey, it became quite clear that getting enough answers would become a difficult

task. One of the reasons for this was the fact that the phase of contacting the companies was postponed due to the collaboration and development of the questionnaire with EDB Business partner, as mentioned in Chapter 4.3. Another reason was that many of the companies on the list of companies were not suitable for participation, either because of their business domain, their size or other properties. Quite of a few of the companies had no QMS, mostly because they felt that they were too small to have such formalities. These companies were typically companies with maximum three-four developers. Some explained that they:

> "Worked so closely together, that they did not need such a system"

or

> "'Our developers know our systems so well. "

To what extent these statements are valid, and if these companies would benefit from a QMS, is not up for discussion in this thesis. Clearly, not all companies see that they need a formal QMS to effectively control their internal routines and procedures. In the next chapter we will a further evaluation of the performing of the survey, and also discuss the validity of the study.

Chapter 7

Discussion of Validity

In this chapter we further discuss aspects concerning how the study was performed and also some of the circumstances for the results we have gained. We do that by introducing four threats to validity of the study, and discuss these. The validity is evaluated along four different aspects as described in Wohlin [WRH+00].

7.1 Conclusion Validity

Conclusion validity is concerned about whether the statistical methods applied are correct. Since the final number of respondents in the survey was so low, the use of statistical methods are limited. Instead we have tried to reason on the results we have, and looking for patterns in those. Our initial plan was to use the two statistical methods T-test and Analysis of Variation (ANOVA), but when the amount of respondents became as low as it got, this was not feasible for all the intended questions. Instead we applied the T-test on a couple of central questions where the number of respondents was reasonably large.
One thing that might become an issue, is the question of fishing; that we have searched for a certain result, and therefore also maybe found proof for this. Since a lot of this thesis and the survey is based on previous studies in the same area, there might be a genuine risk that we unknowingly have searched for similar patterns or conclusions. It is however difficult to do a work like this without becoming biased in one way or another, and it is also very difficult to say if this is the case or not.

7.2 Internal Validity

Internal validity is the matter of whether it exists factors that affects the variables involved in the survey. This may be how the subjects were selected or how the interviews was performed. Since the subjects of this study is selected through a convenience sampling, the chances of the selection affecting the result should be

limited. Still, since we wanted a certain amount of the companies to be certified, we used a quota sample in addition, which may affect the results. When we see that 4 of 7 companies that responded are ISO9001-certified, while only 14 of the 72 companies contacted had such certifications, it is clear that the results may be biased due to this. Is it also natural that companies which have a good working QMS are more eager to participate in surveys like this one? Another form of internal validity is if the respondents have answered truthfully on all questions, or if they one way or another have answered in a specific way to gain some advantage or to not cast their own workplace in a bad light. We have no reason to assume that such has been done, but we cannot guarantee that this is not the case.

To avoid threats to the internal validity, all respondents were given assurance that their name and position would be kept anonymous in this thesis, and that their answers were just for use in this thesis and not to be given either to their employer or other instances.

I addition to this, all questions in the questionnaire was tested both internally among staff at IDI, but also in one company, to get a better understanding of how both developers and managers would react to them.

7.3 Construct Validity

Construct validity is concerned about if the results are possible to generalize back to theory and assumptions made in advance. For example, there is a risk that we have not been explicit enough when making measurements for the results, which can give erroneous conclusions. Again, we meet the issue of too few respondents. Because of the lack of applied statistical methods, it's very difficult to find any real connections and conclude this as either true or false. When reviewing the questions we have found that maybe more of the questions should have been easier to use for statistical methods directly, i.e. by giving the respondents the option to rate their answers on a scale. In this way we would have had more quantitative data, which would have made the analysis less cumbersome. Instead we expected to get enough answers to divide the answers into groups based on features of the companies, which would have allowed us to see differences and similarities between the various kinds of companies etc.

Still, since we rather than using these methods, tried to do other types of analysis, we have not used methods not fitted for the data we had, and therefore the effects on the construct validity are limited.

7.4 External Validity

External validity is validity issues related to generalizing the results to other populations, in this case, the rest of the software industry. Are there special properties about the people, places and times involved in the survey that will affect it's results?

As we also mentioned when discussing internal validity, we have an over-representation of ISO9001-certified companies compared with the total number of companies. This may have affected our results, and is therefore a threat to the external validity. With a larger sample, maybe we could have eliminated this, but as mentioned before, it is always a risk that the companies where the managers are most satisfied with their QMS will be the ones who participate in such surveys. Why we had problems getting companies to participate is another question, and a difficult one to answer. It may be like Rolf Pettersen from ICT Norway suggested, that in bad times, companies can't afford thinking about their internal processes, whilst in really good times, they don't have time for it. Today's situation is that the market is really good for almost all companies developing software and in the ICT industry in general, and the impression we have after performing the study, is that many companies were very busy, and could not find the resources to participate in such studies. Since we ended up doing the survey a bit later than intended, due to the work with EDB Business Partner and the postponement of that work, we also ended up in a situation where many companies were in their most hectic period, when projects should be finished, and deadlines were drawing near.

Chapter 8

Evaluation and Further Work

With the extreme demand for efficiency and high quality in software, companies use a lot of resources on formal Quality Management Systems. Through this thesis, we have tried to find out more about how these systems affect the people developing software, and what impact such systems have on their daily work. By using the results from previous work done in the field, we have performed a survey in a range of Norwegian companies developing software, and interviewed both managers and developers, to get a better understanding of their attitudes towards such systems.

