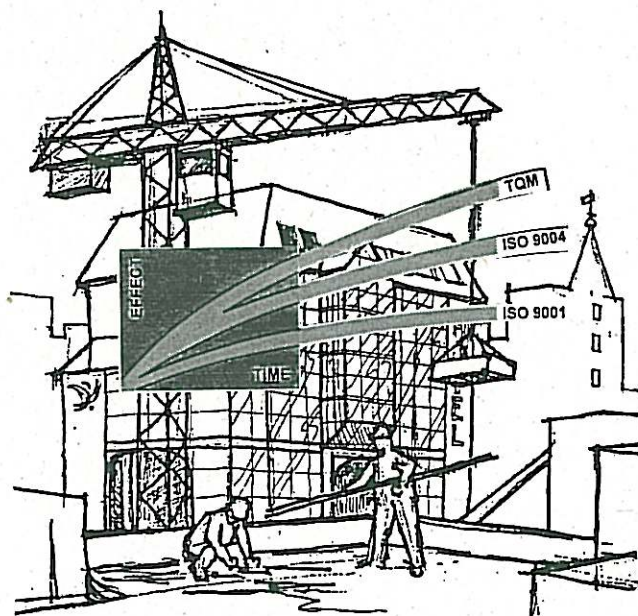


Odd Sjøholt and Ola Stave

# Quality Management System – QMS Selected articles



BYGGFORSK

Norges byggforskningsinstitutt

Odd Sjøholt and Ola Stave

**Quality Management  
System – QMS  
Selected articles**

Project report 174 – 1995

Project report no. 174  
Odd Sjøholt and Ola Stave  
Quality Management System – QMS  
Selected articles

ISSN 0801-6461  
ISBN 82-536-0483-1  
100 copies printed by  
Lobo Grafisk as  
Cyclus recycled paper  
cover 200 g, content 100 g

© Norges byggforskningsinstitutt 1995  
Norwegian Building Research Institute  
Address:  
Forskningsveien 3B  
P.O.Box 123 Blindern  
N- 0314 OSLO  
Phone:  
+47 22 96 55 00  
Telefax:  
+47 22 96 55 42  
(Sales department fax +47 22 96 55 08)

**Key words**

Quality Management System  
Development  
Implementation

# Preface

This report is a collection of articles on practical adaption of the Quality Management System - QMS. This system is tailored for use in building and construction industry. The major developer is the Norwegian Building Research Institute, Byggforsk. The system is currently under further development, in cooperation with many kinds of companies and in contact with building research institutes in several countries.

The articles were originally written to the international conference "Quality management in building and construction". This conference was organized by Byggforsk as one of 18 conferences at the Vision Eureka Lillehammer '94. The proceedings from the conference were printed in a limited number of copies (available from Byggforsk). The articles in this report are selected reprints from the proceedings, concerning particularly the QMS. Together the articles are representing QMS experiences from almost all the main participants in the building process.

Byggforsk is at the moment developing still two more areas. The local building authorities from a number of communities are together with Byggforsk building up their version of the QMS for handling of building control. The QMS for Heating, Ventilation and Air Conditioning - HVAC - is under development within three groups of companies in Norway and Sweden.

As the QMS concept is already widely spread and often requested by new potential users we are publishing this volume of articles giving a fairly broad picture of practical implementation.

Oslo, March 1995  
Norwegian Building Research Institute

Åge Hallquist  
Managing Director

# Contents

<i>Preface</i> .....	3
<i>Contents</i> .....	4
<i>Introduction</i> .....	5
<i>Stave, O.:</i> Quality management system - QMS. Basic concept and practical tools .....	8
<i>Meyer, B.O.:</i> The psychological factor in establishing Quality systems.....	15
<i>Valset, J.J.:</i> Real Estate Developer's Quality System .....	20
<i>Arge, K.:</i> Architectural Quality.....	28
<i>Westgaard, H.:</i> Quality Management for Architects in Norway .....	31
<i>Dolve, I.N.:</i> Implementing Quality Management.....	36
<i>Backe, T. og Åsheim, T.:</i> Implementing quality management - in plumbing companies .....	40
<i>Bonnevie-Svendsen, M. og Eckhoff, J.G.:</i> The development of quality management in the concrete pipe industry in Norway.....	45
<i>Berg, T.F.:</i> Internal Control of Health, Safety and Working Environment integrated in a Quality System. Pilot Projects in the Norwegian Construction Industry .....	51
<i>Klakegg, O.J.:</i> Quality Management in technical education for the building industry .....	57

# Introduction

**Odd Sjøholt**

**Norwegian Building Research Institute, Building Technology Department**

## **International state of the art**

The following conclusions were written in the preface to the proceedings from the Eureka conference "Quality management in building and construction", mainly based on the contributions to the conference.

### *The scope of quality management*

There is a better understanding about nuances between quality assurance, control and management. Total quality management has become a buzz word during the very few last years, also in building and construction. But in some years may be the simple basic words are taking over again, like company management and project management.

The slogan "Three is one" is reflecting quality, safety and environment as three parallel elements being treated together. This is coming up in most countries, even though each of the elements tends to pop up quite individually from the ministries being responsible.

### *Research and development work*

In the pioneer countries the time has recently come for researchers to gather experiences from the industry. This type of work is of great value, to prove the effects of quality development. But on the other hand, the time lag from the introduction of quality assurance and certificates to the reported experiences is quite long. However, the potential for increasing the efficiency through such research seems to be rather high by better cooperation, even between countries. Newcoming countries could avoid some trials and errors of those with experiences.

To speed up the accumulation of knowledge some action type research is used. In some countries with scarce resources this may even be the only type that can be funded. Some academic traditions may hinder the researchers in taking responsibilities in the industry's processes. On the other hand the many inspiring examples presented from companies shows that their work really is worthwhile to subsidize for parallel research involvement. International cooperation being under way may increase the benefit of such work.

A governmental pulling force is to give financial benefits for quality development work, like funding and subsidies. Some countries have subsidized implementation work in the industry, but few have used such funding actively for structuring development work to support special quality goals and policies. This opportunity could have been used giving a better balance between the negative bespoken certificates for their own sake, and on the account of quality improvement programmes.

### *The national and international driving forces, results and future*

The quality movement has greatly contributed to the building and construction industry, and has given a significant signal to unite the industry management improvement. The industry has for many years missed this type of a common slogan.

The public laws and regulations on buildings, health, environment and safety are still the basic driving forces. Tendencies are clear on including quality aspects, either as assurance, control or management. Where the regulations and the industry are ripe there are movements from public inspection to some private internal or self control. It is still to be seen if this can be done efficiently without too much documentation and bureaucracy, which normally do not add value to the product.

Public building and construction work contracting is one other main driving force. Requirements for quality systems are growing, with some references to the ISO standards, and a couple of countries plan to require a certificate. In Europe the EU directives will probably have a pushing effect in this direction, even though they will not require certificates. The certifying bodies are acting as dominant premature pushing forces.

The certification of quality systems has been much criticized, and is probably an area where the goals and methods might be further developed. Other evaluating methods used in quality awards seems to attract the industry more. Even though the methods are more subjective than audits, they give more ideas to improvements.

All partners in the industry as well as public and private clients have to take part in the quality process. If someone is missing, the totality will not improve. Initiatives for coordination of management systems seem beneficial. There are already positive results like the customers orientation, with a focus on the clients brief as well as the facilities management. Even though the feedback loop with improvements is improved within companies, methods for feedback from the projects and the products in use have to be developed.

Only the best managed companies are able to prove sustained and continuous improvements and at least half of the enthusiastic companies do fall back to former behaviour after a while. This is mostly due to type of driving forces and the implementation methods. To overcome this basic challenge we need better strategies both nationally and internationally.

### **The concept of QMS - as documented in the report**

Norway happened to come early into touch with the quality concepts, mainly connected with petroleum activities in the North Sea. The construction industry wanted a more practical approach, based on the industrys own need and benefit. Byggforsk started in 1985 the development of the QMS system, which today is introduced in half a dozen of countries, and experienced by 3-400 companies. They are representing all the partners and trades involved in the building process, the client or owner included.

The QMS features cover what is needed for any type of company or organization to develop and implement their own system.

- a) A basic matrix structure for building up a system (an archive code) for a company involved in any part of the building process
- b) A five step approach for development of a system and implementation in a company
- c) A coordinated group approach for smaller companies establishing their individual systems
- d) Project quality plan models for different trades
- e) A start pack with models for basic forms (on disk).

The QMS concept is spread by consultants being coached by Byggforsk, and having a package of tools available. Included is a database available at Byggforsk, including some hundreds of examples of practical documents in quality systems. They are covering management of companies as well as management of each stage in the building process, from inception to maintenance.

### **The aspects treated by the articles**

#### *The QMS structure, contents, psychological aspects and references:*

Stave, Ola. The basic of QMS

Meyer, Bjørn Otto. The psychological factors in implementing QMS

#### *The client and owner approach:*

Valsset, J.J. The QMS applied to a real estate developer, having joined a club following the five step approach

#### *The architect and quality:*

Arge, Kirsten. A separat study on what architectural quality seems to be depending on.

Westgaard, Halvor. The QMS applied to develop a model for architects, in parallell to implementing individual quality systems in architectural firms participating in a group of companies.

#### *The main contractor - as a case from an association:*

Dolve, Inge N. The QMS concept used as a basis for implementing quality management in the administration of the Norwegian Association of General Contractors.

#### *The subcontractor:*

Backe, Tor and Åsheim, Trond. The QMS concept used as a strategy for the "Association of Plumbing, Heating and Ventilating Contractors" to introduce quality management in their members companies.

#### *The factory and supplier:*

Bonnevie-Svendsen, Morten and Eckhoff, Jan G. The QMS approach for developing a model system for the members of an umbrella organization for a number of concrete pipe manufacturers, in parallell with implementation of individual systems in a pilot group of companies.

#### *The external requirements on health, environment and safety:*

Berg, Torer F. Studies on implementation of Health, Safety and Environmental precautions in companies and projects, seen in connection with quality systems.

#### *The implementation in education:*

Klakegg, Ole Jonny. The basic of quality management and use of the QMS concept in education.



# Quality management system - QMS. Basic concept and practical tools.

Ola Stave

Norwegian Building Research Institute, Building Technology Department, Oslo, Norway

## Abstract

This paper will present the main elements in the development of the Norwegian Quality Management System - QMS. The development started in 1985, and is at the moment used by more than 400 companies in Norway, Holland, Finland, Iceland and Sweden. Companies in other countries are starting to use this as a model to implement practical quality management systems. The paper gives the outline of the basic concept which the development is based on, and gives some information on the main tools for implementation within building and construction industry. It is very easy to do major mistakes in the process within a single company. A lot of experience is gathered in this area from the entire period from 1985, and this is continuously put into the QMS model. Mainly the system is based on a continuously improvement process, like in Total Quality Management concepts. But there are still many pitfalls on this way. Quite a lot of decisions have to be made, and mainly they have to be taken in the right order to give the best results. Many parallel processes are going on at the same time, and it is essential to know which process you are dealing with at the different stages. The QMS relates to ISO 9000 series, and is organized in a way that enables the single company's quality management system to be understood and used in a practical way.

## 1 The development of the QMS

We started up a discussion in 1985 with a group of contractors, a group of plumbers and a group of concrete element factories that there should be developed a more practical way of establishing quality management systems within the building and construction industry onshore. We had seen that the way this area was handled in the offshore industry was too complex for mainly small and medium sized companies onshore. We saw very early that the extensive use of inspection, checklists and separate quality personell was not a practical way of organizing this in the onshore industry. The responsibility had to be organized in the production line.

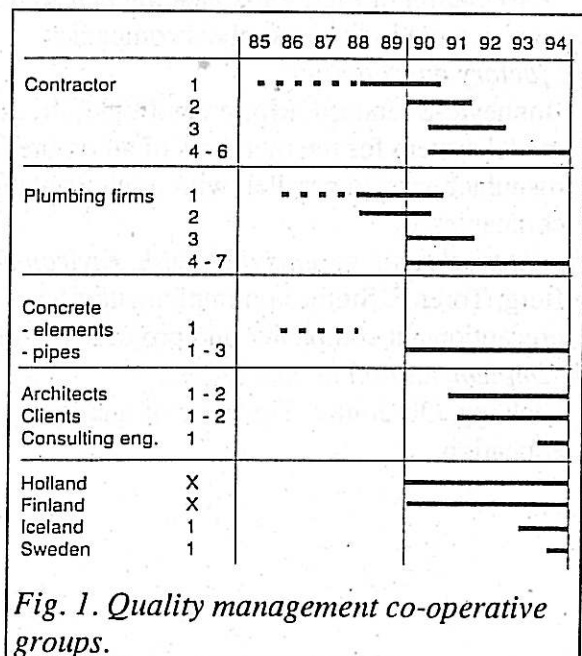


Fig. 1. Quality management co-operative groups.

We started up the process based on many years of experience from production planning, organizing of the building process and other related themes. The three groups started up, and after three years we could present the first model system for Quality Management.

From 1988 we started involving other companies. We organized groups of 6 to 8 companies in the production sector in clubs. We could see good results in most of the companies. [1]. But we could also see that we had to do some things differently. We made an agreement with two students majoring in psychology to do a study on our way of working with quality management guidance in companies. [2], [4]. We still had other challenges. We then started a discussion on strategy. Would we have the best results of quality improvement in the end product - the building - by only running more clubs involving all contractors and subcontractors in the Norwegian building industry? We decided that if we wanted to really do something about building quality we had to start similar processes within groups of architects and clients. We managed to start the two first groups in this area in -90/91. Since then we have also established groups of consulting engineers, HVAC area (heat, ventilation and air conditioning), masonry and other types of production industry. A lot of new experience came up through these new activities. The QMS model system was continuously improved, both by new procedures, but mainly in the process area. We could find quicker ways of doing the implementation within each company, and especially we found ways of dealing with the interface between cooperating companies within a building project.

Already at an early stage we started looking towards the rest of the world. Was there any interesting development going on? Of course many institutions had started up work on this area, but few places had a very practical approach. For us it was a very big milestone that TNO in Holland and VTT in Finland in 1990 bought the rights to use the established knowledge in their countries. Part of the deal was that each country should do adjustments for national laws, regulations and company/ branch cultures. At the moment we have established a more formal cooperation with TNO and VTT for the further development process. [5], [6].

## **2 Contents of the QMS - the tools**

The QMS is a set of tools for a company working in or for the building and construction industry:

- a basic matrix structure for building up a company quality system, including environmental, health and safety matters
- a 5 step approach (quality programme) for establishing a quality system in a company
- a coordinated 5 step approach (quality programme) for groups of companies establishing individual company quality systems
- company quality system model books for various trades, containing procedures and forms
- project quality plan models for various trades
- a guide for consultants on QMS

### **2.1 A basic matrix structure**

A basic matrix structure for building up a company quality system is established. We made the first version of this matrix structure in 1988 based on the experience from the first 20 companies in the production sector. This matrix is founded on the principle that we are looking at the separate functions through the building process. The ISO 9000 series has

elements which are not based on this principle, but we then make a cross reference list to ensure that a quality system made on the structure of the matrix is in correspondence with the relevant ISO 9000 standard. After having used the basic structure of the matrix in Holland and Finland, and after having the experience from the clubs of clients, architects and the other disciplines of the building and construction industry, we have made an agreement with TNO and VTT on a common matrix structure for the whole building process. This is vital for the future cooperation, but it is even more vital for the situation that quality systems in all the involved countries build their system on the same structure. It will then be much easier to ensure cooperation between different companies when they are referring to the knowledge of the same basic structure. Our experience is that this reduces the problems in the interface situation. We think that this matrix structure helps companies to establish their own quality system as to become a practical tool instead of a book on the shelf. This cooperation through Europe will perhaps lead to a standard for quality management systems in the building industry.

One part of the matrix is the division of the quality system into chapters. The two first chapters are chapters concerning all people within the company. The other chapters are for the main functions in the company. With the structure of the common version of the matrix our experience is that all kinds of companies within the building and construction

	1. Common- general	2. Acqui- sition, Initiation	3. Program- ming	4. Design	5. Prepar- ation	6. Produc- tion	7. Delivery	8. Facilitas managem- ent	9. Free use
0. General									
1. Organisation									
2. Communication									
3. Requirement									
4. Resources									
5. Purchasing									
6. Time									
7. Economy									
8. Realisation									
9. Experience, improvement									

Fig. 2. The common matrix

industry can use the same basic structure. The main chapters are: 1: Common/ general, 2: Acquisition/ initiation, 3: Programming, 4: Design, 5: Preparation, 6: Production, 7: Delivery, 8: Facilities management, 9: Free use. The other part of the matrix is based on the four elements of the Deming circle: Plan, do, check, act. We divided this into ten elements: 0: General, 1: Organisation, 2: Communication, 3: Requirement, 4: Resources, 5: Purchasing, 6: Time, 7: Economy, 8: Realisation, 9: Experience/ improvement. With these two sides of the matrix, new routines and checklists always will find their place in a practical way in the established quality system. More about this in [5].

