



COQ IMPLEMENTATION ~ the Swedish Experience and its Lessons for Singapore Organisations

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INTRODUCTION

In 1993 a research project on cost of quality was started in Sweden. The project was initiated and guided by Lennart Sandholm, former Adjunct Professor in Quality at the Royal Institute of Technology. The aim of the project was to develop an effective method of measuring cost of poor quality. The project was carried out at the Royal Institute of Technology by Lars Sörqvist and resulted in a doctor's thesis prepared by him. The thesis was publicly defended in March 1998. Opponent was Dr. A. Blanton Godfrey, Chairman and CEO of Juran Institute, USA.

The research project is based on a qualitative method of approach in which available information and experiences are first gathered and compiled. Then a theoretical model is designed, which is finally assessed and developed by means of field studies in selected companies.

The study can be divided into four main stages. Firstly, a preparatory study was made of the

approaches traditionally used to measure poor quality costs. This work was based on studies of the literature and interviews with representatives of a large number of companies and organisations, all with extensive experience of earlier measurements of poor quality cost. Parallel to this work, studies were also made of internal documentation and the results obtained from earlier poor quality cost measurements made at several of the companies. After this came the basic building of the model upon which the work was based. Finally an evaluation survey was made, in which this model was tested and further developed by means of case studies under actual conditions at companies in both the manufacturing and service sectors. This work resulted in the final model, presented in the thesis. In total more than 30 Swedish companies were involved in the studies.

FOCUS ON COST OF POOR QUALITY!

The traditional breakdown of cost of quality is into prevention cost, appraisal cost, internal failure cost and external failure cost. This means in fact that cost of quality includes basically two cost categories: the costs of attaining quality and the costs of poor quality. There are fundamental differences between these two categories. The first category includes costs adding value to the business, while the second one includes costs adding no value to the business. The activities generating costs of the first category are planned, which means these costs are controlled. Costs of the second category are very often due to deficiencies in the way the work is carried out in the company, which means a real loss to the company. The focus on cost reduction must consequently be on the reduction of the cost of poor quality.

Cost of poor quality is defined as *the total losses caused by that the products (goods and services) and processes are not being perfect.*

There are five levels of costs of poor quality: traditional poor quality costs, hidden poor quality costs, lost income, customer's costs and socioeconomic costs. Costs of the first level are measured using existing poor quality cost systems,

primarily in manufacturing organisations, but not so often in service organisations. Information on the costs of the other four levels is meagre. These costs are probably considerable.

WHY SHOULD WE HAVE INFORMATION ON COST OF POOR QUALITY?

There are three reasons for having data on cost of poor quality:

- Influencing attitudes of top management.

The language used by top management is money. Data on cost of poor quality makes top management realise the impact quality has on profit.

- Demonstrating and giving priorities to problem areas.

Improvement opportunities are evaluated relatively by studying the cost impact on various goods, services and processes.

- Following up quality improvement work. Unfavourable trends are detected and measures are taken.

This means that there is only one main reason for having information on cost of poor quality: *cost reduction by improving quality.*

EXPERIENCES IN MEASURING COST OF POOR QUALITY

In the beginning of the research project, a study of 36 companies in Sweden was made in order to find out the experiences of these companies in measuring cost of poor quality. Both manufacturing and service companies were studied. Among the companies were Ericsson, IBM, IKEA, SAAB, Scania, Sandvik, Sweden Post, Telia and Volvo.

The study showed:

- Most of the cost elements measured are related to production.
- The measuring methods used often lack precision. Measuring problems are experienced.

- Current financial accounting systems are not suitable for measuring poor quality costs.
- Many companies focus excessively on the use of measuring systems to gather information.
- The use of the data obtained is often not clear. The data is not used properly.
- Employees experience discomfort and fear on account of the faults and problems which have arisen. Management often questions the relevance of the information.
- Problems often arise as a result of uncertainty regarding which costs constitute poor quality costs and the account to be charged.