The survey has showed that for the most part, developers are positive to having QMS, but that there are also a lot of challenges left in the field, especially when considering aspects of training, user participation and gaining a better understanding of what we can achieve by utilizing the opportunities in a QMS.

Due to a limited amount of responses to the survey, we have not been able to find a lot of significant results based on statistical analysis, but by discussing the responses we have up against one another we have still found some interesting trends and patterns.

The gap between developers and managers seem to be smaller than what have been suggested, in some previous studies, and this may imply that the industry have grown more mature, and that the Quality Management Systems today are more adapted to the dynamic work situation and development methods that are a part of software development today.

It seems that companies that are certified after formal frameworks may have a very good foundation for further development of their quality assurance and process improvement, but we have found no evidence that such formal certifications is the only way to go. What is the most crucial for the QMS to succeed, seems to be to give the users of the system ownership of their work routines and processes,

and let them be directly involved in the evolution of their workplace.

We suggest that future studies look closer at how these aspects are handled, and also take a closer look at the different roles in software development environments, and how these interact with each other. By looking at the QMS alone we may have gained better understanding of this concept, but we recommend to perform a study which goes deeper into the companies, maybe by performing one ore more case studies, to see how the QMS is actually used by the different roles in the company throughout the development process.

Appendix A

Norwegian Questionnaires

Spørsmål for utviklere

Spørsmålene nedenfor er delt inn i fire kategorier.
K1 Kunnskap om kvalitetssystemet
K2 Bruk av kvalitetssystemet
K3 Implementasjon av kvalitetssystemet
K4 Oppdatering av kvalitetssystemet

Resultatene fra denne undersøkelsen vil brukes i en rapport til en diplomoppgave skrevet ved NTNU våren 2006, men ingen informasjon direkte om firma eller intervjuobjekter vil gjøres tilgjengelig i denne rapporten.

Bedrift: _____

Navn: _____

Stilling: _____

Antall år i firmaet: _____

K1 - Kunnskap om kvalitetssystemet

US1 Vet du om dette firmaet er sertifisert eller godkjent etter noen kvalitets- eller prosessrammerverk? (Kun ett kryss)

- ☐ ISO 9001 / TickIT
- ☐ CMM
- ☐ SPICE
- ☐ Vurdert
- ☐ Annet – Spesifisér ☐
- ☐ Vet ikke

US2 Hva tror du er hovedgrunnene til å ha et Kvalitetssystem?
(Sett gjerne flere kryss)

- ☐ Produktivitet
- ☐ Færre feil i programvare
- ☐ Dokumentasjon for senere bruk
- ☐ Kundetilfredshet / Kundekrav
- ☐ Samsvar med eksterne standarder /sertifisering
- ☐ Ledelseskontroll
- ☐ Annet – Spesifisér ☐
- ☐ Vet ikke

US3 Hvilke deler av utviklingsprosessen dekker kvalitetssystemet?
(Sett gjerne flere kryss)

- [ ] Innsalg og kontraktsinngåelse
- [ ] Planlegging
- [ ] Kravspesifikasjon
- [ ] Design
- [ ] Programmering
- [ ] Testing
- [ ] Leveranse til kunde
- [ ] Forhold til kunder
- [ ] Vedlikehold
- [ ] Kundestøtte
- [ ] Annet – Spesifisér
- [ ] Vet ikke

US4 Hvilken av delene fra US3 er mest relevant for deg som utvikler?
(Kun ett kryss)

- [ ] Innsalg og kontraktsinngåelse
- [ ] Planlegging
- [ ] Kravspesifikasjon
- [ ] Design
- [ ] Programmering
- [ ] Testing
- [ ] Leveranse til kunde
- [ ] Forhold til kunder
- [ ] Vedlikehold
- [ ] Kundestøtte
- [ ] Annet – Spesifisér
- [ ] Vet ikke

K2 – Bruk av kvalitetssystemet

US5 Har du hatt noen trening eller opplæring i bruk av kvalitetssystemet?
(Kun ett kryss)

- [ ] Nei
- [ ] Ja, kurs
- [ ] Ja, workshops/samlinger
- [ ] Ja, fadderordning/mentor
- [ ] Ja, webbasert opplæringsprogram
- [ ] Vet ikke

5.a Hvis opplæring. I hvilke deler av systemet?
(Sett gjerne flere kryss)

- [ ] Innsalg og kontraktsinngåelse
- [ ] Planlegging
- [ ] Kravspesifikasjon
- [ ] Design
- [ ] Programmering
- [ ] Testing
- [ ] Leveranse til kunde
- [ ] Forhold til kunder
- [ ] Vedlikehold
- [ ] Kundestøtte
- [ ] Annet – Spesifisér

US6 Ville du hatt mer opplæring eller trening i bruk av kvalitetssystemet da du begynte i bedriften?
(Kun ett kryss)

- [ ] Nei, kvalitetssystemet er selvforklarende
- [ ] Nei, opplæringen var tilstrekkelig
- [ ] Ja
- [ ] Vet ikke

US7 Hva vil du anbefale at bør gjøres for nyansatte i framtiden, med tanke på opplæring i kvalitetssystemet?
(Kun ett kryss)

- [ ] Mer opplæring
- [ ] Bedre opplæring
- [ ] Bedre oppfølging fra fadder/mentor
- [ ] Annet – Spesifisér
- [ ] Vet ikke

US8 Hvordan vurderer du kvalitetssystemet med hensyn til brukervennlighet? (Kun ett kryss)

- [ ] Lett å navigere og bruke
- [ ] Greit
- [ ] Noe tungvint
- [ ] Ubrukelig
- [ ] Vet ikke