## 2.2 A 5 step approach

A 5 step approach (quality programme) for establishing a quality system in a company is developed to guide companies through parallel processes and all the different decisions they have to take throughout the process. Starting up a quality management process has proved to be confusing for many companies if they don't have a coordinated plan for the coming years. At least we have three parallel processes: The documentation process, the process of learning different quality techniques and the improvement process. The five step process gives help to get some of the discussions and decisions set out in time. Not all questions have to be dealt with at the same time. The five steps are: 1: Working out a Quality programme, 2: Initiating improvements, 3: Analysing current procedures, 4: Developing the Quality System, 5: Integrating and supervising the Quality System. The main thing here is not to start on the formal work too early.

Step 1. The main task for the management is to work out and monitor such a quality programme for the execution of quality improvement work in the company. It must state concrete objectives, which tasks are included, who is responsible and who is involved in each task, time limits and if applicable, budget.

Step 2. The development starts with small improvement programmes where the main objective is to get rapid and measurable results. The easier these results are to measure, the more successful the whole process will be, and the more widely quality management will be accepted in the firm.

Step 3. Then the company collects the "state of the art" procedures and checklist within the company, and starts to use this as the basis for the development towards a consistent quality system.

Step 4. The paper system is finally defined and "new" quality management and assurance elements are integrated in the procedures, both for management activities and for operations. Discussions arising during this phase lead to rationalization, and the resulting written material is of great value for training new staff and substitutes. It must be worked out at the various levels of organization, not by a quality manager. A quality manager can be a pulling force, or a consultant for managers at all levels. He can also be a secretary, coordinating, maintaining and supervising the system.

Step 5. The last step is to ensure that the system is distributed and implemented at every level of the company. Step 5 should also make sure that any practical experience gained from the use of the system is fed back into the system again.

Step two is very important to establish the right motivation for the rest of the process. Step one is also vital. This is the special step for the manager. Here the directions, resources and goals are defined. All the five steps are not just a single step with a start and an end, but imply a continuous activity. As an example we come back to step one at least three or four times a year through the process. In some way we can say that this becomes a form of management style.

### 2.3 A coordinated 5 step group approach

A coordinated 5 step group approach (quality programme) has been established for groups of companies enabling them to establish individual company quality systems over a period of approximately 30 months. We have made a plan that speeds up the process in each company when we do a parallel process in 6 to 8 companies. Each company establishes their own management group for the quality process. This management group consists of 3 to 5 people of special interest and

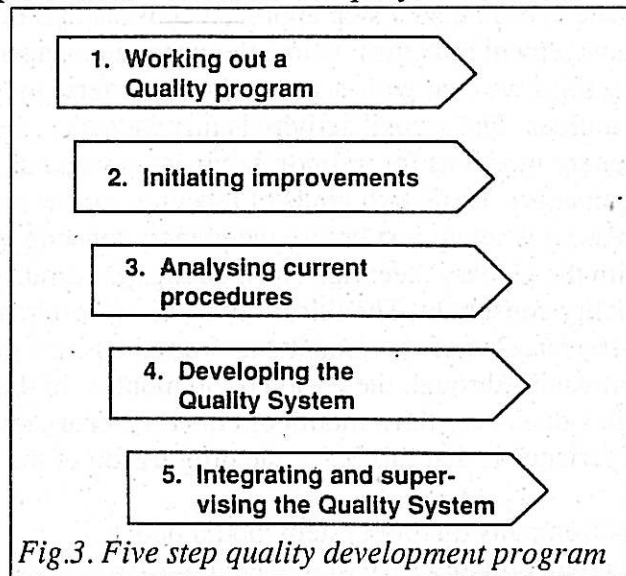


Fig.3. Five step quality development program

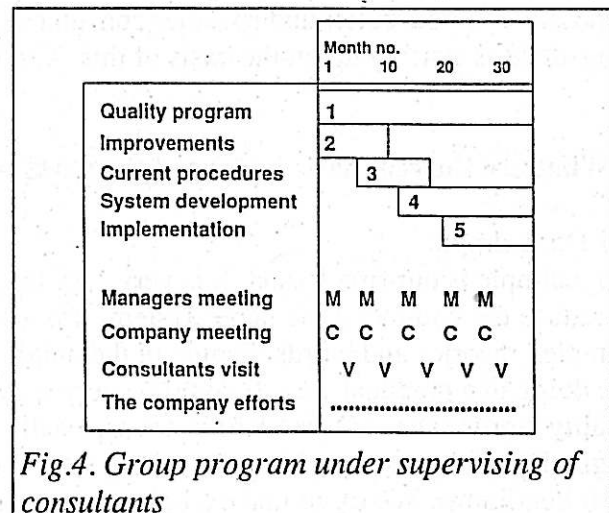


Fig.4. Group program under supervising of consultants

responsibility. They have to coordinate the activities within each company. The general manager should normally take part in this management group.

The coordinated 5 step approach consists of 3 main activities. At first we have management meetings, where the general manager from each company takes part. At these meetings we deal with organizational matters, and questions about goals, time and resources. The second activity is that we gather the management groups from all companies at plenary meetings for training seminars, presentations and for cooperation between the companies. These two kinds of meetings are set up twice a year. The general manager's meeting is set up just before the plenary meeting, or sometimes it is arranged in connection with the plenary meeting. The meetings are arranged and coordinated by a professional quality consultant. The third activity is a consultant's visit to each company at least every half year. One of the consultants from the plenary meeting follows up each of the companies through the period of 30 months. In this way the company will pass a major milestone every third month of either a plenary meeting or a company visit. Our experience is that this helps the progression of the process.

#### 2.4 Company quality system model books

Company quality system model books for various trades, containing procedures and forms for an example of a company is made to make it easier to understand how an established quality system could look. Procedures and checklists for all different trades are put into a common database, and we can extract a model book for each specific company.

#### 2.5 Project quality plan models

Project quality plan models for various trades are also established. Making a quality system for the company is just part of the job. This has to be practiced on the building project on the building site. This has been a major problem. We try to make a fine balance between the system of the company and of the project. The project is the nature of the building and construction industry, and the quality work will be measured in the results of the finished building project.

#### 2.6 Guide for consultants

In the guide for consultants we have gathered experience from all our work on quality management. This guide will be used when new consultants are starting up processes in new countries, new districts and new trades. We have mentioned that there are many pitfalls for the companies starting up in this area, but we think that there are still more pitfalls for quality consultants for the building and construction industry. We think that it is possible to do a better and speedier consultants job for the companies when the consultant is starting up on the basis of this "Guide for consultants".

### 3 What are the real basic lessons of the QMS work

#### 3.1 Do it simple

Do it simple is our first lesson. It is very easy to make a big paper system. We always try to reduce the volume of the paper system. It is also essential to start up with not too complex theories and words. People in the building industry like to understand what they are doing in a practical way. It could be very easy to drown the people with all these fancy quality words. The ISO standard is not especially easy to read and understand in the beginning of the process. Therefore we are introducing the process in the companies on their conditions. We try to make a balance with branch/ discipline knowledge. All our

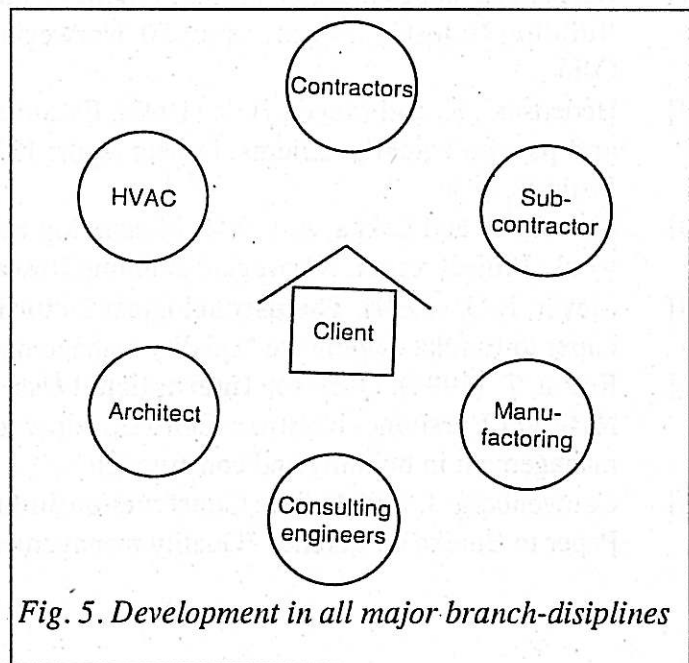
consultants have many years of practical experience before they started working on quality management systems.

### 3.2 Top management involvement

Top management involvement is strongly underlined in ref [2] and [4]. This is essential, and as we work with quality management we have different techniques of helping and ensuring the top managers involvement. We believe that it is impossible to establish a good quality system without this involvement. An important part of this is to make a good link to the company strategy. A great deal of management knowledge is needed in this process, and we are choosing our quality consultants very carefully, based on these principles.

### 3.3 Knowledge and understanding of the whole process

Knowledge and understanding of the whole process in opposition to suboptimizing gives the basis for Total Quality Management (TQM) as far as this can be practised today. Many of the failures and losses - the quality cost - are not linked with the product and its specifications. We have to deal with all the administrative routines around the companies activities, and this has very much to do with communication between people. The dilemma is then that it is easy to understand the importance of communication, but you have to start up on the other end with simple activities and meetings to make improvements.



*Fig. 5. Development in all major branch-disciplines*

### 3.4 Interface between the different companies

Interface between the different companies activities and responsibilities is one of the major problems of the building and construction industry based on the structure of many small and medium sized companies. Many companies are cooperating, over a very short time on each project, on a new site every time, with many different kinds of contracts and with new groups of companies from time to time. As we now have been running clubs in all major areas of the building and construction industry, and the last year we also have been running interdisciplinary clubs, we have seen that there are a lot of improvement areas between the companies in expectations and information, which can be handled in the Total Quality Management process.

## 4 The use of QMS.

One important use of QMS is that this is the basis of the module of quality management in the Norwegian formal education to the level of Master of Construction Management.

As mentioned before the use of QMS has crossed our borders. We have presented the QMS all over the world, and we have met a lot of interest and understanding. Thanks to these international presentations, cooperation with Holland and Finland has been made possible. In 1993 we also obtained a contract with Iceland. In 1994 we have achieved new contracts with Germany and Sweden, and negotiations are going on with other countries. We also have had guest researchers from both Finland and Brazil. This is a very interesting way of achieving international cooperation. All these activities gives new impulses to the further development against a better QMS.

## 5 References

- [1] Hansen, R. and Sjøholt, O. (1989). **Quality Management: A Challenge for the Building Industry**. Project report 50. Norwegian Building Research Institute, Oslo
- [2] Hedenstad, K. and Meyer, B.O. (1993). **Establishing a Quality System: Pitfalls and psychological problems**. Project report 132. Norwegian Building Research Institute, Oslo
- [3] Sjøholt, O. and Lakka, A. (1994) **Measuring the results of quality improvement work**. Project report. Norwegian Building Research Institute, Oslo
- [4] Meyer, B.O. (1994). **The psychological factor in establishing Quality systems**. Paper to Eureka conference "Quality management in building and construction"
- [5] Koivu, T. (1994). **QMS for International Use, Available Tools and Services - National Versions - Network Centres**. Paper to Eureka conference "Quality management in building and construction"
- [6] Couwenberg, J. (1994). **The Construction Industry's special requirements....** Paper to Eureka conference "Quality management in building and construction"

# The psychological factor in establishing Quality systems

**B. O. Meyer**  
Psychologist, Oslo, Norway

## Abstract

We have all heard leaders say "the co-workers are the main resource of the organisation," but what does this mean when it comes to establishing quality-systems? After having completed a study of the psychological processes that takes place in an organisation, when it is being moulded in to the quality paradigm, we found that the human aspect of quality are generally neglected or underestimated. The results of the study describe and compare central aspects of organisational development process of establishing a quality system and found similarities and differences with other more general organisational development processes. Our study focuses on: Responsibilities of the management, the involvement of the workingforce, communication and conflicts. These areas can be summed up in the top-down and the bottom-up processes in the organisations.

The study was done in 1992/93, and included six firms in construction and building industry. The method used was in-depth interviews with personnel on all levels in the organisations. The research was financed and carried out at Norwegian Buildingresearch Institute. The study was carried out by psychologist Kristin Hedenstad and my self under the supervision of Psychological Institute at the University of Oslo.

## 1 The psychology of the quality paradigm

When we started our project we were not able to find any material that studied the psychology of quality process scientifically. The written material on quality focuses on the economical or engineering side. But the essence of establishing quality systems is to build trust in relations to internal and/or external customers. When people collaborate they need to know if they can rely on their supplier of goods or services. When a product is handed over there is always an element of trust or mistrust in the transaction. Quality systems have their main purpose in the interface between people. Quality is not only about the product itself, but is even more about the relationship between people who handle this product. This way of looking at the quality systems puts the implementation process in a different light. It shows the need focus on personal relationships and the way they affect the process of developing, manufacturing, selling and using the product.

This means that the organisations need to include their own climate if they are going to establish and use a quality system. I will in the following give some examples in this line of thinking about quality.



## 2 Anchoring the change process

The anchoring of the continuous development process will either make the quality process *legitimate or illegitimate*. A process of change that has the formal authority of the top-leaders without some real interest or initiative behind it will undermine itself. When the top leaders avoid taking responsibility for the quality system they communicate to the rest of the organisation that this is not of importance. The process will either stop because no one thinks it is really important any more, or it will end up as a system on the side of the life of the organisation. Both alternatives will lead to a quality manual out of touch with the reality in the organisation or its products. The quality manual becomes a paper system that is being experienced as bureaucratic, without practical purposes. In the end it will be neglected and sabotaged by those who should use it. Leaders who could have a helpful device to supervise their organisation end up with less and wrong information. Other leaders say that this is an area of importance, but they do not follow up in actions. One result of this kind of anchoring of the process is that the organisation is splitted between the leaders who are above the quality system and those who have to labour under it. The quality system has become a plague instead of an helpful device.

Some leaders try to unload the responsibility of starting and leading the process of establishing a quality system to external consultants. The problem solution process is removed from the organisation and the organisation is either becoming dependent on external experts or it is being deprived of the possibilities of useful learning. There is also a greater risk that the manual will reflect more of the external experts than the working life of the organisation.

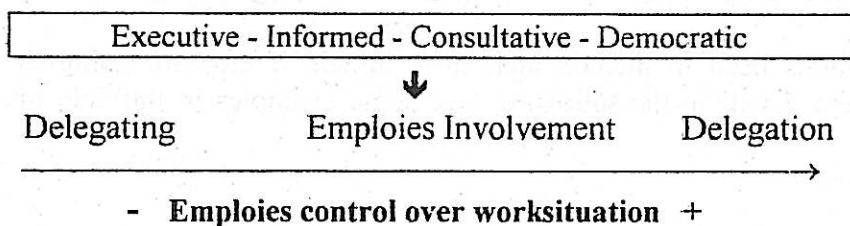
We found that the top leaders who took the responsibility of establishing a policy, clarifying expectations and goals to their subordinates and in a practical sense showed themselves as good role models in action, had a lot better chance of institutionalising the quality system as a part of the organisation's daily life. These findings are in line with general findings in organisational development processes.

## 3 The employees participation in the quality process

The other problem area in the quality process is the involvement of the employees. We have already pointed out that there is a great risk of the employees turning their back on the quality process if they experience it as unnecessary or bureaucratic.

Involving the employees can be done in different ways. But they all have in common that they more or less open up the decisionmaking process and thereby give the employees varying degrees of control over their own work situation.

Figure 2. The continuum of employees involvement.



It has been a matter of controversies in the organisational psychology if control over ones own workingsituation can increase the productivity. Generally the finding point out that lack of control can lead to dissatisfaction and increased rate of absents due to sickness. But there is no direct link between control over the workingsituation and productivity. In Norway we have a long tradition with trying to establish employee involved democracy. In our study we expected to find a relationship between degree of control given to employees and the degree of success in establishing the quality system. This expectation build on the thought that higher degree of involvement will lead to higher degree of association with the goals of the quality process. In other words the process must also be anchored among the employees.

What we did find was that the degree of actual involvement in the decision process was not the crucial point, but the way the employees experienced that the leaders involved them. This means that if an employee had an emotional experience of being involved this was more important then the actual involvement. This can be boiled down to the principle of trust. When the employee experienced that he could trust his leader to take care of him and his interests he had a positive attitude to suggestions from leader. He knew that even if he did not have a formal participation in the decision process, his voice would be heard. On the opposite side the employees knew that even if they had a formal position in the decision making process they would not get through any how. This we think is a reflection of the kind of attitudes the leader shows his employees.