MEASURING COST OF POOR QUALITY

There are two general methods for measuring the cost of poor quality in an organisation. Either a measuring system is built up to enable employees to report the quality failures which occur, or an assessment is performed, in which a team analyses the business as a means of identifying poor quality costs. By tradition, most companies have endeavoured to introduce permanent measuring systems often without realising that there are alternatives and without questioning their choice. Experience shows that company-wide measuring systems are very difficult to use successfully, as they require very far-reaching changes in attitudes and corporate culture. The time required can also vary widely, as a measuring system may take several years to build up, while a study can usually be carried out in a few weeks. Below we have presented a model developed by Lars Sörqvist, in collaboration with Swedish business, which demonstrates how both methods can be used. In many cases it may be particularly useful to employ a combination of the two methods.

Assessment

An assessment to map the quality status becomes

simple and systematic if the analysis is made sequentially along the processes in the business. By starting the study with external customers and moving back to external suppliers, valuable information can be obtained from later stages in the process on problems in earlier stages. Such studies consist of four phases, as shown in figure 1.

Phase 1: Preparation. Before the assessment starts the project must obtain necessary support of top management. This can be obtained by informing management at a seminar. The scope of the assessment and the breakdown level required are then established. This decision represents a balance between the quality of the study's result and the time taken. The project team, which is to carry out the assessment, is appointed. It should be cross-functional in character, so that the team is well informed about all aspects of the business. Employees from the financial and quality functions can make a valuable contribution. The team is then given training to ensure its members have the necessary skills and understanding.

Phase 2: Planning. The purpose of the assessment is stated in detail. A timetable for the work is drawn up, giving clear final and subsidiary targets. The necessary resources are allocated. The

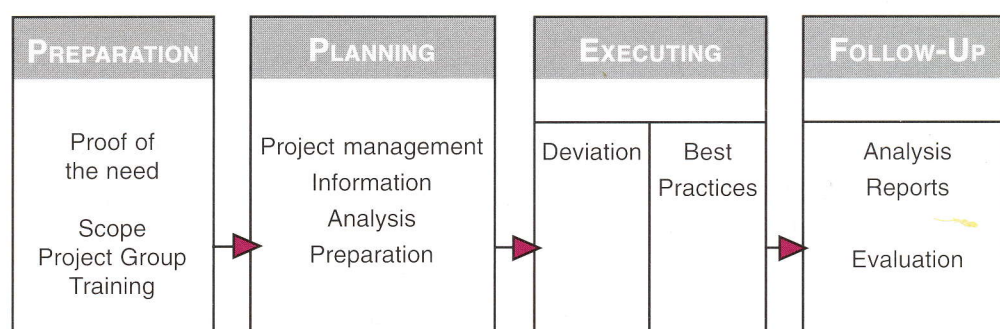


Figure 1. Method for mapping the costs of poor quality.

methods for the work are established. Employees are informed about the assessment. An inventory is made of what secondary data are available. Brainstorming is used to produce a list of potential items of cost of poor quality in the business.

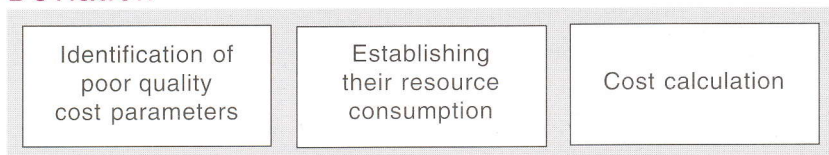
Phase 3: Executing. The work can be carried out in accordance with two principles, as shown in

figure 2. According to the first principle, the existing faults and failures are listed, their frequency is determined and their costs are estimated. This method is called deviation analysis. The second principle involves determining the best possible way of running the business and then comparing this with the current situation to establish the cost of poor quality. This method is called best practise analysis. The latter method is usually more complicated to use, but it has a better chance of identifying problems of a chronic nature.

data collection phase, where questions are asked about existing problems, faults and failures and estimates of their frequency. Another way of obtaining this information is to carry out a survey in the form of a measurement of limited duration. This can be carried out using a simple report form, on which employees can make daily notes of the faults and problems that occur. Data can also be collected by time studies or process analyses.