US9 Hvor ofte bruker du kvalitetssystemet? (Kun ett kryss)

- [ ] Aldri

☐ Noen få ganger det siste året
☐ Noen få ganger i måneden
☐ Noen få ganger i uken
☐ Hver dag
☐ Vet ikke

9.a Hvis sjeldnere enn noen få ganger i måneden, hvorfor det?
(Kun ett kryss)
☐ Føler ikke behov for det
☐ Det fjerner fokus fra mitt arbeide
☐ Jeg har ikke tid
☐ kvalitetssystemet er ikke godt nok
☐ Vet ikke

US10 Hvor nyttig er kvalitetssystemet for ditt arbeid?
(Kun ett kryss)
☐ Svært nyttig
☐ Nyttig noen ganger
☐ Ikke veldig nyttig
☐ Unyttig
☐ Vet ikke

US11 Tror du at du bruker systemet mer eller mindre enn hva som er gjennomsnittet for utviklere i denne bedriften? (Kun ett kryss)
☐ Mindre
☐ Omtrent som gjennomsnittet
☐ Mer
☐ Betydelig mer
☐ Vet ikke

US12 I forhold til hvordan rutiner og prosesser er formelt beskrevet i kvalitetssystemet, hvordan samsvarer dette med de faktiske arbeidsprosesser? (Ett kryss pr rad)

Del av prosjekt	(4)Svært likt	(3) Ganske likt	(2)Noe ulikt	(1) Helt ulikt	Vet ikke
Kontraktsinngåelse	☐	☐	☐	☐	☐
Planlegging	☐	☐	☐	☐	☐
Kravspesifikasjon	☐	☐	☐	☐	☐
Design	☐	☐	☐	☐	☐
Programmering	☐	☐	☐	☐	☐
Testing	☐	☐	☐	☐	☐
Leveranse til kunde	☐	☐	☐	☐	☐

Forhold til kunde	☐	☐	☐	☐	☐
Vedlikehold	☐	☐	☐	☐	☐
Kundestøtte	☐	☐	☐	☐	☐

K3 – Implementasjon av kvalitetssystemet

(Ved implementasjon menes her utvikling av rutiner og prosessbeskrivelser, samt innføring av disse i organisasjonen)

US13 Var du ansatt i denne bedriften da kvalitetssystemet ble innført?
☐ Ja
☐ Nei
☐ Vet ikke

Hvis Ja (ansatt ved innføring av kvalitetssystemet)
13.a Var du på noen måte involvert i innføringen av kvalitetssystemet?
☐ Ja
☐ Noe
☐ Nei
☐ Vet ikke

Hvis Ja (involvert i innføringen):
13.a.1 Hvordan var du involvert?
☐ Utviklere ble rådspurt om deres rutiner og daværende arbeidsprosesser
☐ Utviklere fikk muligheten til å komme med forslag til endringer
☐ Det ble gjennomført workshops, møter eller samlinger der utviklere deltok
☐ Annet – spesifisér ☐
☐ Vet ikke

13.b Ville du ha likt å være mer involvert i innføringen av kvalitetssystemet?
☐ Ja
☐ Nei
☐ Vet ikke

K4 – Oppdatering av kvalitetssystemet

US14 Hvor ofte blir rutiner og prosessbeskrivelser i kvalitetssystemet oppdatert?
☐ Svært ofte (månedlig)
☐ Ofte (Noen ganger årlig)

- [ ] Sjelden (Årlig)
- [ ] Så å si aldri
- [ ] Vet ikke

US15 Er du direkte involvert i oppdateringen av kvalitetssystemet?

- [ ] Ja
- [ ] Nei
- [ ] Vet ikke

Hvis Ja (involvert i oppdateringen):
15.a Hvordan er du involvert?

- [ ] Utviklere foreslår oppdateringer eller endringer
- [ ] Kvalitetsansvarlige har workshops eller møter med utviklere
- [ ] Utviklere gjør mindre endringer direkte i kvalitetssystemet etter behov
- [ ] Vet ikke

Spørsmål for kvalitetsansvarlige / ledere

Spørsmålene nedenfor er delt inn i fire kategorier.
K1 Kunnskap om kvalitetssystemet
K2 Bruk av kvalitetssystemet
K3 Implementasjon av kvalitetssystemet
K4 Oppdatering av kvalitetssystemet

Resultatene fra denne undersøkelsen vil brukes i en rapport til en diplomoppgave skrevet ved NTNU våren 2006, men ingen informasjon direkte om firma eller intervjuobjekter vil gjøres tilgjengelig i denne rapporten.

Bedrift: _____

Navn: _____

Stilling: _____

Antall år i firmaet: _____

K1 – Kunnskap om kvalitetssystemet

LS1 Hva slags bedrift er dette? (Kun ett kryss)
☐ Konsulentselskap
☐ Programvarebedrift for COTS (Commercial-off-the-shelf)
☐ Intern IT-avdeling i større selskap
☐ Annet – Spesifisér ☐
☐ Vet ikke

LS2 Eies bedriften av et moderselskap med et sentralt kvalitetssystemet?
☐ Ja
☐ Nei
☐ Vet ikke

LS3 Vet du om bedriften er sertifisert eller godkjent etter noen kvalitets- eller prosessrammerverk? (Kun ett kryss)
☐ ISO 9001 / TickIT
☐ CMM
☐ SPICE
☐ Vurdert
☐ Annet – Spesifisér ☐
☐ Vet ikke

Hvis bedriften er sertifisert eller godkjent:
3.a Hvorfor? (Sett gjerne flere kryss)

- [ ] Krav fra kunder
- [ ] Intern avgjørelse
- [ ] Bestemt av moderselskapet
- [ ] Vet ikke

3.b Hvor lenge har bedriften vært sertifisert? (Kun ett kryss)

- [ ] 0-2 år
- [ ] 3-5 år
- [ ] 6-10 år
- [ ] Lengre
- [ ] Vet ikke

Hvis bedriften ikke er sertifisert:
3.c Har noe slikt noen gang vært vurdert?