There is a two-way-process: the leaders who show respect for the employees and in return gets their co-operation. If this two-ways process is halted the leaders will not get the recognition they need from their employees, the result is conflict.

#### **4 Quality systems, a new area of conflicts**

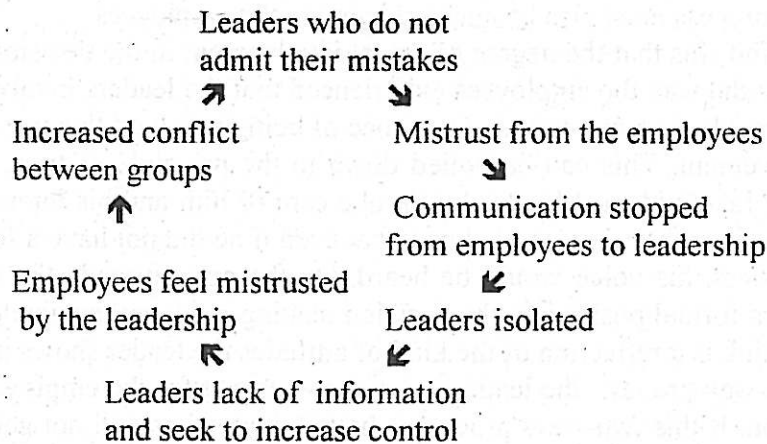
Conflicts are not necessary a bad element in the organisationl. In a creative problem solution process the conflicting views are a resource to be chariest. When the conflict is disturbing the main purpose of the organisation, then the conflict is creating a problem.

In our material we found that the quality process was halted in several organisations due to old conflicts. Conflicts that were not openly discussed, but were regulating relationships. Co-workers that did not talk openly with each other about their common tasks because they were on different sides in a conflict between two other colleges. The interface was marked of mistrust instead of trust. This way conflicts move around in the organisation and create group conflicts. The most common conflict we found was between leaders and employees. When the leaders introduced the quality concept it was met with mistrust. "This is just another way of exploiting us." The result was that routines and check lists were sabotaged. The leaders did not get the information they needed in order to run the operations effectively. Information were twisted or not given at all because the employees were protecting them self in the situation. This was especially obvious in organisations were conflicts were splitting leader teams. The employees were orienting themself in a minefield. They never knew when the next bomb went off. Obviously they did the smart thing, not move at all. The defensive way the leaders were handling conflicts paralysed the whole organisation in their effort to establish the quality system. This kind of conflicts create a special kind of communication pattern.

## 5 Communication

I will not go into the whole aspect of communication, but concentrate on communication patterns that develop as a result of conflicts that are not handled openly.

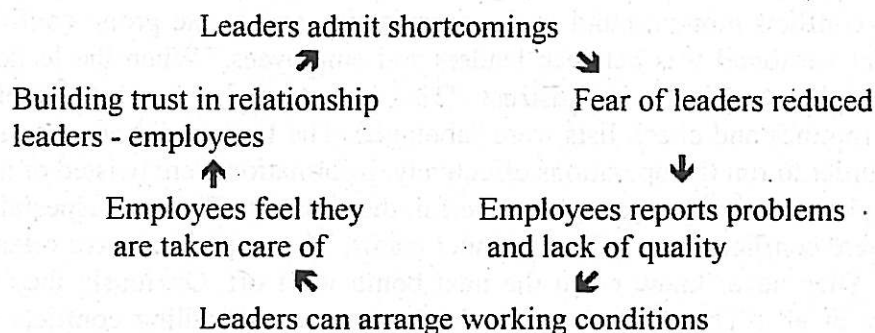
Figure 3 The conflict circle



When leaders stop communicating openly with their employees in order to protect themselves they set off a reaction that in the end will deprive them of information. The only point this circle can be broken is at the leaders defensive communication. Employees will only report problems and quality improvements when they are certain that this will not be used against them by the leaders.

When the positive communication circle starts running the effect will be higher quality in the relationships and straightened communication-network in the organisation.

Figure 4 Positive communication circle



Every leader needs to have his authority confirmed by his subordinate. If it is not confirmed the leader is only left with might. That means he will have to push his orders through with threats of negative consequences if they are not carried out. On the other hand when his authority is

legitimated by his subordinate he will have their cooperation and their arguments for not to follow his orders. This is closely linked to the kind of explanations the leaders use for lack of quality. When leaders blame employees personally for lack of quality the leader at the same time rid himself of the opportunity to improve the quality. The leader is attributing responsibility to factors outside his control. We found that leaders who were able to see the working operations in system, that means to be able to see their own responsibility as leaders, were more respected and had created a better atmosphere of co-operation with their employees.

## **5 Top-down and bottom-up**

This can be summed up in two different movements in the organisational development that takes place when the organisation is establishing the quality system. The leaders obligation is to give the process the authority it needs, to establish policy and make it clear what they expect, to show a respectful attitude towards their employees, to take the temperature on their own organisation and deal with the conflicts openly.

This will pave the way for the other movement: the bottom-up. When the employees are getting involved in the quality process they can use their first hand knowledge of possibilities for quality improvement. This means reporting to their superiors and follow up the quality system requirements. The one process will be useless with out the other.

## **6 Reference**

Hedenstad, K. and B.O.Meyer, (1992) **Psykologiske Faktorer i Implementering av Kvalitetsstyring**, Hovedoppgave Psykologisk Institutt Universitetet i Oslo.

Hedenstad, K. and B.O.Meyer, (1993) **Establishing a Quality System: Pitfalls and Psychological Problems**, Project Report 132, Norwegian Building Research Institute.

# Real Estate Developer's Quality System

**Jon J. Valset**  
Avantor AS, Oslo Norway

## Abstract

This paper is an extract of collected experiences from the practical use of the newly developed quality system by a group of real estate companies in the Oslo region. This group has been working together with the Norwegian Building Research Institute to develop a system where we could direct our own efforts and give requirements to and control of the efforts of our contractors. Furthermore the new Norwegian standards regarding general condition of contracts for construction and building require all decisions to be put down in writing. Linked up with an ever increasing office surplus market it became necessary to have close control of the building costs and get maximum value for our money.

## The need for a quality system for the real estate companies

In the late eighties the need for a quality system became more and more apparent: With a surplus of vacant premises for hire, the real estate companies had to lower rent-rates in order to attract customers. To achieve that the building costs had to come down. From our own practical experiences we had registered the great cost overruns and the uncertainty and difference between predicted and actual costs in the building process. We had to enter the field and participate in the game. We had to influence the project as early as possible at a time when something could be done about the costs.

The effect of new Norwegian building standard NS 3430 - General conditions of contracts for construction and building-is that improvements were necessary both in the firms' systematic approach to a project and in their more or less existent quality systems. The codes require written documentation and the treatment of non-conformity reports. The duty to give written notice and to reply in writing is accentuated.

We had therefore to improve our own project administration and to create our own quality system.

## The real estate companies' quality system group

The 8 major and professional real estate companies convened in 1991 to develop a model quality system. Our common and main fields of operation are to invest in, produce ( build, develop or modernise) administer/hire, and market "quality buildings".

The project was sponsored by the Norwegian NTNF's Research and Development program "The development in the use of systems and technology in the building and construction industry"

### **The project programme**

The project programme was implemented from 1991 to 1993. We agreed to develop the system by a 5-step plan:

1. Quality Management
2. Improvements
3. Existing Procedures
4. Development of the Model System
5. Use of the Quality System

When working out the model system there was a continuous feed-back from the participants on the practical results and experiences as soon as the various procedures were applied on their pilot projects. There was a constant interaction between the use of old and new procedures that now appear in the model quality system.

We had several meetings each of 2 days duration and each dealing with a specified topic which each of us had to make preparations for. Outside expertise was often called in. We drew very much on the valuable know-how and assistance of the Norwegian Building Research Institute in making out the procedures and forms properly and in co-ordinating our efforts.

### **The structure**

The model quality system is structured within a matrix form. The code system is with a archive key according to NS 4104. Each procedure is positioned in its respective box.

The horizontal axis of the matrix has 10 chapters:

Chapters 0-1-2 cover the company's common functions,

Chapter 3-7 cover project development and production,

Chapter 8 covers activities linked to the completed building.

Each chapter has the same subdivisions, each of which is made up by the elements in the Deming circle: Plan, perform, control and correct.

The quality system enables us to make quality plans with the listed procedures and supporting accessories such as checklists, forms, diagrams etc. The model system contains 140 documents. We can by this quality assurance better secure and direct the efforts of all parties involved in the project: ourselves, the architect, the consulting engineers, the contractors and the authorities.

The real estate company quality system is made with a view to ISO 9001. Some of the companies involved in the development of the model system are known to tailor and develop their own quality system towards a ISO 9001 certificate. We in Avantor are now in the process of doing just that.

### **The implementation and practical use of the quality system**

#### **The pilot project**

Throughout the process of making the various procedures each company had their own running pilot project to test out the new procedures.

Our pilot project was the erection of a 5 stories office building for the largest consulting firm in Norway in Sandvika just west of Oslo. The layout has the shape of a semicircle with offices on both sides of a corridor. In the middle there is an open space from a central ground level area to a glass-covered roof.

At ground level at each end of the building there are a few business shops. There are two parking levels below ground, the lowest also contains a bombshelter structure.

Total area of the building is appr. 23.000 m<sup>2</sup>, of which 15.000 m<sup>2</sup> is office space.

### **Completion time**

From the start with clearing of the site in August 1992 to the tenant firm had moved in took 14 months.

### **The letting of contracts, construction management**

We are the owners of the building. We had the project management throughout the construction. Letting of contracts was split into 3 different phases:

**Phase 1:** Foundation works (prefabricated concrete piles to rock bearing.) Below ground level in-situ concrete to retaining walls, slabs and the bombshelter.

**Phase 2:** Building frame system with steel columns -bracings and steel beams for support of hollow concrete precast slabs.

**Phase 3:** Remaining works towards a complete office building.

Phases 1 and 2 were led and supervised by us. Individual contracts were made by each. Phase 3 was a total contract made with one main contractor.

### **Practical use of the model system**

Because the model quality system had not been put into full use but was being made along the way we had only a limited amount of old and new procedures to enable us to forecast what we wanted, and how we wanted it to be done

We can say that our quality plan was made up along the way. In this chapter I will show you the type of procedures we used.

#### **Building programme:**

1. We made procedures to establish the economical and functional framework of the building.
2. Procedure for establishing the various functions and organisation of the user was made.
3. A room programme was made out
4. Then a procedure was made to find out and establish the functional requirements of rooms, areas, systems, environment all at the same time taking into account the user's specific needs.

#### **Bid requirements:**

Minimum functional building standards were defined. Our procedure on the requirements as to what we wanted to be delivered was based on measurable **end values** that could be controlled. If that would prove difficult to measure, the bill of quantities was made narrow and specific.

One of the requirements was the procurement and our approval during the construction of the **supplier's data** of the various items that was to be built in. These specifications were subjected to close scrutiny beforehand by our maintenance people and the janitors, and should finally appear in the " as built " documentation.

#### **Decision plans:**

During the construction had made openings in the bill of quantities for multiple alternative choices in the finishing works, choice of materials, colours, type of equipment etc.

Our procedures as to register, evaluate and decide on the specific wishes of our client on these alternatives were emphasised. The tenant was our customer and had a major voice in the decision making.

Procedure as to how and when the various decisions had to be made were used especially under the main contract to decide the choice of the alternatives offered.

We required that bidders should verify and submit their **quality system**, and that a total **quality plan** related to the project should be submitted within 3 weeks after a contract was signed.

We also specified that certain items in the quality plans were subject to **our audits**.

We laid down procedures for the **handing over** of the project when completed, involving testing, checking rounds, teaching of the janitors in advance, " as built " documentation and the procurement of a specified book dealing with **maintenance and operational procedures**

### **Practical use of quality plans**

A quality plan is compiled out of the work procedures in the company's quality system.

One of the bid requirements on our pilot project was the procurement of quality plans related to the project. These plans were to be presented for our approval 3 weeks after signing of contract.

We had approved the contractor's submitted quality plan. We had screened his quality plan to ensure that he had sufficient laid-down routines for the main work operations. The same was required that he did for his sub-contractors.

We constantly checked the use of the plans both in our regular meetings with the contractor and when the actual work was in progress. Regular meetings were held between the contractor and his subcontractors to clarify and emphasise the various quality plans and to ensure that no procedure had been omitted or forgotten.

The quality of the quality plans varied very much; from the most simple to ones based on ISO 9001 certificate!

The content of the Main Contractor's quality plan is mainly on the following:

Filing plan, design, calculations, the project organisation, contracting, starting up, progress plans, subcontractors and deliveries, follow-up of the production, meetings, economy, nonconformity reports additional works, alterations, control and inspections, environment and safe work procedures, checklist for finishing and handing over the project.

We also wanted quality plans from the architectural firms and the consulting engineering firms. Unfortunately we did not obtain these plans mostly due to the fact that no coherent or sustainable quality system or quality plans had been developed. We knew that a group of architectural firms were working with a model quality system similar to ours, but had not come that far for practical purposes.

Hopefully we will in later projects try to obtain quality plans from customers such as the building authorities, insurance companies and the banks for the services they render us and that we pay for.

### **Practical experiences in the following up of quality control**

#### **In the construction period**

The making of drawings and specifications was slightly ahead of the construction process. Everybody was pressed for time. The use of procedures by the contractor, architect and the consulting engineers to ensure that things were made correct the **first time** became important. The contractor had a procedure for going through each work in detail beforehand with his own people and subcontractors. They would then be instructed about the requirements and of the measurable end values of their jobs.

On our pilot project the consulting engineer had to learn the hard way: Just because of a non-existent procedure to check bar schedules, he had to pay heavily for delays and the speed-up



work to make and position the missing reinforcement bars in order to meet a delivery time of cast in situ concrete.

The main contractor, on his part, had to relate to our procedures (old and new according to the progress in the aforementioned group of real estate companies.), and our checklists. He complied very well as he had to according to contract!

#### **Audits required by the owner**

The owner made regular inspections at critical stages according to verify that the work was performed according to the specified requirements.

These inspections were made at critical phases of the building process, for example:

Before precast elements left the plant. (Inspections should have been made more often!)

Sufficient dust covering of ventilation ducts upon arrival at site.

Before closing in of building elements such as ducts, piping, walls etc.

#### **Procedures used**

The various procedures, checklists and forms that were used were a mixture of some old ones we had used previously, some that were under development by the group making the new quality system and some that were established as final.

#### **Non conformity reports**

These standard report forms were to be filled out by all as soon as anything was discovered not to be according to requirements. Each party had their own form. As soon as a non-conformity was registered it was required that the form was filled out and submitted at once to the parties involved.

Actions for remedy or preventing the non-conformity to happen again should be taken immediately. It should also be registered any consequences in the building progress or costs due to the non-conformity.

Follow up: The reports were registered at the regular progress meetings between the contractor and the owner. There were time limits as to when the various steps should be implemented.

The content of a non-conformity report form is as shown in figure.

#### **The procedures and auxiliaries we used were:**

Our owns, the Contractor's own and various checklists and forms (non-conformity report form, forms from various inspection). By filling out and presenting these documents they became formal and had to be dealt with at once.

#### **The handing over of the project**

The preparations were made well ahead to ensure the proper and active participation of the authorities, the contractor, our consultants, and the coming tenant.

A special procedure deals with the responsibilities and work areas of each and one.

One dealt with how the inspection rounds should be taken care of (copies, follow-up, contract items what would the contractor do about it, etc..)

The taking over document form covers the items that have to be filled out according to the procedures and rules in the Norwegian Standards 3431 or 3430.

Important documents that serves as appendixes to the main document is:

The form to register non-conformity work. The procedure for registering this is first to assure that the contractor announces his work completed and ready for inspection. This is a date well ahead of official taking over time. If one finds any incomplete work, the inspection is stopped and a new time for inspection is agreed upon. A complete inspection is made and forms filled out only when there are minor things not done according to requirements. The contractor has the remaining time left to the final deadline to correct his work completely.

The form to register the non-conformity works must give information where the fault is, (room number, story etc.) and describe what is the fault. Correct names must be used to define the fault. The form must be filled out as to what type of work it involves.

Time limits to correct the faults have to be set and agreed upon.

There has to be inspection of the corrected works.

Check lists were made out and used to check that nothing had been forgotten.

#### **Did the contractor follow up his work properly?**

We experienced that very few of the works deliveries and tests were reported back to be ready complete for inspection. When this was finally done the work very seldom complete, often something was missing or done wrong. The contractor had to use much time to re-inspect the work. Had it been done correctly the first time costs and progress would have benefited.