In a *best practise analysis*, the best practise can be established by making a theoretical analysis of

Deviation



Best Practise Analysis

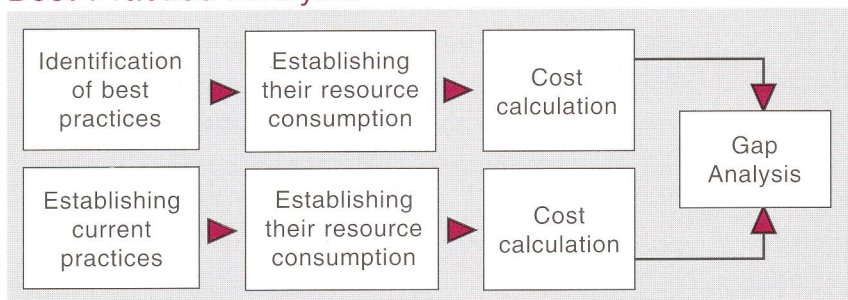


Figure 2. Deviation analysis and best practise analysis.

The collection of data for the *deviation analysis* begins by collecting existing information from the accounting system, the measuring and reporting systems, and other available documentation. Information can also be obtained with relative ease by identifying individuals and units, which are concerned wholly or partly with poor quality costs. They could include, for instance, inspectors, adjusters and complaints departments.

When the documented and readily available data have been collected, the study continues with interviews of the personnel concerned. The interviews can vary in scope, from general interviews with top management to detailed interviews at a lower level. These interviews can take the form of personal interviews, group interviews or questionnaires. A good way of beginning the interview is with an information and motivation phase, in which the necessary background is provided. This is followed by the

the process, empirical studies and comparisons or by a combination of both methods. A theoretical analysis can be made by surveying and studying the process or by simulations. A empirical study can be carried out in the form of interviews, where employees make assessments of how their work would be done under ideal conditions, in the form of time and work studies, or in the form of benchmarking in which different situations are compared and the most suitable methods are identified. Benchmarking can be done internally

at various levels, from individual to company level, or externally in relation to other companies.

Phase 4: Follow-up. Analysis of the data obtained. Proposals for improvement projects are established. Reports are drawn up for management and the units concerned. The assessment is evaluated and proposals drawn up for improving its procedures.

Measuring system

Measuring systems can be useful for monitoring the quality level over a period of time. Here it is inadvisable, however, to attempt to introduce a measuring system which is intended to reflect the entire business. This type of work is complicated and a very high level of maturity is required among both management and personnel. Many have failed in this. Measuring systems should instead be focused on a few costs or a selected area with

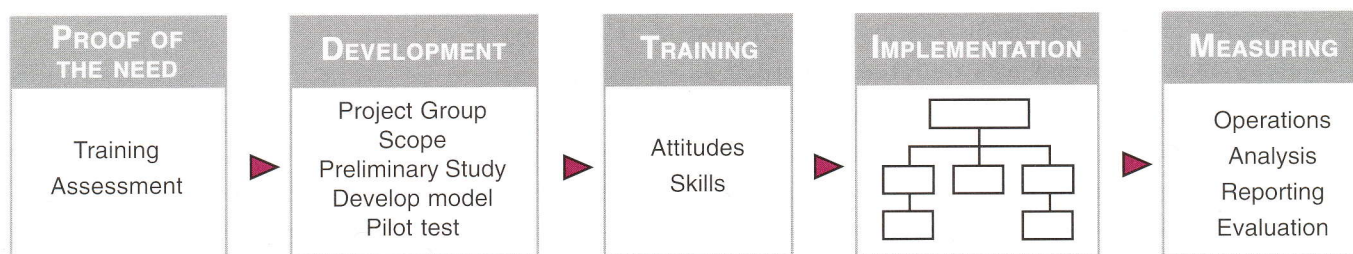


Figure 3. Development of system for measuring the cost of poor quality.

readily available information, for instance, production in a manufacturing company. If a well-designed measuring system is used, the measured data will be accurate. The work of developing a measuring system can be divided up into **five** phases, as shown in figure 3.