- [ ] Ja
- [ ] Nei
- [ ] Vet ikke

Hvis Ja (det har vært vurdert):
3.c.1 Hvorfor ble det bestemt å ikke gå videre med dette?

- [ ] For kostbart
- [ ] Ville ta bort fokus fra primæroppgaver
- [ ] Annet – Spesifisér
- [ ] Vet ikke

LS4 Det finnes flere interesseorganisasjoner for IKT-bedrifter i Norge. Er din bedrift medlem i noen av disse?

- [ ] Den Norske Dataforening
- [ ] Norsk organisasjon for Kvalitet og Risikostyring (NFKR)
- [ ] IKT-Norge
- [ ] Abelia Innovasjon
- [ ] Annet – spesifisér
- [ ] Vet ikke

LS5 Hvordan er kvalitetssystemet (kvalitetssystemet) representert? (Kun ett kryss)

- [ ] Web-grensesnitt
- [ ] Samling av dokumenter lagret elektronisk, men uten ekstra funksjonalitet
- [ ] Papirbasert
- [ ] Integrert inn i verktøy
- [ ] Vet ikke

LS6 Hva er ledelsens primære mål for å opprettholde et kvalitetssystem? (Sett gjerne flere kryss)

- [ ] Økt produktivitet
- [ ] Færre feil i programvare
- [ ] Dokumentasjon for senere bruk
- [ ] Kundetilfredshet
- [ ] Samsvar med eksterne standarder
- [ ] Ledelseskontroll
- [ ] Annet – Spesifisér
- [ ] Vet ikke

LS7 Hvilke deler av utviklingsprosessen dekkes av kvalitetssystemet? (Sett gjerne flere kryss)

- [ ] Innsalg og kontraktsinngåelse
- [ ] Planlegging
- [ ] Kravspesifikasjon
- [ ] Design
- [ ] Programmering
- [ ] Testing
- [ ] Leveranse til kunde
- [ ] Forhold til kunder
- [ ] Vedlikehold
- [ ] Kundestøtte
- [ ] Annet – Spesifisér
- [ ] Vet ikke

LS8 Hvilken del av kvalitetssystemet anser du som mest relevant for ditt arbeid?

K2 – Bruk av kvalitetssystemet

LS9 Hvordan utføres trening og opplæring i kvalitetssystemet? (Kun ett kryss)

- [ ] Ingen spesiell opplæring
- [ ] Interne kurs
- [ ] Workshops/møter med utviklere
- [ ] Fadderordning/mentor
- [ ] Webbasert opplæring
- [ ] Annet – Spesifisér
- [ ] Vet ikke

LS10 Har dere nok ressurser til å utføre nødvendig opplæring og motivasjon til bruk av kvalitetssystemet? (Kun ett kryss)

- [ ] Ja
- [ ] Noe, men ikke nok
- [ ] Svært lite
- [ ] Ikke noe ressurser
- [ ] Vet ikke

LS11 Hvor ofte bruker du personlig kvalitetssystemet? (Kun ett kryss)

- [ ] Aldri
- [ ] Noen få ganger det siste året
- [ ] Noen få ganger i måneden
- [ ] Noen få ganger i uken
- [ ] Hver dag
- [ ] Vet ikke

LS12 Hvor ofte tror du utviklere bruker kvalitetssystemet? (Kun ett kryss)

- [ ] Aldri
- [ ] Noen få ganger det siste året
- [ ] Noen få ganger i måneden
- [ ] Noen få ganger i uken
- [ ] Hver dag
- [ ] Vet ikke

LS13 Hvor nyttig er kvalitetssystemet for din rolle som leder/kvalitetsansvarlig? (Kun ett kryss)

- [ ] Svært nyttig
- [ ] Nyttig til tider
- [ ] Ikke særlig nyttig
- [ ] Unyttig
- [ ] Vet ikke

13.a Hvilke deler synes du er mest nyttige for deg?

LS14 I forhold til hvordan rutiner og prosesser er beskrevet i kvalitetssystemet, hvordan samsvarer dette med slik du arbeider til daglig? (Ett kryss pr rad)

Del av prosjekt	(4)Svært likt	(3) Ganske likt	(2)Noe ulikt	(1) Helt ulikt	Vet ikke
Kontaktsinngåelse	☐	☐	☐	☐	☐
Planlegging	☐	☐	☐	☐	☐
Kravspesifikasjon	☐	☐	☐	☐	☐
Design	☐	☐	☐	☐	☐
Programmering	☐	☐	☐	☐	☐
Testing	☐	☐	☐	☐	☐
Leveranse til kunde	☐	☐	☐	☐	☐
Forhold til kunde	☐	☐	☐	☐	☐
Vedlikehold	☐	☐	☐	☐	☐
Kundestøtte	☐	☐	☐	☐	☐

K3 – Implementasjon av kvalitetssystemet

(Ved implementasjon menes her utvikling av rutiner og prosessbeskrivelser, samt innføring av disse i organisasjonen)