#### **What were our experiences?**

It is very important in all quality works for all to follow up the items in the quality circle of Deming: Planning, construction, control, and correction.

We benefited from the thorough scrutiny of the quality plans. We learned how the various works were planned to be done, and the contractor was forced to deal with the plans- both their own and those of their subcontractors.

The subcontractors must go through their work, the specification and requirements beforehand. This gives all an opportunity to become familiar with their work, they know what is non-conformity work, (easier to report) and much time is saved by knowing and doing things correct the first time.

There is a danger for contractors to become "paper tigers". It can easily become to many check-points that can create a feeling of saturation. No-one must experience that quality planning results in a heavy bureaucracy, costly manuals, or in a stiff and un-manageable documentation process.

The quality work must be followed up at all levels in the organisation. At present I have a feeling that the workers, especially the older ones, has difficulty in adopting to the new procedures. Many of the workers must be taught to regard non-conformity reports as a positive factor that would teach them to do things correctly the next time.

What is generally missing is to give report back when the work is ready for inspection.

The non-conformity reports force the site management and the builder to take action at once and to follow up and close the issue at hand there and then. This is in accordance with NS on the subject of giving written notice when a non-conformity occurs. In this way there will be "no loose ends" at the end of construction, there are and will be few things to argue about left. At our pilot project we could close the accounts much sooner as usual and leave each other as much better friends.

#### **Results**

The quality system places the tenant in focus. A quality building makes a satisfied customer that most likely will renew his contract when it expires.

We made effective improvements in our own organisation.

The quality system contributes to a more constructive co-operation with the contractors, with increased ability to deliver a quality project.

Maintenance and operational costs are reduced with a good quality system.

The quality system specifies more stringent requirements as to delivery times, quality of

product and of organising activities than before.

Areas of authority and responsibility became better defined.

Throughout the project it was emphasised to clarify quality requirements for all the activities in the building process. This simplified the use of quality plans and the quality inspections to ensure we would get what we had ordered to the time and price agreed upon.

We have learned out of the model quality system to make our own quality system and quality plans.

## Conclusions

Quality management -to do the correct things the first time in a more rational way than before - was before a sadly neglected field within the building and construction sector.

There are signs in the air that we are on the road to recovery.

Our goal must be to get a building we are proud to have planned and built a quality building, and that we not the least will have pleased tenants.

## References

Oldebråten, Lars A. **Practical quality management for clients-system development through pilot projects. Quality system for real estate companies.** Project report no N 6160. Norwegian Building Research Institute, Oslo 1993. (In Norwegian)

# NON-CONFORMITY REPORT

Form nr 18-011

Project nr                      Project    Report nr                      Date

**Discovered by:**

Drwg.control,  own contr.,  authority contr.,  completion inspection,  complaint,  other

on drawing nr.:  
 in the area:

Discovered when:

By whom:

**Description of the non-conformity:**

**Cause of the non-conformity:**

What:

Whom:

**Consequences:**

technical:  
 progress:  
 economical:

**Suggestion for correction:**

Date:

Signature:

**Approval of suggestion for correction:**

Yes  
 No, comments:

Date:

Signature:

**Correction completed:**

Date:

Signature:

**Correction controlled:**

Date:

Signature:

**Corrective action made to prevent recurrence:**

**Corrective action completed:**

Date:

Signature:

# Architectural Quality

Kirsten Arge

Norwegian Building Research Institute, Housing Research Department, Oslo, Norway

## Abstract

This paper is an extract of the Norwegian Building Research Institutes (Byggforsk) research on architectural quality. The conclusions are based on a case-study of ten building projects, five rated as good and five rated as bad, chosen by five architectural firms in Norway, who are all participating in a larger project introducing quality management in architectural firms. For architects, managing architectural quality is an important element in their Quality Systems. The research project does not try to define or to measure this quality. Based on the assumption that the design process is a social process, we have studied the process itself and the conditions under which the process developed. Architectural quality is dependant on the architect, but this is not a necessary condition in itself. The study shows that the quality of the client and direct communication between the architect and the client/user of the building is a crucial factor, as well as enough time and budget in the design process. If architectural firms want to secure high quality architecture, they have to consider the possibilities and limitations in the commissions they undertake, to reach that goal, and make this an integrated part of their quality management systems.

## 1 A qualified client is instrumental in securing good architecture

The study shows that the client is an important factor in securing good architecture. The five good project-cases in the study had clients who

- had high quality, also architectural, goals with the project,
- communicated directly with the architects or through a qualified project manager permanently connected to the client
- demanded professionalism and was himself professional
- trusted and provided professional space for the architect
- gave the architects enough time and budget in the design process.

In the five bad project-cases in this study, none of these requirements were met.

The study indicates that it is difficult to elevate the architectural quality of a project beyond what the client allows for. The result is dependant on the clients goals, which influence the conditions under which the design process are carried out.

## 2 A good client has high quality goals for their projects

In the good project-cases the clients had high quality goals for their projects, also architecturally. In the bad caseprojects the clients main goal was as low project cost as possible, and architectural goals were not considered at all, or below cost goals.

Dana Cuff, architect and sociologist, characterises excellent clients as demanding and with esthetic opinions, but open and flexible towards the professional views of the architects. They are conscious about their own limits of competence and respects the professional integrity of the architect. The unprofessional clients can be rigid and ignorant about what they like and want, and none of this promote quality, says Cuff. This corresponds with the findings in our study.

The architectural firms in our study had high architectural ambitions in all the project-cases, both good and bad. In the bad project-cases the necessary conditions to realize these goals were missing.

### **3 A good client communicates directly with the architects or through a qualified project manager**

In all the bad project-cases the architects commissioner were not the client himself, but an intermediate element in the project organisation. In all the good projectcases the client himself were the architects commissioner. This indicates that direct communication between architect and client improves the achitectural result and that a managerial level between the client and the architect can prevent the development of good architecture.

An important question is how to develop a design process which gives high architectural quality. Literature based on the tradition "knowledge in action", which architecture belongs to, points to an open, dialogical communication as the best way. Excellent projects are dependant on good chemistry between the most central participants in the design process. Therefore, the architectural profession must focus more on the process, and so must the architecture schools.

### **4 The architect were the leader of the design-team in most of the good projectcases**

The management of the design-team, i.e. all the consultants commissioned for a project, has traditionally been the architects job. During the last 10-15 years, engineers and firms specializing in project administration have taken over this task.

In four of the good project-cases the architect was manager of the design-team. All of them came from the architectural firm commissioned to design the project. In the only project where the architect did not manage the design-team, the team-manager was paralleled by a senior architect responsible for advising the client on professional matters.

In four of the bad project-cases the architecte was not the leader of the design-team. In all these cases the manager of the design-team was connected to the firm who commissioned the architect.

The good project-cases in our study were predominantly bigger and more complex than the bad projectcases. In some of these projects the manager of the design-team, i.e. the architect, had an important role in the total project management, including controlling the total cost of the project. The client chose the architect as manager of the design-team trusting his professionalism and ability to master this complex task. Architects must take responsibility of the total design-process and be qualified to do so. This doesn't mean they shall master everything, but they should master those parts of the design process which can contribute such that their professional knowledge and abilities can be realized the best way.

## **5 Good architecture depends on enough time and budget in the design process.**

The architectural firms used more than double the time per m<sup>2</sup> floor space in the good project-cases compared to the bad. The total fee which the firms received were considerably better per m<sup>2</sup> floor space in the good project-cases compared to the bad. Even so, the resulting fee per working hour on the projects were in most cases higher on the bad project-cases compared to the good.

We have reason to believe that architects, when they have demanding clients and enough time, give priority to quality and not to business. There is also reason to believe that the timepressure in the bad project-cases has not allowed the architects to use more time than what was available, thereby resulting in better business.

To design high quality architecture without enough time and budget is difficult. One of the firms say that under such conditions they choose to work on specific elements architecturally and let the rest be as it may.

## **6 Professional development in the architectural firms depends on the projects**

The five firms in the study all claim that the most important arena for professional and technological development is the projects. Only the good project-cases in the study have had room for such development. In these projects the firms have had enough time and the clients have been demanding and have provided the firms enough professional space. Such projects and clients are not in abundance. If architects tie their professional development to projects only, their professional competence may wear out and their technological development be left behind. This can hit both the profession and their clients badly. To develop working strategies which can give both high quality and high productivity can be decisive for the architectural development but also for the architects own future.

## **7 References**

- Arge, K et als. (1994): **Arkitektkontorenes kvalitetssystem - Arkitektonisk kvalitet.**  
Prosjektrapport, Norges Byggeforskningsinstitutt
- Cuff, D. (1991): **Architecture - the Story of Practise.** MIT-press

# Quality Management for Architects in Norway

**Halvor Westgaard**

**Norwegian Building Research Institute, Housing Research Departement, Oslo, Norway**

## **Abstract**

Two different groups of architectural firms have been working according to Byggforsk's (Norwegian Building Research Institute) 5-step model, developing and implementing their own quality system for each individual firm. One group has been working through a period of 30 months, the other through 16 months. In both groups some firms have completed their task, some have not.

Developing and implementing a quality system means that the firm has to work systematically towards a set goal, and maintain a regular activity according to an agreed quality programme thereafter. Even though the firms are working through an established method like the 5-step model, certain skills are required within the firm to be able to run the process. The fact that only some of the participating firms in these two groups have completed their quality systems shows that more emphasis must be put on developing these skills within the firm during the process.

A model quality system for architects has also been developed.

## **1 The first group of architects**

During the 80'ies the quality system thinking became apparent in Norwegian building industry. Byggforsk, who had worked with quality assurance in several other disciplines of the building process, approached in 1990 the Norwegian Association of Consulting Architects (NPA) suggesting a project about quality management for architectural firms. When the project was presented, a sufficient number of firms wished to participate to secure funding through the Research Council of Norway. The group consisted of nine firms, two from Bodø, two from Bergen, one from Sandnes and four from Oslo. All of them are of medium size, from five to approximately 20 people. They are all relatively well organized, and have good reputations from running their projects. One of the firms from Oslo was NPA itself who wanted to play an active part in the project. The firms being so wideley spread around the country added some extra traveling costs to the project.

## **2 The second group of architects**

When the first group was well into its first year, time had come to invite a second group of architects to do a similar project. In this project emphasis was laid on small firms. In order to improve the economy, this time the group consisted of 9 firms all from the same town, Trondheim. The firms range from two persons up to approximately 10, but most of them are around three to five people. As with the other group, these firms also have a good reputation,



and appears to be well organized. Through NPA funding was secured from the Royal Ministry of Local Government and Labour.

### 3 The project process

For both groups the project process have had three main activities. These have followed an established pattern evolved by Byggforsk. The basic activity is the firms working individually on their own quality systems. Then the firms have met regularly in two-day seminars to share results and plan ahead. Small work-groups have been used, and some teaching have been provided on relevant quality subjects. Between seminars the firms have received individual assistance and guidance with the consultant from Byggforsk visiting each firm.

The first group have had a seminar every six months, six altogether. The consultant from Byggforsk has been to each firm five times. Three consultants have participated, and shared the firms between them. They have all participated in the seminars.

The second group have had a seminar every four months, with a total of five seminars. The last of these lasted only for one day. Only one consultant have been out there doing the job, while Byggforsk have had a second one as supervisor.

In both groups the seminars have had similar topics as follows:

- communication
- problem solving
- quality programmes for the firms,
- preparation of plans for the coming six months
  
- client's briefing
- organizing of projects
- architectural quality
- third step of the method, the current procedures
  
- how to document a procedure
- contents and structure of a quality system
- fourth step of the method, system development
  
- activities and methods in the early design stages
- handling of changes, inspection schedules
- continuing system development, plans for the next period
  
- handling of non-conformity, corrective actions
- firm's long range aims and quality policy
- preparation of quality plans
- system description
  
- quality plans for actual projects
- design review
- quality system audit

Although the seminars have had their particular topics, an important, and very essential element in each seminar has been the regular reporting of the individual firms on their own work.

#### **4 The 5-step model**

For each individual firm work has basically followed the 5-step model developed by Byggforsk. The 5 steps are:

1. Planning the process
2. Improvement Measures
3. Current procedures
4. System development
5. Implementation

The method has evolved through work with a number of different firms from various disciplines in the building industry. The basic concept is that of developing the firm's general ability to improve their work as an organization. The method is a tool which may work well with firms with a larger organization. But it seems that for an average architectural practice this tool ought to be developed further.

Architectural practices think and work in a project-oriented way. Therefore, it would probably have been better to introduce the quality plan at a much earlier stage than we did. Through developing a quality plan for a project, the means of quality assurance could be established. Then it might be easier to apply these to the firm's general organization. Before we brought the project into focus, the idea of working with improvement measures seemed to develop confusion among the participants too easily.

#### **5 The model Quality system**

There has been an increasing tendency from clients to ask for the architect's quality system. Several firms have had to document their systems in order to secure a contract. Government authorities apparently are leading the development here.

Some major changes in the Norwegian planning and building legislation are also due. Following these, architects and other consultants are facing new roles with increased responsibilities and control functions on behalf of the client

These are the main reasons for the model Quality System for the Architectural Practice. The system is based on the accumulated knowledge of Byggforsk and the results from the work of the 9 firms participating in the "club". The model system has a structure very similar to the general Quality Management System that Byggforsk has produced.

*Fig. 1 Structure of the model Quality system*

- 0 Description of the system
- 1 The firm
- 2 Marketing - Competitions - Bids - Contracts
- 3 Establishing job - Programming
- 4 Designing
- 5 Factory production

- 6 On site production
- 7 As-built - Handing over
- 8 Maintenance
- 9 Administrative assignments

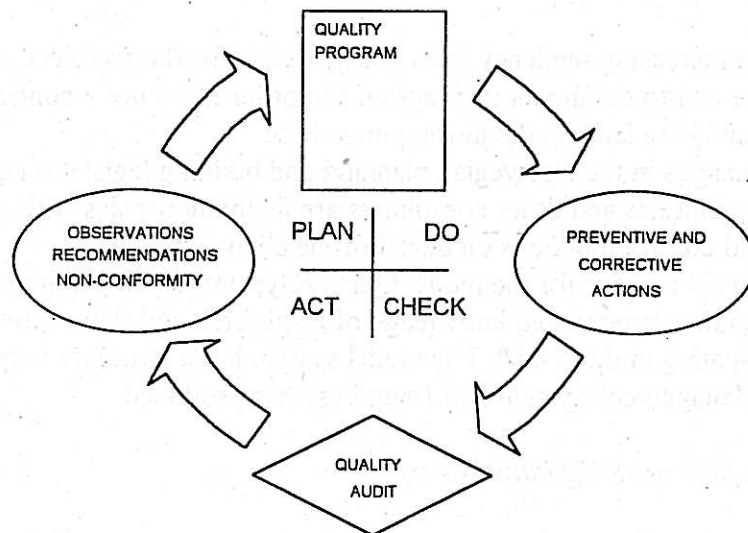
The system starts with the firm itself, then follows the process normally associated with the architectural practice. This means that chapters 5 and 8 is empty, and that chapters 6 and 7 contains very few elements. Chapter 9 is supposed to cover those assignments where design work is defined as a separate contract. Chapters 1 through 9 are meant to be organized in similar sequences, starting with general elements(0), then organization(1), communication(2), specifications(3), resources(4), purchasing(5), time(6), economy(7), execution(8) and practical experience(9).

The model system is now available. The number of copies being sold to architectural firms are by the time of writing this paper approaching one hundred. To what extent the firms will adapt the system to their own practice remains to be seen.

### 6 Quality improvements as a continuing process

The core message from Byggforsk is that quality work implies continually improving the firm's way of doing their various tasks, both related to the firm itself and to the projects and assignments. Deming's Quality cycle has been introduced to illustrate and emphasise this. Through the quality system, other tools have been introduced, such as Quality Programme, Preventive and Corrective Actions, Quality Audit and Observations and Recommendations. These are terms rather unfamiliar to architects, but by superpositioning these on the Deming cycle the continuing process of quality work in the architectural firm can be illustrated as shown below:

Fig. 2 *Quality work as a continuing process*



This illustration shows the continuity of the process. Although terms are unfamiliar, the thought of working continuous with improvement measures is even more unfamiliar. Architects do keep informed about developments and trends in architecture, but there is hardly

any culture of organizational development or leadership in the architectural practices. Therefore establishing a quality system is regarded more as a technicality.

## 7 Observations

Based on the two groups of architects a few thoughts come to mind.