LS15 Hvem sto for implementasjonen? (Sett gjerne flere kryss)

☐ Eksterne konsulenter
☐ Moderselskap eller toppledelse
☐ QA-avdeling
☐ Prosjektledere
☐ Utviklere
☐ Vet ikke

LS16 Var utviklere eller andre brukere av kvalitetssystemet involvert ved implementasjonen?
(Kun ett kryss)

☐ Ja
☐ Noe
☐ Nei
☐ Vet ikke

Hvis Ja (utviklere var involvert):
16.a Hvordan var de involvert?? (Sett gjerne flere kryss)

☐ Utviklere ble rådspurt om deres rutiner og daværende arbeidsprosesser
☐ Utviklere fikk muligheten til å komme med forslag til endringer
☐ Det ble gjennomført workshops, møter eller samlinger der utviklere deltok
☐ Annet – spesifisér ☐
☐ Vet ikke

K4 – Oppdatering av kvalitetssystemet

LS17 Hvor ofte blir rutiner og prosessbeskrivelser i kvalitetssystemet oppdatert? (Kun ett kryss)

- [ ] Svært ofte (månedlig)
- [ ] Ofte (noen ganger årlig)
- [ ] Sjelden (årlig)
- [ ] Så å si aldri
- [ ] Vet ikke

LS18 Hvem er ansvarlige for oppdateringer av kvalitetssystemet? (Sett gjerne flere kryss)

- [ ] Eksterne konsulenter
- [ ] Moderselskap eller toppledelse
- [ ] QA-avdeling
- [ ] Prosjektledere
- [ ] Utviklere
- [ ] Vet ikke

US19 Er utviklere involvert i oppdateringer av kvalitetssystemet? (Kun ett kryss)

- [ ] Ja
- [ ] Noe
- [ ] Nei
- [ ] Vet ikke

US20 Finnes det en systematisk samling av erfaringsdata som blir brukt ved oppdatering av kvalitetssystemet?

- [ ] Ja
- [ ] Nei
- [ ] Vet ikke

Appendix B

Results Spreadsheets

Analyse Utviklere														
Firma	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Navn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Stilling	Systemutvikler	Designer	Designer	Systemutvikler	Utviklingsingeniør	Systemutvikler	Systemutvikler	Systemutvikler	Systemutvikle	Systemutvikle	Systemarkitekt	Systemutvkler	Systemutvikler	
Antall år	3	3	3,5	1	5	1	7	1	3	5	16	9	1	
														SUM
US1 Vet du om dette firmaet er sertifisert eller godkjent etter noen kvalitets- eller prosessrammerverk? (Kun ett kryss)														
ISO 9001 / TickIT	1	1	1	1	1	1	1		1	1	1	1	1	12
CMM														0
SPICE														0
Vurdert														0
Annet – Spesifisér														0
Vet ikke								1						1
US2 Hva tror du er hovedgrunnene til å ha et Kvalitetssystem?														
(Sett gjerne flere kryss)														
Produktivitet	1							1	1		1		1	5
Færre feil i programvare			1		1	1	1	1	1	1	1	1	1	10
Dokumentasjon for senere bruk			1	1		1	1		1	1	1	1	1	9
Kundetilfredshet / Kundekrav	1	1	1	1	1	1	1	1	1	1	1		1	12
Samsvar med eksterne standarder /sertifisering				1	1	1			1	1	1		1	7
Ledelseskontroll				1		1		1	1		1			5
Annet – Spesifisér														0
Vet ikke														0
US3 Hvilke deler av utviklingsprosessen dekker kvalitetssystemet?														
(Sett gjerne flere kryss)														
Innsalg og kontraktsinngåelse	1	1	1	1		1	1		1		1			8
Planlegging	1	1	1	1	1		1		1	1	1		1	10
Kravspesifikasjon	1	1	1	1	1	1	1		1	1	1	1	1	12
Design	1	1	1		1		1		1		1	1	1	9
Programmering	1	1	1		1	1	1		1	1	1	1	1	11
Testing	1	1	1		1	1	1	1	1		1	1	1	11
Leveranse til kunde	1	1	1		1	1	1		1	1	1		1	10
Forhold til kunder	1	1	1	1	1	1	1	1	1		1			10
Vedlikehold	1	1				1	1	1	1		1		1	8
Kundestøtte	1	1			1	1	1	1			1			7
Annet – Spesifisér			1											1
Vet ikke														0
US4 Hvilken av delene fra US3 er mest relevant for deg som utvikler?														
(Kun ett kryss)														
Innsalg og kontraktsinngåelse														0
Planlegging						1	1				1		1	4
Kravspesifikasjon		1		1		1	1			1	1		1	7
Design	1	1	1				1		1		1	1	1	8
Programmering	1	1	1			1					1	1	1	7
Testing	1	1			1	1	1	1			1			7
Leveranse til kunde	1						1							2
Forhold til kunder														0
Vedlikehold	1	1				1		1						4
Kundestøtte	1													1
Annet – Spesifisér														0
Vet ikke														0
K2 – Bruk av kvalitetssystemet														
US5 Har du hatt noen trening eller opplæring i bruk av kvalitetssystemet?														
(Kun ett kryss)														
Nei								1		1				2
Ja, kurs				1			1		1					3
Ja, workshops/samlinger	1	1	1		1						1	1	1	7
Ja, fadderordning/mentor						1								1
Ja, webbasert opplæringsprogram													1	1

Kravspesifikasjon				1		1	1		1		1	1	1	7
Design	1		1		1		1		1		1	1	1	8
Programmering	1		1			1	1		1		1	1	1	8
Testing				1	1	1	1		1		1	1	1	8
Leveranse til kunde					1									1
Forhold til kunder					1									1
Vedlikehold				1									1	2
Kundestøtte														0
Annet – Spesifisér		1												1
														0
US6 Ville du hatt mer opplæring eller trening i bruk av kvalitetssystemet da du begynte i bedriften?														
(Kun ett kryss)														
Nei, kvalitetssystemet er selvforklarende								1				1		2
Nei, opplæringen var tilstrekkelig	1	1		1		1			1		1		1	7
Ja					1		1			1				3
Vet ikke			1											1
														0
														0
US7 Hva vil du anbefale at bør gjøres for nyansatte i framtiden, med tanke på opplæring i kvalitetssystemet?														
(Kun ett kryss)														
Mer opplæring						1				1				2
Bedre opplæring							1							1
Bedre oppfølging fra fadder/mentor					1			1				1		3
Annet – Spesifisér											1		1	2
Vet ikke	1	1	1	1					1					5
														0
US8 Hvordan vurderer du kvalitetssystemet med hensyn til brukervennlighet? (Kun ett kryss)														
Lett å navigere og bruke								**1**			**1**			2
Greit		1	1	1		1	1					1	1	7
Noe tungvint	1				1				1	1				4
Ubrukelig														0
Vet ikke														0
US9 Hvor ofte bruker du kvalitetssystemet? (Kun ett kryss)														
Aldri														0
Noen få ganger det siste året													1	1
Noen få ganger i måneden				1	1				1	1	1			5
Noen få ganger i uken	1		1			1	1	1						5
Hver dag		1										1		2
Vet ikke														0
9.a Hvis sjeldnere enn noen få ganger i måneden, hvorfor det?														
(Kun ett kryss)														
Føler ikke behov for det				1									1	2
Det fjerner fokus fra mitt arbeide														0
Jeg har ikke tid														0
kvalitetssystemet er ikke godt nok														0
Vet ikke														0
US10 Hvor nyttig er kvalitetssystemet for ditt arbeid?														
(Kun ett kryss)														
Svært nyttig	1		1				1							3
Nyttig noen ganger		1		1	1	1		1	1	1	1	1	1	10
Ikke veldig nyttig														0
Unyttig														0
Vet ikke														0
US11 Tror du at du bruker systemet mer eller mindre enn hva som er gjennomsnittet for utviklere i denne bedriften? (Kun ett kryss)														
Mindre										1				1

US12 I forhold til hvordan rutiner og prosesser er formelt beskrevet i kvalitetssystemet, hvordan samsvarer dette med de faktiske arbeidsprosesser? (Ett kryss pr rad)														
Kontraktsinngåelse														
Svært likt						1								1
Ganske likt				1										1
Noe ulikt														0
Helt ulikt														0
Vet ikke	1	1			1		1	1	1	1	1	1	1	10
Planlegging														
Svært likt													1	1
Ganske likt		1				1	1			1	1			5
Noe ulikt				1	1				1					3
Helt ulikt														0
Vet ikke	1							1				1		3
Kravspesifikasjon														
Svært likt											1		1	2
Ganske likt	1	1		1	1	1	1		1	1		1		9
Noe ulikt														0
Helt ulikt														0
Vet ikke								1						1
Design														
Svært likt													1	1
Ganske likt	1	1	1		1	1	1		1		1	1		9
Noe ulikt				1										1
Helt ulikt														0
Vet ikke								1		1				2
Programmering														
Svært likt						1							1	2
Ganske likt	1	1					1		1	1	1	1		7
Noe ulikt					1									1
Helt ulikt				1										1
Vet ikke								1						1
Testing														
Svært likt								1			1		1	3
Ganske likt	1	1			1				1	1		1		6
Noe ulikt				1		1	1							3
Helt ulikt														0
Vet ikke														0
Leveranse til kunde														
Svært likt						1		1			1		1	4
Ganske likt					1		1							2
Noe ulikt														0
Helt ulikt														0
Vet ikke	1	1		1					1	1		1		6
Forhold til kunde														
Svært likt								1						1
Ganske likt						1	1							2
Noe ulikt														0
Helt ulikt														0
Vet ikke	1	1		1					1	1	1	1	1	8
Vedlikehold														
Svært likt								1						1
Ganske likt	1	1				1	1			1	1			6
Noe ulikt														0
Helt ulikt														0
Vet ikke				1					1			1	1	4
Kundestøtte														
Svært likt								1						1
Ganske likt						1				1	1			3
Noe ulikt							1							1
Helt ulikt														0