- \* A quality system is usually thought of as synonymous with the paperworks, not as the way or order of doing the firms various tasks.
- \* The assumption that a continuing improvement process may be established is usually premature. The firm's first objective is to satisfy their customer's demand that they should have a quality system documentation.
- \* Only a few of the firms have been able to complete their documentation. This leads to the thought that some skills are required that normally are not present in an architectural firm. In groups of firms like the two described one has supposed that these process-related skills would be convey to the participants during the seminars. The need to actually train the participants in specific skills have probably not been realized in previous projects.
- \* In order to be able to keep a continuing quality programme running in a firm, even more emphasis must be laid on these process skills being present within the firm itself.
- \* A continuing quality programme will probably not be established until the firm sees it as a means to reach its own goals and objectives.

# Implementing Quality Management

I. N. Dolve

The Norwegian Association of General Contractors (LBA), Oslo, Norway

## Abstract

LBA has quality as a major goal. The organisation is familiar with the "Byggforsk-concept", as the origin to this implementation kit was a network of 8 LBA members. Aiming to communicate with the members in the best possible way on this subject, the LBA administration has started implementing quality management itself. They are running improvement activities and see reducing costs and increasing income. Today, they have started documentation of their quality system. Experience from the implementation process as far as today is that it is hard to give the process satisfactoring priority. An improvement is to establish more firmness with the quality meetings where planning and monitoring of the quality activities take place. Even the improvement groups need to be controlled in this respect.

## 1 LBA's quality goal

I have been asked to express my thoughts on the subject Implementation of Quality Management in this honorable society. The challenge is slightly different from what I usually am facing as quality is concerned: As managing director for an association who has declared quality management as an overall goal, one of my major objectives during the last years has been to inform, motivate and argue for quality management to our member companies and their leaders. This evening, I am addressing You; - "the believers", persons within the building and construction industry who are dedicated to quality, that have experienced the value of quality management, and who need no convincing argument from me. - What then, can one, humble quality-believer share with an army of more or less professional "qualitators"?

## 2 LBA-companies and Quality

LBA-members were in fact one of the first groups of companies in Norway that paid attention to this new way of running a business, after it had "crawled onshore" early in the eighties. Not so peculiar, as the major contracting companies early became suppliers to the North Sea petroleum connected industry, and had to deal with quality assurance requirements through offshore contracts.

In 1985, eight of our member companies formed a group with the intention to cooperate in developing company-individual quality systems. Byggforsk had the job as secretary and process facilitator for the group, based on the institute's experience on facilitating networks in building and construction industry. During the three following years each of the eight companies gradually developed their own quality systems.

### **3 A model for the documentation of a quality system**

This first "contractors quality club" was financially supported by the norwegian governmental program "3 B" ("Better buildings to lower cost"), and the mutual experience from the co-operation, was presumed to be made available for others within the trade. Thus, new groups of contractors, each consisting of 6-8 companies, emerged in order to develop and implement quality systems. The "hardware" coming out of the pilot club was a number of "best-practice" examples, later referred to as "QMS". This is a set of procedures, forms and checklists from eight different origins, forming the documentation part of the quality system in a fictive contractor company. In this way the pilot club gave all successors a flying start: The structure of the system was prepared for them, as well as good examples covering all parts of a building and construction company's business.

### **4 Documentation vss. implementation**

As you all know, the paper-part of a quality system is of no value, if it isn't a documentation of the company's very own procedures and practice. A "model-book" might lend itself to abuse by less serious leaders who need a quality system over night to satisfy forth-coming demands from the customers. (Such leaders will certainly not be represented within the member-companies of LBA). It was important to avoid production of such "fake" systems. How could that be possible? - In addition to the contractor club two other trades within the building and construction industry were running similar clubs. A "spin-off" from the work in these three pilot-clubs was an understanding of how to ensure an effective implementation process. The experience was documented by Byggforsk, and has later been known as "The fivestep method". The method is not a strict proceeding where one step follows the next, but rather a "checklist" of important activities to ensure quality to be implemented and gradually be a natural part of the company's core business. Key words of the method are  
improvement,  
time,  
participation at all levels in the company.

To avoid uncritical use of the "hardware", distribution was linked to implementation service, preferably a long term "quality club", but also in-company guidance by trained quality-consultants..

Improvement and quality management are, in my opinion, synonymous: In fact, quality management is to ensure that improvement processes are running continuously in all parts of the company. Identification and implementation of an improvement needs time, and participation from the "process owner" is crucial for the success. This is what the pilot clubs experienced, and what consequently was organized as an effective quality implementation method.

### **5 The fivestep method**

The five step method will be a topic for professional presentation during the next days. What I find important is that it addresses both management and staff: Step 1 and step 5 covers the management's planning of quality activities and monitoring these activities and the entire quality system with respect to suitability and effectiveness. Psychologists name this a "Top-down"-process. Step 2, 3 and 4 cover the "Bottom-up"-process. These are the activities which

involve the whole staff. That is the quality control activities, consisting of improvement work of core business and further development of the quality system. Problem analysing and problemsolving techniques are focused. It is essential to choose an easy operated technique, and encourage the (ad-hoc) improvement groups in the company to use it in their work. Improvements are essential, and it is important to start with small, measurable initiatives.

## **6 The LBA administration**

The LBA administration is built to serve the member companies in short and longer range. We are organised in five departments:

The administration and economy department, who supports me, the board of directors, different working groups, and runs the office from day to day.

The employer department, who handle mutual communication with the union of building workers

The trade policy department, who works on the strategic topics and long term challenges with respect to the ever changing conditions of the market and the government

The education department, who produces trade conferences, courses within all important areas of contracting, in-company learning etc.

The information department, who has editing and publishing of our magazine "Byggeindustrien" ("The Building Industry") as its main objective.

As one might see, - a wide range of objectives and tasks, and as our owners / customers all are contractors and staff members in building and construction companies, it is important that the LBA administration "speak the contractor's language" and are well skilled and familiar with the LBA member's business and needs.

## **6 Quality in the LBA administration**

The LBA board of directors have long ago decided to give quality in buildings and constructions high attention through different activities: In 1981 our information department (the magazine Byggeindustrien) established the annual "Byggeindustrien's Quality Award", based on a number of self-established quality criterias. Even if it isn't as rigorous and prestigious as the Demingprize, Malcom Baldrige, European or Norwegian Quality Award, winning the Byggeindustrien Quality Award has become something our member company are striving for. We are convinced that the initiative increases the attention of the competitors and gives positive effect on quality in the production within the trade.

As quality management became a subject for our member companies, through direct and indirect customers requirements, I thought it would improve our service if all individuals in the LBA administration were able to communicate on this subject with our members. Through our internal evaluation of how to increase our knowledge at the quality field, we understood that "learning by doing" would be the most suitable and effective way. In addition we were influenced by the arguments that we ourselves passed on to our member companies, and started to believe that there might be something to gain through an improvement process within our own staff.

Preparation was done autumn 1992. Through research and evaluation we made a "bidders list" of three facilitators, and after bidding and negotiations, we signed the contract with Byggforsk, and started in january 1993. The contract focused on knowledge more than

development of our own quality system, and we thought that much would be achieved during a period of 18 months. In other words, the project should have been concluded these days. There are more than one reason why we have decided to enlarge the project to last for 24-26 months: First of all we have experienced that the process gives rise to increased productivity and profit on the activities that have been focused, and we want to continue the improvement activities. Next, we have got stronger ambitions and have decided new goals: Now we want to have the LBA quality system documented. The education department, who is very exposed through their continuous interface with a large market of external and LBA-internal customers and used to the "right first time, - every time" expectation, has yet come a long way. The other departments are following, one by one. We can see a few obstacles connected to the character of some of our tasks: Trade strategies and negotiating strategies are sensitive internal and external operations. Hence, it isn't always suitable to document the procedures, even if there are some good arguments for documentation.

LBA administration is far from a contractors staff. Never the less we feel confident in use of the five step method: The main message is in fact trade-independent, saying that there are no short cuts when the decision to start implementing quality management is taken. And further, we have learned that there are no one but yourself to do the job. Advisors and facilitators, - yes, but improving quality is in fact changing of attitudes within the company, and must be developed by the management and the employees together.

## **7 What can be improved on our improvement process?**

I shall not bother You with my bad conscience for not paying enough attention to the implementation process all the time. People who have been through the implementation process know that it is a question of motivation, and that you get de-motivated from time to time. It will always compete with "must-be-done-now"-demands in core business, - and a meeting in the improvement group has to be postponed, a report is not written, a preparation is forgotten and ....

There will always exist an opposition to the implementation process, not by people in the company being against quality management, but by the way we always have done our jobs, and by lack of time, caused by doing the things in the way we always have done it. You can keep the process going for a while based on enthusiasm and good will, but gradually it is given lower priority than necessary.

To ensure the quality process to continue successfully in my organisation, I will pay more attention to regularity of meetings. First of all in the management, who must prove its dedication to quality by activities more than by words. But also in the different improvement groups, who must work continuously to achieve the improvements. Meetings must follow a predecided agenda, and they shall not exceed an hour. The quality managing group must come together twice a month. The improvement groups must adjust their meeting frequencies to the nature of the improvement effort in question, but rather every week than more seldom.

## **8 Conclusion**

There are other improvements to implement too, but listing them can take the attention away from the most important comment to the LBA staff quality process: It develops efficiency and increased productivity, and it even supports creativity. It is value for money.



# Implementing quality management - in plumbing companies

**Tor Backe**

Norwegian Association of Plumbing, Heating and Ventilating Contractors, Oslo, Norway

**Trond Åsheim**

Norwegian Building Research Institute, Building Technology Department, Oslo, Norway

## Abstract

This paper is written in cooperation between the Norwegian Association of Plumbing, Heating and Ventilating Contractors (NRL) and the Norwegian Building Research Institute (NBI). It tells the reason why NRL decided to support NBI in their quality management work in plumbing companies. An extract is given, of some important experiences from several cooperating groups led by NBI. Being one of the participants in the first pilot group, it is obvious to realise that quality management has become a much more practical tool than we experienced in the mid eighties. Nowadays it is drawn much more attention to the process in the company and the participation of the employees in the improvement work. The paper ends with some comments on NRL's plan of action, mentioning pre-qualifications and special measures for the smallest companies.

## 1 NRL's strategy and thinking around quality management

### 1.1 Background

In a Norwegian context, the concept of quality assurance first arose in the oil industry. The concept then spread to the building industry in the mid eighties as a result of demands from the oil industry that contractors submitted quality assurance documents for office and other on-shore constructions. In the case of the Norwegian Association of Plumbing, Heating and Ventilating Contractors (NRL), it was the building of Norwegian Hydro's office building at Sandsli, Bergen, that precipitated the NRL's engagement in the development of a quality management system for the plumbing industry. Suddenly one of the association members received demands for documentation of a quality management system that, at that time, did not exist. The question then arose as to whether the NRL as an organisation could contribute to a solution.

## 2 Taking action

### 2.1 The QMS-developing groups - several important lessons learnt

The pilot-groups in 1985-89 were led by the Norwegian Building Research Institute (NBI), and they were sponsored by public funds from the 3B-project ("for better and cheaper housing"- the Ministry of Labour and Public Works).

Åsheim was the representative of one of the contractors who joined another company group for developing the pattern book for a quality system for main contractors. Sometimes during this process, all the participants felt rather frustrated. They did not know, and perhaps not even Byggforsk really knew, what the real aim of the project was.

So after a period of time, when there were collected tons of papers which described the best practise within the participating companies, the outline of the pattern book took shape. The engineers, were awakening and starting to contribute more eagerly. Now they could see that their effort would not be in vain - they would in fact end up with some concrete "hardware".

The problem was however, that there were no special measures taken and no arrangement made for increasing the motivation within the individual companies. They ignored the process in their own company. Themselves were becoming experts in how the content of a quality system should be documented, but they did not ensure the continued growth of our own quality system. The other employees did not participate neither in discussions, nor in developing any company procedures.

Nowadays we know that such participation is rather crucial if we want to ensure real improvements of the process in the company. One other important lesson learnt, was that all development work must be carefully planned and actively and continuously followed up, if one is to achieve lasting changes and improvements. Plans for quality system development should therefore be drawn up a few months at a time. Plans should include the work to be carried out, a time schedule, and assignment of tasks and responsibilities. This is **step one** in what we call **the five step model** - a theoretical model for establishing of a quality system in a company. It describes the **process** in the company, which was worked out by the end of the project in the pilot group.

The model will not be dicussed any further. It may be mentioned however, that it aims at giving priority to that area of improvement that is most pressing. All the time employees are actively involved in the improvement measures which concern themselves.

## 2.2 The NRL/NBI project "Quality assurance in the plumbing industry"

This co-operative project was established by the resolution of the NRL Board on the 2/10-85. Six of the country's larger plumber's companies comprised this project group. It was sponsored by public funds from the 3-B project ("for better and cheaper housing"- the Ministry of Labour and Public Works). The grant from the 3B-programme was remarkable, since it was the first time funds have been granted for development work within a typical subsidiary-contractor's field.

It is also noteworthy that NRL, in engaging in this work, was the first organisation in the building industry to address this challenge, and to make a long term investment in the competence levels of its member companies. The project was completed in 1988, and resulted in a QM handbook for the plumbing industry, and in six "QM-educated" plumber's companies.

## 2.3 Why did NRL choose the NBI as project partner?

For NRL, this was a natural choice. The NBI was already involved in similar projects both with main contractors and with one of the largest professional clients of the building industry. In this way one managed to gather those involved at the various levels of the building industry around a common goal - a rational and fruitful path to follow in the small market Norway actually represents. Experience has shown that this was indeed a profitable path to follow: NBI's QM system is now widely used throughout Norway. The last party to enter the arena was the

Norwegian Association of Chartered Architects. They finished drawing up their QM objectives in the Spring of 1994.

### 3 Cooperating groups

#### 3.1 Different models of cooperation have been established

Competing companies working together to develop and establish a quality system is a rather special Norwegian phenomena. It has aroused attention far beyond the borders of Norway, as far as New Zealand.

Because of the fact that Byggforsk has positive experience of club cooperation, we feel that this is an approach that is absolutely worthy of priority. This is the best and most effective way of spreading the know-how around the country.

The first groups, established in '89 - '91, were quite similar:

- 7-8 companies
- duration for about 2½ year
- more or less the same programme
- two consultants cooperating
- five plenary meetings every sixth months and personal visits to the companies in between

However in case of impatient customers, sometimes it is necessary to offer the customer a program lasting a shorter period of time, in fact sometimes only half of the normal implementation period. The result might not be so satisfactory, but this of course depends of how much effort they show. It is important to realise that companies do have different needs.

For instance some wish to structure their administrative procedures, while others wish to focus on the building site. The QM-model focuses on both areas. For optimal motivation it is better to take the company's own priorities into consideration.

Nowadays several different models of cooperation have emerged, and some new models tried out recently, prove that they may be even more efficient than the original one. Required flexibility regarding the model is also due to:

- differencies between smaller and bigger companies
- different opinions of how much they are willing to pay
- a professional union or association requests special help with their development work

#### 3.2 Local clubs

One particular example which is quite different from earlier clubs, is a small group consisting of three plumber's companies. They are all competitors in the same city, but they cooperate so eagerly when working together. There are no travel expenses and there are only gatherings which are something in between plenary meetings and ordinary visits. This model becomes very cost-efficient - only one consultant, and so far the experiences are promising.

Other local clubs are established together with external consultants. An external consultant engaged to cooperate with NBI, is intended to be the local operative consultant at his own place of work. The aim is to broadcast the conclusions of our work on quality systems as fast and as widely as possible. We are achieving this by building up a network of trained QM consultants as NBI's cooperating partners.

Local QM consultants will contribute in increasing the competence in distant regions. This local district profile will emphasise that quality is no high-flying goal, but a down to earth objective, and available to smaller local firms. Local consultants will be of paramount importance in spreading the message to other countries, where adaption to the local culture

and conditions is a key point. A locally engaged consultant will be better qualified for such work.

The point of an external consultant is that he belongs geographically to the same area as the company group he is to work with. The short journey will enable him to visit client companies more frequently, as the situation demands. Familiarity with the participants in a company group is also a clear advantage. This will ensure the best environment for an active exchange of ideas and experience, and a fruitful cooperation.

#### **4 NRL's plan of action**

##### **4.1 Why go in for QM?**

There were two reasons for NRL's early and intensive engagement in Quality Management. The first was the market's demand for QM documentation on submission of tender. The second was the advantage to the companies themselves that would result from the integration of quality assurance systems in their respective companies. A QM system results in things being done "right first time", which in turn results in fewer complaints, less loss of capacity, fewer lost orders, and greater goodwill in the market. In other words, quality assurance gives a more profitable company. This train of thought proved to be justified in the light of the crisis suffered by the building industry towards the end of the eighties, when the market shrunk and prices were pressed down, so that margins between profit and loss were so small that a slight miscalculation could result in considerable loss. Those companies that already had on-going QM systems at this point were better equipped to face the crunch than others.