Hvis Ja (ansatt ved innføring av kvalitetssystemet)														
13.a Var du på noen måte involvert i innføringen av kvalitetssystemet?														
Ja			1				1				1			3
Noe		1										1		2
Nei	1													1
Vet ikke														0
Hvis Ja (involvert i innføringen):														
13.a.1 Hvordan var du involvert?														
Utviklere ble rådspurt om deres rutiner og daværende arbeidsprosesser							1				1			2
Utviklere fikk muligheten til å komme med forslag til endringer		1	1				1				1			4
Det ble gjennomført workshops, møter eller samlinger der utviklere deltok											1			1
Annet – spesifisér														0
Vet ikke														0
13.b Ville du ha likt å være mer involvert i innføringen av kvalitetssystemet?														
Ja														0
Nei	1		1				1	1			1	1		6
Vet ikke		1				1								2
K4 – Oppdatering av kvalitetssystemet														
US14 Hvor ofte blir rutiner og prosessbeskrivelser i kvalitetssystemet oppdatert?														
Svært ofte (månedlig)	1													1
Ofte (Noen ganger årlig)		1	1	1		1	1			1	1	1		8
Sjelden (Ärlig)					1				1				1	3
Så å si aldri														0
Vet ikke								1						1
US15 Er du direkte involvert i oppdateringen av kvalitetssystemet?														
Ja			1	1		1	1		1	1	1	1	1	9
Nei	1	1			1			1						4
Vet ikke														0
Hvis Ja (involvert i oppdateringen):														
15.a Hvordan er du involvert?														
Utviklere foreslår oppdateringer eller endringer			1	1		1	1			1	1	1		7
Kvalitetsansvarlige har workshops eller møter med utviklere									1	1			1	3
Utviklere gjør mindre endringer direkte i kvalitetssystemet etter behov											1			1
Vet ikke														0

Analyse Kvalitetsansvarlige								
Firma	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Navn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Stilling	Kvalitetsansvarlig	Kvalitetssjef	Prosjektdirektør	Kvalitetsansvarlig	Kvalitetsansvarlig	Kvalitetsansvarlig	Education Manager	SUM
Antall år		16	1	1	1	19	10	
LS1 Hva slags bedrift er dette? (Kun ett kryss)								
Konsulentselskap			1	1	1			3
Programvarebedrift for COTS (Commercial-off-the-shelf)		1				1	1	3
Intern IT-avdeling i større selskap	1							1
Annet – Spesifisér								0
Vet ikke								0
LS2 Eies bedriften av et moderselskap med et sentralt kvalitetssystemet?								
Ja	1				1		1	3
Nei		1	1	1		1		4
Vet ikke								0
LS3 Vet du om bedriften er sertifisert eller godkjent etter noen kvalitets- eller prosessrammerverk? (Kun ett kryss)								
ISO 9001 / TickIT		1		1		1	1	4
CMM								0
SPICE								0
Vurdert	1							1
Annet – Spesifisér			1					1
Vet ikke								0
Hvis bedriften er sertifisert eller godkjent:								
3.a Hvorfor? (Sett gjerne flere kryss)								
Krav fra kunder				1		1		2
Intern avgjørelse		1				1		2
Bestemt av moderselskapet							1	1
Vet ikke								0
3.b Hvor lenge har bedriften vært sertifisert? (Kun ett kryss)								0
0-2 år								0
3-5 år				1				1
6-10 år						1	1	2
Lengre		1						1
Vet ikke								0
Hvis bedriften ikke er sertifisert:								
3.c Har noe slikt noen gang vært vurdert?								
Ja	1							1
Nei			1					1
Vet ikke					1			1
Hvis Ja (det har vært vurdert):								
3.c.1 Hvorfor ble det bestemt å ikke gå videre med dette?								
For kostbart	1							1
Ville ta bort fokus fra primæroppgaver								0
Annet – Spesifisér								0
Vet ikke								0

LS4 Det finnes flere interesseorganisasjoner for IKT-bedrifter i Norge. Er din bedrift medlem i noen av disse?								
Den Norske Dataforening		1	1		1		1	4
Norsk organisasjon for Kvalitet og Risikostyring (NFKR)								0
IKT-Norge			1					1
Abelia Innovasjon								0
Annet – spesifisér		1						1
Vet ikke				1				1
LS5 Hvordan er kvalitetssystemet (kvalitetssystemet) representert? (Kun ett kryss)								
Web-grensesnitt	1		1	1		1	1	5
Samling av dokumenter lagret elektronisk, men uten ekstra funksjonalitet		1			1			2
Papirbasert								0
Integrert inn i verktøy				1				1
Vet ikke								
LS6 Hva er ledelsens primære mål for å opprettholde et kvalitetssystem? (Sett gjerne flere kryss)								
Økt produktivitet	1	1	1	1	1	1	1	7
Færre feil i programvare		1	1	1	1	1		5
Dokumentasjon for senere bruk		1				1	1	3
Kundetilfredshet	1	1	1	1	1	1	1	7
Samsvar med eksterne standarder						1	1	2
Ledelseskontroll		1			1	1		3
Annet – Spesifisér			1					1
Vet ikke								0
LS7 Hvilke deler av utviklingsprosessen dekkes av kvalitetssystemet? (Sett gjerne flere kryss)								
Innsalg og kontraktsinngåelse		1	1	1	1	1	1	6
Planlegging	1	1		1	1	1	1	6
Kravspesifikasjon	1	1		1	1	1	1	6
Design	1	1		1	1	1	1	6
Programmering	1	1		1	1	1	1	6
Testing	1	1	1	1	1	1	1	7
Leveranse til kunde		1		1	1	1	1	5
Forhold til kunder		1		1	1	1	1	5
Vedlikehold		1	1	1	1	1	1	6
Kundestøtte		1		1	1	1	1	5
Annet – Spesifisér								0
Vet ikke								0
LS8 Hvilken del av kvalitetssystemet anser du som mest relevant for ditt arbeid?								
		1	1	1	1		1	5
K2 – Bruk av kvalitetssystemet								
LS9 Hvordan utføres trening og opplæring i kvalitetssystemet? (Kun ett kryss)								
Ingen spesiell opplæring								0
Interne kurs		1		1			1	3
Workshops/møter med utviklere					1	1		2
Fadderordning/mentor								0
Webbasert opplæring	1							1
Annet – Spesifisér			1					1
Vet ikke								0