##### **4.2 How to introduce QM to the company?**

There were certain barriers that had to be surmounted before we could introduce QM to the companies. The very concept of QM frightened many companies. They perceived QM as remote and insurmountable, a great paper monster that would destroy even the most eager and best educated of managers. NRL therefore laid emphasis, in meetings all over the country, on the fact that QM is simply the systematisation of routines that already exist in the company, and in that respect is certainly not a new and frightening bureaucratic system. It was also important to actively involve employees in the development of the system in their own company. We found to begin with that employees regarded the system with suspicion. Plumbers reasoned that employers would use the system to supervise them and cause them extra work that they would not be paid for. These "start phase" problems were solved, partly because NRL also involved the trade unions in the work.

##### **4.3 Pre-qualifications of tendering companies**

Once NRL's work with QM had got properly started within the organisation, one then made a conscious effort, through the medium of the Technical Contractors Association (electricity, plumbing, ventilation, temperature regulation and elevators), to help building clients to appreciate the advantages, and make more frequent use of pre-qualification of tendering companies. The idea is to get the client to think more in the direction of quality, and less of price alone, when selecting the tenderer. Besides serving the interests of the client, the use of pre-qualification will focus on the system competence of a company, and will therefore lead to increased use of QM, which will, in its turn, increase the profitability, the competence, and the competitive strength of the company. To a large degree this work has already been successful,

especially since the authorities have nearly completed their revision of the Planning and Building Law, where it is precisely professional and administrative competence that are to be emphasised in the new official approval/licensing system for, among others, contractors. Following these proposals, contractors will be classified into various classes, according to their documented competence.

#### 4.4 What about smaller plumbing companies?

In its strategy and action plan for the period 1993-95, the Board of the NRL has resolved to continue the work with QM. Up to now, it is only the largest companies that have embraced NBI's QM system. They have done so with positive results. However, since 80% of NRL's members are companies with less than 10 employees, the conclusion is that a QM system must be made available to them as well. We realise, however, that NBI's system could be over dimensioned, and perhaps difficult to access for the smallest companies. While the larger companies, through their QM systems can achieve ISO certification, this is not an objective for smaller companies. But it is just as important for them to systematise their daily routines, and this is what NRL now aim to achieve, this time without a co-operative party. This QM system, in regard to the limited resources and finance of smaller companies, will be introduced through short courses, held throughout the country, where only those who participate in the course will have access to the purchase of the QM system.

Our expressed aim is to increase the competence level of our members in their entirety, in order to secure their position, both on the domestic market, and within the EC area.

# The development of quality management in the concrete pipe industry in Norway

**M. Bonnevie-Svendsen**

Norwegian Building Research Institute, Building Technology Department, Oslo, Norway

**J. G. Eckhoff**

A/S Alfanor, Oslo, Norway

## Abstract

The paper present a development project carried out in cooperation between the Alfanor Group and the Norwegian Building Research Institute (NBI). The Alfanor Group is an umbrella organisation for a number of individual concrete pipe producers and A/S Alfanor is the central service office with responsibility for design and development of common interest within the group. Development of quality management has been a three year project within the Alfanor group. The project has focused both improvements in practical working routines and the development of formal routines forming the documentation of the quality management system. The development process has been according to a 5-step model.

## 1 Why make the effort?

The task of the Alfanor group is to develop and bring to the market a complete system of sewage products with defined quality to an acceptabel price. This is to be carried out through the different cooperating companies covering the whole market of Norway. In order to manufacture products to meet the demand of identical quality and, considering limited capital to be invested, The Alfanor group decided to develop a model quality system for the group of companies. The developing process started as a project in 1990 and went on for three years until the project closed in the autumn of 1993. At that time the first company had been through internal audit on the basis of ISO 9002.

## 2 Participants and project organisation

The project partners were the Alfanor sentral organisation, seven companies of pipe producers and NBI as the project leader. The typical size of the companies were in the range of 10 - 20 employees and a turnover of approximately NOK 10-20 mill. The project was funded by the participating companies and the Royal Norwegian Council for Scientific and Industrial Research.

Before the main project was started, one of the major companies was selected as a pilot company. This company worked for half a year according to a 5-step model. The experience

from the pilot company was then evaluated, before decision was taken in the Board of Alfanor to go on for the full project.

### 3 Development according to the 5-step model

The concept of the developing process was the 5-step model of NBI. This method takes care of the two parallel processes during the initial development of quality management in a company:

- The development of new skills and attitudes.
- The development of carefully structured documentation.

Improvement work is used as a forceful method to keep the attention, provide training and beneficial results to the company during the initial development period. As the results from this project shows, problem solving can be directly measured in reduced production costs. In the process NBI did not contribute with solutions of technical problems. Defining problems and finding ways of solving them must be the responsibility of the companies.

The main elements in the 5-step model are presented in table 1:

*Table 1 The NBI 5-step model was the basis of the development and implementation process within the Alfanor Group.*

STEP	TASK OF EACH STEP	COMMENTS
Step 1	Working out a quality program	To give direction, aim and responsibilities to the personnel involved.
Step 2	Initiating improvements	Contribution to improvements effecting the everyday work, to be achieved over a limited periode of time.
Step 3	Analysing current procedures	Collecting and analysing existing routines.
Step 4	Developing the quality system	Decide upon the structure of the system and which part to develop first.
Step 5	Integration and supervision of the quality system	Make sure that the system is understood and correctly employed.

### 4 Pilot Company - first experience

For the pilot period, the company decided upon a quality program that focused on three main production quality aims. See aims and results in table 2:

*Table 2 Aims and results in the pilot period for the Alfanor pilot company.*

No.	QUALITY AIM	RESULT
1	Improvements in visual appearance of the pipes.	There was difficulty in finding objective methods for measuring, but improvements had obviously been achieved because of less finishing work (repair).
2	20 % of bottom shaft sections to be finished without additional work after demoulding.	In the periode March-August, 83 % of the shafts bottom sections could pass without further finishing work.
3	The wreckage of the production is to be reduced by 30 % for one of the production lines.	For two production lines the % of wreckage was reduced from 9 to 3 % and from 6 to 3 %.

The improvements were achieved in cooperation between the machine operator, the foreman and the mechanical service crew, all within the resources of the company, and practically without money investments. The results gave the background for the decision of the Alfanor board to go for the full project scheme.

## **5 Project activities**

### **5.1 Development in production**

This activity was carried out through visits in the plants and through meetings where all the companies were present. The company visits represented an opportunity for detailed discussions on implementing issues and advice upon the quality program governing the main development activities for the company in the next half year. Important elements in the regular meetings every half year amongst the project participants were the exchange of experiences and mutual learning, together with new lessons preparing the next step in the 5-step model.

### **5.2 Development in construction**

In addition to the production units the project also had to address the central organisation. This meant that development of quality in design must have a parallel process in the central organisation. The leading and coordinating role this body traditionally had, would have to adjust to the future role when cooperation would be within the framework of a quality system.

### **5.3 Development of the quality manual**

For this work a drafting committee was set up. The committee defined the structure of the quality manual, collected written routines from the companies, and prepared model procedures on the basis of the common experience within the Alfanor group. The model routines later had to go through changes within the companies in order to be adopted as a company routine.

## **6 Improvements - examples and results**

Why is the improvement process of such importance?

- 1 This is practical training in dealing with non-conformance.
- 2 The improvements made visible, to be recognised in figures, speaks for itself. It supports motivation and keeps the development process alive.
- 3 This is the link between the evening work spent on the quality system and the production of the working day.

This is our answer to the problems in implementation. It can not be emphasised strongly enough, that implementation starts with improvements in an early stage of the developing process.

### **6.1 In production**

The main focus for the majority of the companies were the manufacturing. Many improvements were made in order to reduce the number of pipes to be sorted out as wreckage production and increase productivity. Some examples can be found in the table 3. This is part of a table prepared by a production manager in one of the companies. One important use of this information was as internal feed-back to the operators.



Table 3 Systematic improvement work, examples from one of the Alfanor companies.

No.	IMPROVEMENT	START week/year	TO BE FINISHED	EXPECTED RESULT	INVESTMENT	PAYBACK
1	Hydraulic controle of the core drilling machine	25/91	27/91	Reduction in time spent on the drilling operation	- Material: NOK. 5.000,- - 10 working hours	NOK 8.000,- per year
2	Connections between mouldingform and vibration table	39/91	2/92	Reduction in time spent on the changing of moulding forms	- Material: NOK 10.000,- - 85 working hours	NOK 80.000,- per year
3	New vibration table for special products	44/91	46/91	- Increase in production capacity - better working condition/working height	- Existing equipment - New material NOK 2.000,- - 70 working hours	NOK 25.000,- per year

Other examples of improvement work in production were:

- the reduction of finishing work
- complete machine responsibility given to operators of the machine
- more light on the production floor
- improvements in the testing equipment

Both technical matters, and the responsibilities of the operators, have been subjects for change and improvements.

## 6.2 In the stockyard

The companies store their finished products outdoors. There have also been improvements in the stockyard, eg;

- the number of products stored have been reduced (reduced inventory)
- improved gear for the handling of pipes
- traffic areas have been improved reducing; the maintenance costs for trucks, and the number of pipes destroyed under transportation

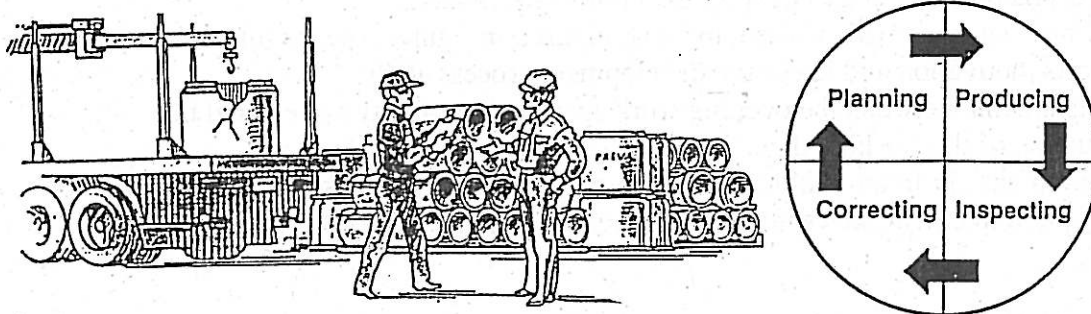


Fig. 1 Avoid damage by correct handling of concrete pipes. This require training of drivers and contractors.

### 6.3 Other improvements

Purchase and sales have been integrated in systematic improvement work, and reducing transportation costs and reducing the number of credit invoices.

### 6.4 Cost reductions

Several of the companies made accounts of their cost reductions. These figures shows that the investments in the project participation have been returned many times. Savings are in the order of several hundred thousand NOK. per year.

## 7 The quality manual - Documentation in three levels

The drafting committee started work in January 1992 and had prepared a draft of the Alfanor Quality System (AQS) during the summer 1993. The AQS was organised in three levels. See table 4. The *Description of the Alfanor Quality System* formed the top level. The second level was the *Quality Handbook*. The third level consisted of the most detailed instructions and product specifications collected in the *Inspection Books*.

Table 4 The structure of the Alfanor Quality System

LEVEL	DOCUMENT	COMMENT
I	<b>Description of the Alfanor Quality System</b>	This is an open document prepared for two purposes: - information to customers about Alfanors organisation, politics and quality control. - tool for internal company training
II	<b>The Quality Handbook</b> 1 The company in general 2 Sales 3 Design 4 Purchasing 5 Production 6 Storage 7 Transportation	The Quality Handbook is divided into seven main chapters according to the stages in the execution of customers orders. The content of the main chapters are the routines and forms describing internal responsibility and the requirements and guidelines for the critical operations. Chapter number 8 and 9 are reserved for the companies individual needs.
III	<b>The Inspection Books</b> The system already established before the start of the project.	Contains specifications of the products and detailed product inspection guidelines. It was decided to keep this as a separate volume. The handbook give references to the detailed instructions within The Inspection Books, well known by the operators.

### 7.4 Procedures in level II

There are three kinds of routines depending on the responsibility for development and up-dating:

The Alfanor common routines are mandatory routines concerning design and production control. The inspections of the final product are among these routines in order to secure that Alfanor products from any company meet the Alfanor quality requirements.

The model routines are examples covering important elements in all main chapters. These examples have to be adjusted to the local conditions in every company, and can not be implemented directly. It is the responsibility of the central organisation to collect experience from the whole organisation as a basis for further development of the model routines.

The company routines are defined by the single companies according to the local needs, and are up-dated by the individual company.

#### 7.5 Standard procedure form

A standard procedure form is developed. This form provides the necessary questions for the personnel involved in developing formal routines. The standard procedure form has shown to be particular useful in the first stage of developing the quality system.

#### 8 Final remark

The developing process in the Alfanor group will be extended to all the other cooperating companies in the group. The spirit during the process has been outstanding in a situation shadowed by a general recession in the building industry. The comment by one of the top leaders in the last gathering gives the future direction: "We can not stop now!"

# Internal Control of Health, Safety and Working Environment integrated in a Quality System. Pilot Projects in the Norwegian Construction Industry

Torer F. Berg

Norwegian Building Research Institute, Oslo, Norway

## Abstract

In 1992 new regulations concerning health, safety and working environment were introduced in Norway, The Internal Control. The authorities strategy is to move from site inspections to control system audits. Many information programs were, and still are running to get the new regulation into practise. In the construction industry the new internal control practice is difficult to establish due to the continuously changing environment, always new projects, new project partners etc. This paper is an extract from Norwegian Building Research Institute's (Byggforsk) work with developing a practical way of integrating the new regulation in the construction industry. The scope of the project was both to integrate the internal control practice in the company systems and into the management of construction projects.

Byggforsk took an action research approach, using the quality management system as a formal framework and a systematic way of collaboration, both between the different companies and between workers and management, as a development strategy. Three pilot projects run simultaneously in three regions, with participants from main and sub-contractors. Three seminars in each region were the key activity. The projects were successful in bringing different parties together discussing multi-disciplinary health, safety and environment problems. Each company formalised the common practise and experience through procedures and forms. Some companies added these to their quality system, other started formalising a documented system through the project. The way the pilot projects were run is well documented and a cost efficient way of introducing and making the parties in construction and building projects committed to the objectives in the new regulation.

## 1 Background

The project was developed in collaboration with The Associated General Contractors of Norway (LBA) and financed by The Employers Federation of Norway (NHO). One of the three parallel projects was lead by Thorbjørn Ingvaldsen and the other two by Torer F. Berg, both researchers at Byggforsk.

Two to five main contractors were the basic "partners" in each region. The contractors choose three to five special- or subcontractors each as participants in the project. This made a total of 31 companies (with about 2000 employees).

### 1.1 The Acts and Regulations

The regulations concerning internal control were laid down by Royal Decree of 22 Mach 1991. The regulation entered into force on 1 January 1992 and contains provisions that stipulate that the person responsible for an enterprise has an obligation to arrange for systematic follow-up of current requirements as laid down in: *The Working Environment Act*,

*The Pollution Control Act, The legislation related to the fire and explosion hazard and fire prevention, The Product Control Act, The Civil Defence Act and The Act relating to Inspection of Electrical Equipment.*

The purpose is to promote health and good working environment, and to improve safety. The regulation underlines the employers' responsibility, but demand active participation from all persons involved.

The Internal Control Regulations has been practised in the offshore activity in the Norwegian part of the North Sea since 1985, and with very good results. This is why the regulation was introduced to all entities in Norway, both private and public<sup>1</sup>.

The main change for the employers, after the introduction of this regulation, is that they are not only responsible for ensuring that the activities are performed in accordance to the requirement stipulated in or pursuant to the Acts or regulations, but that this also has *to be documented in writing*, in a systematic way.

## 1.2 Quality System - The Framework for an Internal Control System

The internal control system is said to be a quality assurance system for the health-, working environment- and safety works.

Like the quality system, the internal control systems shall state the "internal control" policy of the enterprise, the way they organise the effort, responsibilities etc., and how the internal control system is developed, revised and used in the everyday works. Similar to the quality system, the internal control system shall describe procedures that will support the intended effort in the legislation. Like ISO 9000 standards the internal control system contains procedures for monitoring, verification, system audit etc. In some aspect it differ; system audits shall take place in co-operation with representatives of the employees. This is according to the Working Environment Act.

## 1.3 System Control. The New Role for The Working Inspection

The external system audit shall be carried out by The Labour Inspection Body. This means new task for the labour inspectors responsible for inspections in the building industry. Until now they did control installations and activities at the building- and construction sites. The inspectors were a sort of "safety- and environment police". The changes from site inspections to system verification and audit, leads to a new and difficult role, both for the officers in the Labour Inspection, for the employers and the employees. In our pilot projects this was emphasised through involving the Labour Inspection directly in the activities.

## 1.4 Productivity Through Participation - "Prod-Part"

Byggforsk chose to introduce this collaborative approach as an answer to the demands in the Working Environment Act. In § 12 in the "Working Environment Act", which is one of the dominant laws lying behind the Internal Control Regulation. It states "that employees shall be kept informed about, and receive the training required to enable them to understand the systems employed for planning and directing the work. They shall also help to develop these systems". The approach is based on Norwegian work life tradition, developed for the building process in the 1980s through the project "Produktiviteten gjennom samarbeid - PROSA" (Productivity Through Participation - Prod-Part), (Berg 1993). In short this means formal arrangement for collaboration between the parties in a construction project, normally with the main contractor in a key role.

---

<sup>1</sup>For further information "The Internal Control. Regulations, with guidelines" English version.

**Prod-Part effort** normally starts when the main (or design and build) contractor makes an **invitation to tender** for the subcontracts. The contractors do inform the subcontractors that they have to take part in, and contribute positively to the Prod-Part effort.

The **site start-up seminar** is the practical

start of the effort. The contractors participating in the early stage, are present, both with managers and gang leaders. The project is openly discussed, the production plans and production strategy put forward and everybody is invited to come up with alternatives. One of the main tasks at this meeting is to set the scene, invite to collaborate in a positive with open minded way.

**Project investigation** is an important procedure where two or more contractors together go through (part of) the project, to uncover difficulties, faults, look for improvements, efficient way of collaboration at site etc. The investigation shall be properly prepared, with all the necessary drawing, bill of quantity, standard, laws and regulations, data sheets etc. at hand. If possible the most important drawings shall be put up on the walls. The investigation shall take place in meetings with no disturbing disruptions, and no telephones. The procedure can be compared to the Contract review of the ISO 9000 standards.

Participation in **project planning** is also on of the more important procedures in the effort. In our project the subcontractors got their view on optimal production procedures put forward through group discussions at the seminars.

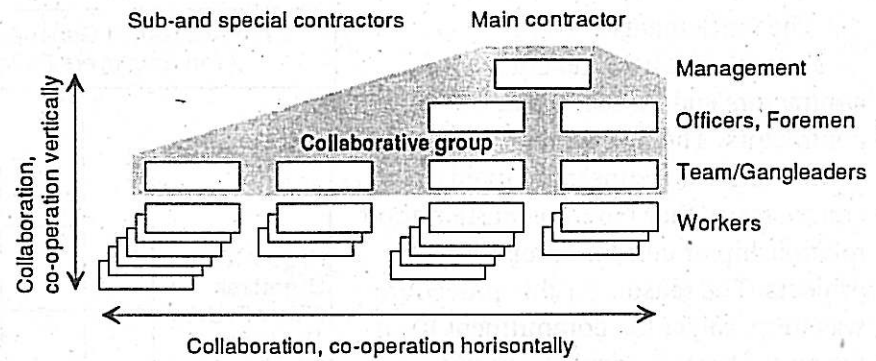
**Short-time planing** or **week-scheduling** is the meeting point between the parties at the site. The meeting should be regular with gang leaders participating. The purpose is scheduling the production effort the week or period to come. The schedule says what to do, where, when and by whom.

## 2 The Pilot Project(s)

The project was a joint activity between The Associated General Contractors of Norway (LBA) and Norwegian Building Research Institute financed by The Employers Federation of Norway (NHO). Byggforsk was responsible for running the project and summarise the experiences. The organisation is illustrated in figure 2. The budget for these efforts was NOK 680,000. The total budget including the effort in the enterprises was NOK 2.5 mill.

### 2.1 Objectives

- Integrating the internal control system in the quality management systems (or the main business system) of the enterprises, both the everyday working practise and in the way it is documented in writing.
- Find cooperative solutions to the problems in managing and co-ordinating the internal control aspects in projects, i.e. between the contractors and subcontractors.
- Develop a model for spreading good and realistic internal control practise, among the participants in construction projects.



*Fig. 1 Participants from the different contractors are organised horizontally and vertically in collaborative groups.*

## 2.2 The Participants

31 enterprises; 11 general contractors and 20 sub/special contractors. The sub and special contractors were chosen by main contractors either based on earlier good relationship or current co-operation in projects. The reason for this procedure was to try to get the commitment from the participants on day one of the project. This seemed to be an effective way of mixing different contractors together. One other criterion for choosing participants was a positive attitude towards the new regulation and that they were developing or had just started developing their own internal control system.

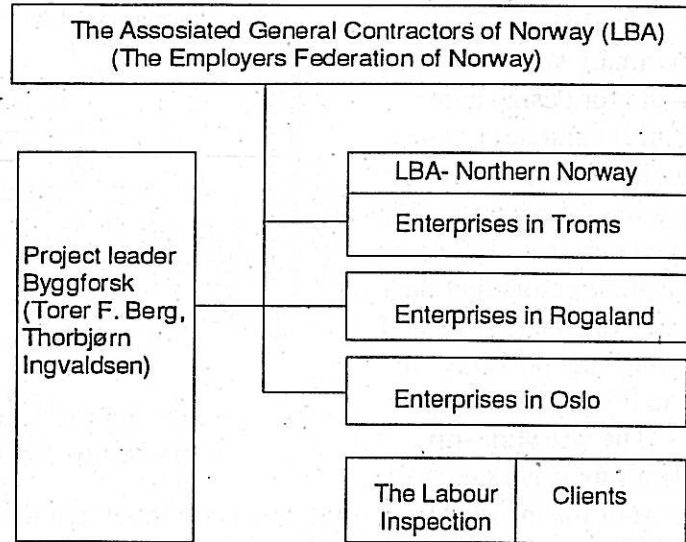


Fig. 2 The organisation of the project

## 2.3 The Activities

The three seminars were held over a period of 12 month, in each region. "Homework" in the enterprise was done between the seminars, like development of relevant procedures both in the enterprises and at Byggforsk with forms, checklists etc. Some of the participants also worked in the same projects and tested out some of the "tools" introduced at the seminars.

These tools were strongly focused during the seminars, and included the developing of health, safety or/and working environment procedures, exchanging experiences, reporting progress, discussing common problems, and finally "internal audit" of the documented systems.

One of the main things in the project was to find out how to use the quality systems in the companies as the methodically and systematically framework for the internal control work.

## 3. Key Challenges. Findings

### 3.1. The Internal Control System

Entities that have developed or started developing a quality system try to integrate the internal control system in the quality system. So far, most of the entities in the construction industry do not have a formal operative quality system. Therefore one way to establish a better quality practice is to start with the internal control system and add quality procedures later on.

Through the pilot projects the question of how to combine the different subsystem of a company did evolve. Figure 3 shows the quality management system emerging as the common formal system of the company. Each circle in the figure represents a sub-system that lies inside the company system.

One major challenge in the pilot projects was to get the internal control system integrated in the core activity, and described in the quality management system. One other aspect was to use the quality management approach as a general framework for development, documentation, information, etc.

The quality management system "ring" illustrate how this established framework can be used in one entity. The same principal can be used in construction projects, but then through the project quality plan.

### 3.2. Internal Control in Construction Projects

We strongly emphasised the collaboration and coordination in ordinary building and construction projects. The experiences were that the contractor gradually increased the collaboration through the internal control effort. We did see positive results both in reduced duration of absence and to simple, efficient safety procedures.

According to the legislation the enterprises in construction projects are responsible for organising the internal control for their own activities and the activities that need to be coordinated with other enterprises. Normally the coordination activities are given to the main contractor or to one of larger contractors (in construction management or client managed projects). These coordination activities and responsibilities were frequently discussed and seem to be an increasing problem for both the contractors and the Labour Inspection especially on client managed projects, which is increasing in Norway.

### 3.3 The Responsibility Of The Client

When offshore clients are building "on shore" they seem to focus both on internal control as well as quality control. In Rogaland offshore clients and their "onshore" projects were a main item in the seminars. These clients ask for pre qualification before allowance to tender and exclude contractors and suppliers who could not verify documented quality and internal control systems. However, in ordinary projects, the "normal" client seldom demanded quality systems and so far no internal control systems. Through the pilot projects the contractors developed the view that the client ought to ask for pre-qualify on the content of the internal control systems as well as other relevant criteria to the project. This would be an important step to get the "unprofessional" out of business, contractors who always are willing to gamble on health, environment and safety to reduce cost.

## 4. Results

Most of the companies did add health, environment and safety aspects to their quality procedures and regular practice. They integrated the new written procedures in their quality systems. Some of the smaller companies used this internal control approach as a start in their quality system works. In all three regions some of the companies did implement a good health environment and safety practice.

The local seminars became an efficient arena for learning, committing both the general contractors and the subcontractor to work consciously with the internal control and collaboration aspects. One or more of the Prod-Part techniques can be used when some of the participants collaborate in new projects. However, the effect of better planning and

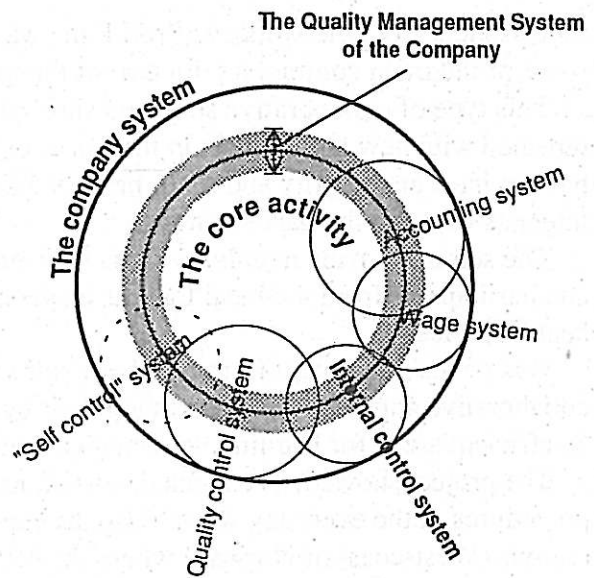


Fig. 3 The different systems in relation to the core activities, the Quality system and the "Company system"



involvement from the workers (Prod-Part) was difficult to confirm in these short projects, but some of the main contractors did try out the techniques, and will continue to do so.

This type of collaborative seminars showed to be easy to organise and run, and can easily be repeated with new participants in the same, or in new regions. However, the seminar leaders have to have an integrity and multi professional skill making it possible to balance the different interests between the participants.

The seminars made a realistic arena for learning, both from other participant in the industry, and participants from the local Labour Inspections, clients, assurance companies, company health service etc.

One of the participant from Northern Norway stated in an international seminar, that this collaborative approach combined with their own effort in establish quality management, made an efficient arena for learning, information and change.

The project showed, as expected, variations in the priority of health, environment and safety procedures in the everyday work. Also, as expected, the priority was higher in one of the regions (West-coast of Norway) where the off-shore industry is frequent client to the industry. The projects showed the advantage of mixing new item with established practise in a multi professional setting. This is approach that is not easy to arrange due to the traditional separation in special trades and crafts. The "top-down" approach with The Employers Federation of Norway as the gathering force, made these projects possible and seems necessary to establish the right multi disciplinary forum.

It is also possible to integrate the content in the seminars to larger project. Byggforsk do recommend the Associated General Contractors of Norway introduce this in traditional and design and build contracts.

Byggforsk will, as part of their strategy to be close to the actual problems and challenges in the industry, offer similar seminars run in other regions and/or for other participants.

## 5. Literature

Berg, T. F. (1991) **Produktivitet gjennom samarbeid - PROSA.** (Productivity through Participation - Prod Part) Rapport fra 1. delprosjekt Øvre Skogvei, Oslo. Norwegian Work Life Center, Oslo, Norway.

Berg, T. F. (1993) **Rosenborggt. 7-9 i Oslo, Norway. The Nature, the Management and the Co-ordination Devices of the Project.** (Assignment in MSc-cours Project Management 1992-93), Department of Construction Management, University of Reading, UK.

Berg, T. F. (1989) **Samarbeid på byggeplass.** Rapport 88, Norges byggforskningsinstitutt, Oslo, Norway.

Hansen R., Sjøholt O. (1989) **Quality Management. A challenge for the Building Industry.** Project report No. 50 Norwegian Building Research Institute, Oslo, Norway.

**Internal control. Regulations, with guidelines.** (1991) Ministry of Local Government, Oslo, Norway.

# Quality Management in technical education for the building industry

**Ole Jonny Klakegg,**  
Norwegian Building Research Institute, Oslo, Norway

## Abstract

European countries are developing a common market for building and construction services. To form a rational basis for international cooperation between companies in different countries, the Quality Systems and the educational background of key personell should be comparable. Further development of the international cooperation in order to improve Quality Management in the building and construction industry should include development of internationally accepted structures and descriptions for educational purposes. This will improve the basis for certification of Quality Personell in the industry and simplify the certification process. The Norwegian Building Research Institute (NBI), in cooperation with a number of technical schools and universities, has developed a flexible structure for such purposes. Interested parties are invited to make contact, in order to initiate a cooperation to establish an international basis for teaching Quality Management to students in the building and construction industry.

## 1. Strengthening quality in technical education

For some years now, subjects like Quality Assurance, Quality Control and Quality Management has been highlighted in discussions, literature, seminars and in everyday life of every modern company or business. This also applies to the building and construction industry. Unfortunately, this has not been reflected in technical education for the industry. Knowledge of Quality Management is vital to the development of the company in a increasingly competitive market.

Some technical schools and educational institutions in Norway have started to work in this field. Usually as a result of the effort of single teachers with interest and knowledge to give their students an offer, based on their own experience. Most technical schools do, however, mention quality in a few words in their courses as an "important word in our time".

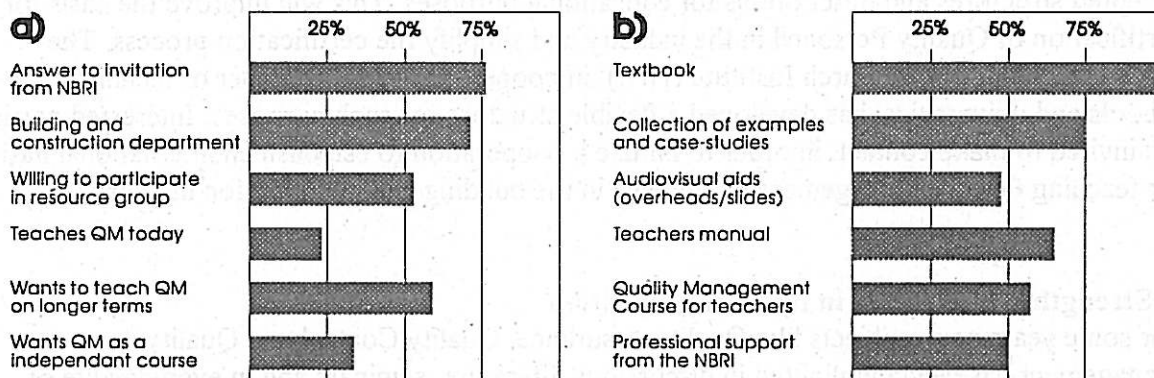
The main reasons for this are:

- The teachers in general have not enough knowledge of modern Quality Management to give a adequate and systematic presentation of the main subjects within Quality Management.
- There is very little room for new subjects on the time-table of the technical schools. The main teaching effort in technical schools is still focused on pure technical and mathematical subjects.
- Lack of a general textbook, covering the basic needs of different sectors of the building industry like architects, engineering, construction business, building material factories made it very difficult for teachers to "get started" teaching Quality Management. All previous books in this field is either too voluminous or too much focused on statistical methods or other specialities within Quality Management.

Throughout the 80s the Norwegian Building Research Institute has built up a substantial base of experience and knowledge on Quality Management [1]. The NBI has developed a general Quality System covering the basic needs of all participants in the building process. The structure of the system has advanced to a international Quality System Matrix and is close to being accepted as standard in several countries. The "Five step model" is important in the work of NBI to establish a Quality System in the building and construction company. This implementation plan offers great pedagogic advantages, due to its simplicity.

It is the policy of the institute, that its experience should be applied to strenghten the building industry by offering consultancy services to companies in the industry, and by contributing to the improvement of technical education for the building and construction industry.

The Norwegian Building Research Institute took the first steps to attain this in 1992 with an inquiry to the Norwegian Institute of Technology at the University of Trondheim, all engineering and technical postgraduate colleges and the three biggest technical collages in Norway, teaching engineering students in building and construction. The purpose was to survey the plans for introducing a Quality Management course, and what kind of pedagogic support is needed to achieve this. The results of the inquiry are shown in fig. 1.



**Fig. 1 Result of the inquiry.**

a) Interest and possibility to include Quality Management in the teaching program (percentage of invitations).

b) Priority of pedagogic and professional help to establish teaching of Quality Management in technical education for the building industry (percentage of answers).