LS10 Har dere nok ressurser til å utføre nødvendig opplæring og motivasjon til bruk av kvalitetssystemet? (Kun ett kryss)								
Ja	1		1	1			1	4
Noe, men ikke nok		1			1	1		3
Svært lite								0
Ikke noe ressurser								0
Vet ikke								0
LS11 Hvor ofte bruker du personlig kvalitetssystemet? (Kun ett kryss)								
Aldri								0
Noen få ganger det siste året			1					1
Noen få ganger i måneden								0
Noen få ganger i uken					1		1	2
Hver dag	1	1		1		1		4
Vet ikke								0
LS12 Hvor ofte tror du utviklere bruker kvalitetssystemet? (Kun ett kryss)								
Aldri								0
Noen få ganger det siste året								0
Noen få ganger i måneden					1	1		2
Noen få ganger i uken		1	1	1			1	4
Hver dag								0
Vet ikke								0
LS13 Hvor nyttig er kvalitetssystemet for din rolle som leder/kvalitetsansvarlig? (Kun ett kryss)								
Svært nyttig	1	1	1	1		1		5
Nyttig til tider					1		1	2
Ikke særlig nyttig								0
Unyttig								0
Vet ikke								0
13.a Hvilke deler synes du er mest nyttige for deg?		**1**	**1**	**1**	**1**		**1**	5
LS14 I forhold til hvordan rutiner og prosesser er beskrevet i kvalitetssystemet, hvordan samsvarer dette med slik du arbeider til daglig? (Ett kryss pr rad)								
Kontraktsinngåelse								
Svært likt		1	1				1	3
Ganske likt				1				1
Noe ulikt						1		1
Helt ulikt								0
Vet ikke					1			1
Planlegging								
Svært likt		1		1			1	3
Ganske likt					1	1		2
Noe ulikt								0
Helt ulikt								0
Vet ikke			1					1
Kravspesifikasjon								
Svært likt		1		1		1	1	4
Ganske likt					1			1
Noe ulikt								0

Helt ulikt								0
Vet ikke			1					1
Design								
Svært likt		1				1	1	3
Ganske likt				1	1			2
Noe ulikt								0
Helt ulikt								0
Vet ikke		1	1					2
Programmering								
Svært likt						1		1
Ganske likt				1	1			2
Noe ulikt								0
Helt ulikt								0
Vet ikke		1	1				1	3
Testing								
Svært likt						1		1
Ganske likt				1	1			2
Noe ulikt								0
Helt ulikt								0
Vet ikke		1	1				1	3
Leveranse til kunde								
Svært likt					1		1	2
Ganske likt				1				1
Noe ulikt						1		1
Helt ulikt								0
Vet ikke		1	1					2
Forhold til kunde								
Svært likt				1			1	2
Ganske likt					1	1		2
Noe ulikt								0
Helt ulikt								0
Vet ikke								0
Vedlikehold								
Svært likt						1	1	2
Ganske likt				1	1			2
Noe ulikt								0
Helt ulikt								0
Vet ikke								0
Kundestøtte								
Svært likt						1	1	2
Ganske likt				1				1
Noe ulikt								0
Helt ulikt								0
Vet ikke					1			1
K3 – Implementasjon av kvalitetssystemet								
(Ved implementasjon menes her utvikling av rutiner og prosessbeskrivelser, samt innføring av disse i organisasjonen)								
LS15 Hvem sto for implementasjonen? (Sett gjerne flere kryss)								
Eksterne konsulenter								0
Moderselskap eller toppledelse		1		1		1	1	4
QA-avdeling		1		1	1		1	4
Prosiektledere	1	1	1		1		1	5

Utviklere		1	1		1			3
Vet ikke								0
LS16 Var utviklere eller andre brukere av kvalitetssystemet involvert ved implementasjonen?								
(Kun ett kryss)								
Ja		1		1	1	1	1	5
Noe			1					1
Nei								0
Vet ikke								0
Hvis Ja (utviklere var involvert):								
16.a Hvordan var de involvert?? (Sett gjerne flere kryss)								
Utviklere ble rådspurt om deres rutiner og daværende arbeidsprosesser		1	1			1	1	4
Utviklere fikk muligheten til å komme med forslag til endringer		1	1	1		1	1	5
Det ble gjennomført workshops, møter eller samlinger der utviklere deltok		1			1	1		3
Annet – spesifisér								0
Vet ikke								0
K4 – Oppdatering av kvalitetssystemet								
LS17 Hvor ofte blir rutiner og prosessbeskrivelser i kvalitetssystemet oppdatert? (Kun ett kryss)								
Svært ofte (månedlig)						1		1
Ofte (noen ganger årlig)	1			1				2
Sjelden (årlig)		1	1		1		1	4
Så å si aldri								0
Vet ikke								0
LS18 Hvem er ansvarlige for oppdateringer av kvalitetssystemet? (Sett gjerne flere kryss)								
Eksterne konsulenter								0
Moderselskap eller toppledelse		1				1		2
QA-avdeling		1		1	1		1	4
Prosjektledere	1	1	1			1		4
Utviklere	1	1	1			1		4
Vet ikke								0
US19 Er utviklere involvert i oppdateringer av kvalitetssystemet? (Kun ett kryss)								
Ja	1	1			1	1		4
Noe			1	1			1	3
Nei								0
Vet ikke								0
US20 Finnes det en systematisk samling av erfaringsdata som blir brukt ved oppdatering av kvalitetssystemet?								
Ja	1	1						2
Nei			1	1		1	1	4
Vet ikke					1			1

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