A total of 21 teaching institutes were contacted. Within 17 answers, only one was negative. The negative respondent was a school not teaching building or construction subjects. None of the Building and construction departments offered Quality Management as a independant course at the time of the inquiry.

Based on the inquiry the Norwegian Building Research Institute decided to initiate a process towards better support for teachers of Quality Management courses.

## 2. Cooperation between different levels in education

The Norwegian Building Research Institute decided to develop a textbook in cooperation with experienced teachers and resource persons from five different schools on three different levels of the norwegian educational system. The main task of the resource group was to perform Quality Assurance on the pedagogic level of the textbook. In addition, the teachers in the group shared their experience and ideas on Quality Management and how to improve the teaching of the subject.

The prototype of a new textbook was completed in August 1992 and implemented in practical teaching in the cooperating schools. A lot of experience and good ideas for changes and improvement of the textbook were gained.

The reason for including all three levels of the educational system, is that Quality Management is equally important in all of them. However, the basic level of secondary education was excluded because the ambition of the textbook was to cover the needs on the academic levels beyond skilled workers in production. On the basic level, the needs are different and difficult to combine with the engineering levels. All the cooperating levels had about the same starting point in the process of establishing a good teaching arrangement for the students in the subject of Quality Management.

There was no important conflicts in needs or priorities within the resource group or between the different levels of schools. One important ambition was to make the structure of the textbook general and open in order to give the teachers in different schools the opportunity to adapt their own priorities in choice of subjects and examples.

The cooperation was organized as an informal resource group and operated by telephone contact and letters. In addition the group met twice. The work was actively supported by The Engineering Education Council of Norway and The Norwegian Association of General Contractors in terms of financial support and cooperation. The schools financed their own participation in terms of spent time and travel cost.

In 1993 the official version of the textbook was introduced and is now in common use in schools at all the three levels. Today, Quality Management is still not an independent course in most of the schools. Quality Management is integrated in other courses, mainly together with subjects like project management, economy or engineering and fills from 6 to 20 hours of teaching. In addition, the students solve individual and group problems and write reports within Quality Management. The textbook is also used in a lot of condensed courses in Quality Management for professionals from the building and construction industry.

### **3. Structure of the textbook**

The structure of the textbook [2] was formed as a framework for the teaching of Quality Management. Main topics are described in nine chapters and comprise a basic course of one semester. The book has a total of only 107 pages and does not cover details of all possible interesting topics and problems within Quality Management. It was never meant to do so.

Chapter 1: "Quality - a key to success".

This chapter sums up and illustrates the main arguments why Quality Management is a very important and necessary investment for the future of any company. This chapter is intended to motivate students and teachers, giving them the necessary backing to put a great effort in Quality Management as a part of the technical education.

Chapter 2: "Development of Quality Management - an international perspective".

The chapter gives an overview of the international management trends during the last century and towards the year 2000. A brief description of the situation in the building and construction industry is included. The description focuses on differences between sectors of the industry. This chapter aims to give the students a broader perspective as background for understanding Quality Management, including the present trends seen in professional magazines and articles.

### Chapter 3: "Quality Control and Improvement processes".

The best way to face the future is implementing a successful improvement process, motivated by internal needs in the company. This chapter covers the most important definitions as well as the basic conditions for a successful improvement process in a building and construction company. Experience from international experts on Quality Management is presented, together with additional experiences from the Norwegian Building Research Institute and the teachers involved in developing the textbook. From a pedagogic view, this chapter covers the most important topics, and is for that reason the most important single chapter.

### Chapter 4: "The Quality System".

The chapter gives basic knowledge on how the Quality System of the construction and building company should be structured. The different elements and main topics of the system are described. The international standard ISO 9004 (EN 29004) "Quality Management and Quality System Elements - Guidelines" is described to give a general overview. The main object is not to focus on the paperworks, but to point out important properties of the Quality System as a powerful tool for improvement. It is a pedagogic challenge to avoid over-focusing on the Quality System as documentation and a customers demand, as seen in some parts of the industry.

### Chapter 5: "External demands of Quality Assurance".

An overview of different kinds of demands for documentation and Quality Assurance in the industry is given. Requirements from the government and customers are discussed. Both different laws, technical standards, specifications, demands of competence and certification of personell is mentioned. The international standards ISO 9001-9003 (EN 29001-29003) is also covered, and the role of these standards in the future of the building industry is discussed. The main object is to point out the reason for all kinds of demands and how they are part of the basis for good quality. A main point is the discussion on wich demands should be used to optimize the total process of building and construction.

### Chapter 6: "Quality Control in projects".

A brief overview on a general process through all phases of a project is presented. The description is limited because the details will differ from one level of teaching to another. This made this chapter the most difficult to develop. In stead of many details connected with the different project phases, we have covered Quality in the light of general Project Management and Organization. An effort is made to describe Quality Plans, Inspection and Handling of nonconformity. To give the book a more practical touch, ten examples of quality problems from different real-life projects are included. Each teacher is intended to form his own presentation around the framework given in this chapter

### Chapter 7: "Analysis and Quality Cost".

The chapter covers a wide range of simple methods, practical and helpful in the improvement process, in group work and analysing Quality Cost. These tools covers the first basic needs in motivating and developing a improvement process in the building and construction company. Teachers may naturally choose to focus on other methods than the ones presented in the textbook. The chapter also gives a brief summary of research results, illustrating the influence of Quality Cost on the economic results of the company. This motivates why it is a favorable long-term investment to use resources in the improvement process and in building a Quality System.

#### Chapter 8: "Quality Audits".

To make the Quality System helpful in the improvement process, it has to be continuously developed. After the first phases where an improvement process and a Quality System is established, Quality Audits will be one of the most important tools in the improvement process. The chapter also briefly covers certification of Quality Systems and Products. The chapter is aimed at giving the student knowledge and motivation to participate in the auditing process and improvement of the company systems, without fear of the auditing team as a police-force looking for "criminals" in the company system.

#### Chapter 9: "Internal Control".

Improving the staff health and safety, and protecting the environment are vital parts of Quality Management in construction and building companies. Laws and regulations are presented, and the effect of investments in this field on the company management, organizing and economy is discussed. The goal of this chapter is to give the student an over-all view, complete with the whole company and all aspects of its activities present, in the light of modern Quality Management.

The text-book also includes a glossary with the most important definitions, according to international and Norwegian standards.

### **4. A flexible solution**

The textbook offers the teacher freedom to select which topics should be focused in his teaching. Missing details can be supplied on individual basis. The rest of the book could easily be read by the students for a brief overview. In fact the book is also formed to work as object to self-studies and could easily fit to distance learning and correspondance courses. This is one of the important characteristics of the chosen lay-out.

The book structures the basic knowledge and the most important ideas and topics within Quality Management. The basic fields which all students should know is covered in the textbook. Each school and teacher can choose to focus on topics within the book or complementary sources to fit the actual needs of the school, or to the students needs and priorities. This way the textbook is applicable to architect- or civil engineering students at the university level on one hand, and technician-students in technical colleges on the other hand.

The courses will be very different from one school to another, even if the same textbook is used. There will also be great differences between courses for different sectors within civil engineering, like production of building materials, construction, engineering, planning and management. The time spent on Quality Management in courses where the textbook is used, is also very flexible. Different teachers use it in different ways.

The book has proved to be a useful handbook for engineers and other professionals in the building and construction industry. The book is used in postgraduate courses offered by the Norwegian Building Research Institute and the Norwegian Institute of Technology.

### **5. Further development**

Today, the experience of the Norwegian Building Research Institute is combined with experience and knowledge from other countries through international cooperation. This has resulted in adaption and use of the norwegian Quality Management System in the Netherlands,

Finland, Iceland and other countries. Based on this cooperative effort, an international course is also developed.

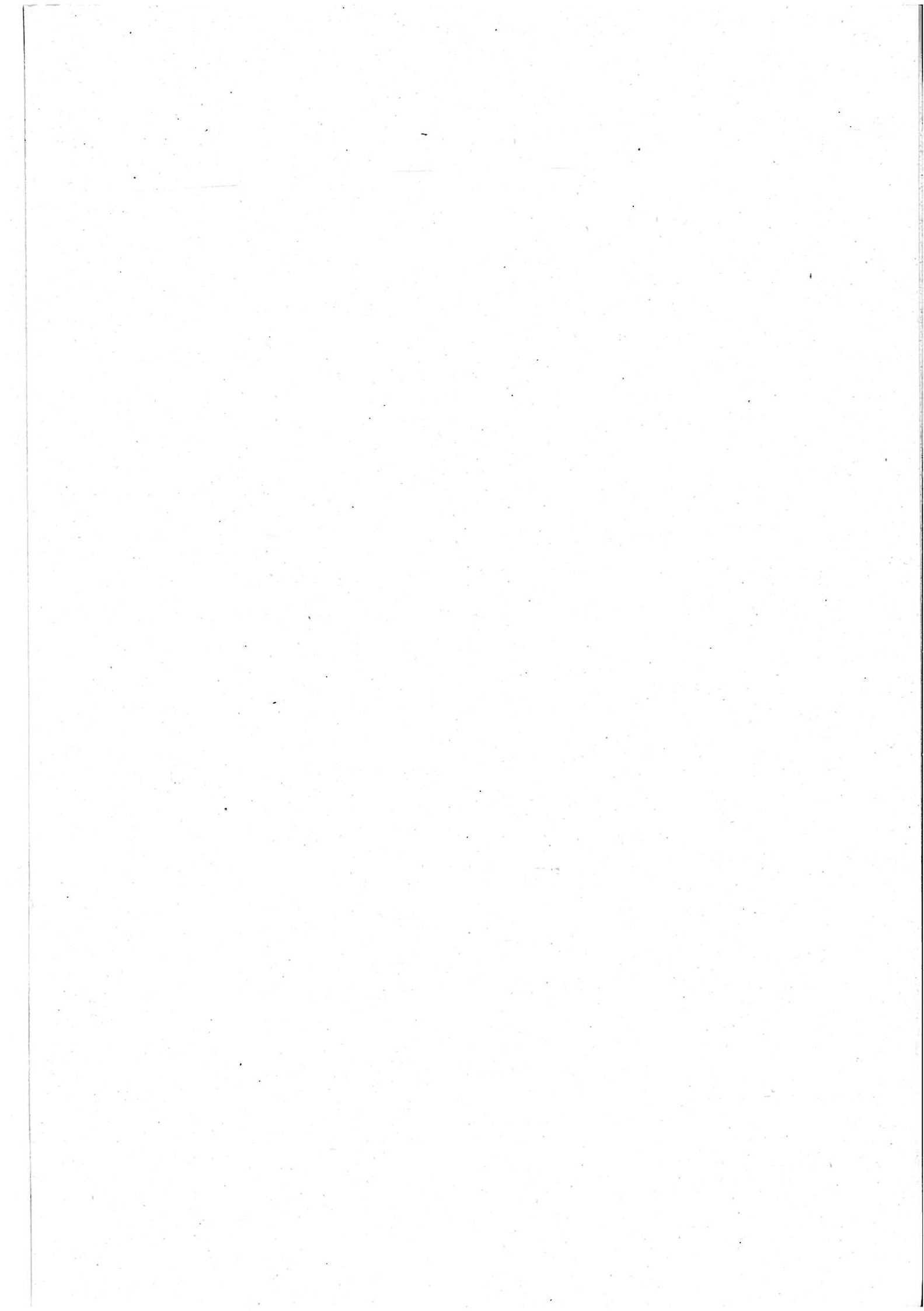
A parallel development in different European countries is increasingly important, since the market for building and construction services is opened through international agreements. To form a rational basis for international cooperation between companies in different countries, the Quality Systems and the educational background of key personell should be comparable. The international standards ISO 9000-9004 (EN 29000-29004) are important, since the definitions and important system elements are accepted by most European countries.

Further development of the international cooperation to improve Quality Management in the building and construction industry, should include development of internationally accepted structures and descriptions for educational purposes. This will improve the basis for certification of Quality Personel in the industry and simplify the certification process.

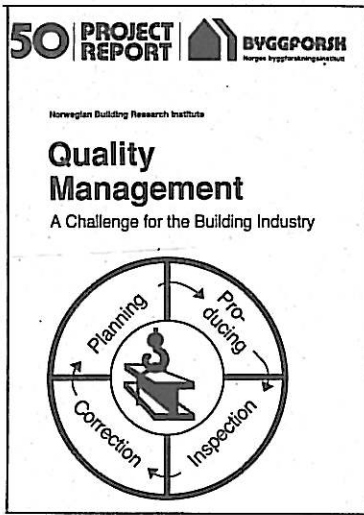
The Norwegian Building Research Institute hereby invite interested parties to make contact, in order to initiate a cooperation to reach this goal (adr. Norwegian Building Research Institute, P.O.Box 123 Blindern, N-03 14 OSLO, NORWAY).

## REFERENCES

- [1] Ralph Hansen and Odd Sjøholt, **Quality Management - A challenge for the Building Industry**, Project report 50, Norwegian Building Research Institute, Oslo, NOR, 1989, 43 pages in English.
- [2] Klakegg, Ole Jonny, **Kvalitet i bygg og anlegg**, Håndbok 43, Byggforsk, Oslo, NOR, 1993, 107 pages in Norwegian.





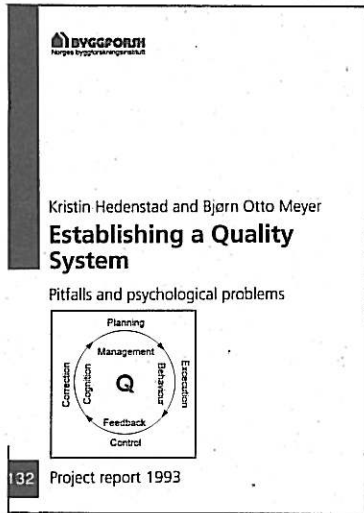


**Project Report 50**

**Quality Management - A challenge for the Building Industry**

This report is based mainly on the results and practical experience gained from quality management projects that the Norwegian Building Research Institute has been involved in. The basic elements of the *Quality Management System - QMS* - is described. This includes a system structure, a five step implementation process and a company group cooperation model.

Norwegian Building Research Institute 1989.  
Price NOK 195,-

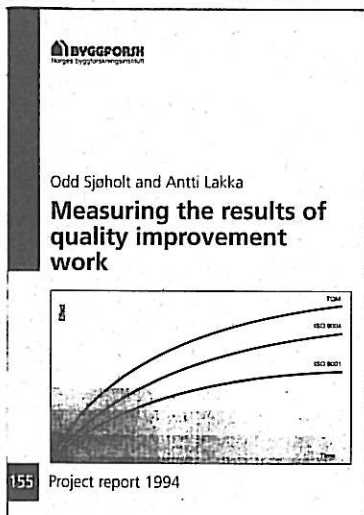


**Project Report 132**

**Establishing a Quality System - Pitfalls and Psychological Problems**

This project report is a presentation of some of the findings in a thesis made by the psychologists Kristin Hedenstad and Bjørn Otto Meyer, on the psychological aspects of introducing and establishing improvements within a company. The study was a useful evaluation of the *Quality Managements System - QMS* - emphasising the importance of a genuine living quality system opposed to "paper work systems".

Norwegian Building Research Institute 1993.  
Price NOK 195,-



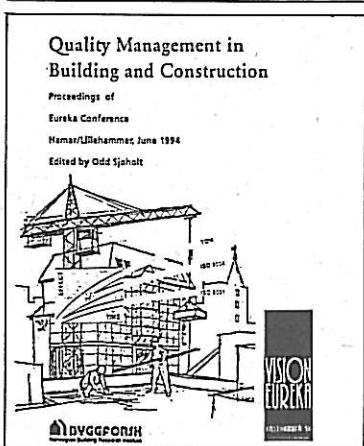
**Project Report 155**

**Measuring the Results of Quality Improvement Work**

The report is a result of a collaboration between Nordic researchers and representatives of 12 Nordic contractors. It is written by Odd Sjøholt and Antti Lakka.

The report contains examples on measuring nonconformancies and waste, including results of measurements from a selection of companies. The report also discusses experiences with internal assessments based on Quality Award Criteria.

Norwegian Building Research Institute 1994.  
Price NOK 195,-



**Proceedings from the EUREKA conference Hamar/Lillehammer 1994**

**Quality Management in Building and Construction**

About 160 persons from 30 countries participated in the three days conference for building and construction. The conference has been widely bespoken as a great success. The proceedings in particular were highly appreciated.

The conference proceedings are printed as a book of 520 pages, containing 80 articles.

Norwegian Building Research Institute 1994  
Price NOK 525,-

For sale from

Norwegian Building Research Institute, P.O.Box 123 Blindern, N-0314 OSLO, Norway.  
Telephone +47 22 96 55 00, Telefax +47 22 96 55 08 (Sales department)