Phase 1: Proof of the need. Top management must first decide on whether a measuring system should be introduced. The reason for this is that it is essential for the functioning of the system that management gives it priority and constantly asks for and uses the information it provides. Developing this support may require training of top management. It is also useful to present the results of earlier assessments of the costs of poor quality.

Phase 2: Development. This work is most appropriately done in the form of a project. A cross-functional group is formed. The scope of the measuring system is established. It is important not to have too high ambitions, as this can lead to difficulties. It is often a good idea to begin on a small scale and then expand. Available sources of information (for instance, accounting and other measuring systems) are studied. A model for a measuring system is then created. This could be an integrated component of an already existing system or a separate system. The former is often preferable. Detailed parameters for the cost of poor quality are established. Procedures for reporting are developed. A comprehensive pilot test should be carried out to adapt the system to the conditions of the business. During the development stage, it is important that as many employees as possible feel involved in the work.

Phase 3: Training. Before the system can be implemented, all users need to be given training. The object of the training is to impart skills in the

use of the measuring system and to change the attitudes of employees. This change of attitude has proved to be essential to the functioning of the system.

Phase 4: Implementation. The measuring system is not implemented until the pilot tests show positive results and the skills and attitudes of the employees are judged to be adequate. If there are any doubts, then implementation should be delayed and development and training should continue, as a failure always makes further attempts more difficult. When the measuring system has been introduced and is functioning, responsibility is transferred to a line function, which could appropriately be the financial function.

Phase 5: Measurement. Procedures should be established and responsibility decided for the supervision and maintenance of the measuring system, analysis of the data obtained, design and distribution of reports, and evaluation and improvement of the system.

CASE STUDIES

Company A

Company A is a large Swedish manufacturing enterprise with some 20,000 employees and an annual turnover of approximately 30 billion SEK. Its products are sold in numerous countries and it has production facilities in many locations in many different countries. The company now has high market shares, which are steadily being raised, on most of its global markets.

A unit which designs and manufactures customised models of the company's products was chosen as the area for the assessment. This unit

contains features of all the company's different areas of activity and was therefore regarded as particularly suitable for the assessment. It was decided that the scope of the assessment would cover all stages in the flow from identifying customer needs to use by the customer.

The first stage in the assessment was to analyse the information already available in the system. Then interviews were arranged with selected individuals who explained their current problems and deficiencies, and estimated the extent.

The poor quality costs were determined by estimating minimum and maximum deviations from the registered estimates. The result was that the poor quality costs measured corresponded to 11 per cent and 13 per cent respectively of the direct costs of the process. The limited variation between the minimum and the maximum estimates was interpreted to mean that the accuracy of the assessment was relatively good.

An action plan was drawn up on the basis of the result of the analysis of poor quality costs. The causes of the major types of cost were identified and goals for corrective measures were drawn up. Particular priority was given to those factors which could be applied to a new main product recently introduced by the company and to factors which were of particular importance in the eyes of customers. Finally, the measures were taken and followed up.

In an evaluation of the methodology used for this assessment of poor quality costs it was found that the technique was easy to use. The assessors were generally well received in the organisation and the employees concerned regarded them as more of a support than as a threat. The assessment also helped to improve the level of knowledge in the organisation with regard to its own activities in general and to quality activities in particular. The capability of the method to generate valuable results for a small input in terms of man-hours also attracted interest. The total time spent on the assessment was estimated at around 150 man-hours.

Company B

Company B is a process industry. The company is part of a Swedish group with approximately 10,000 employees world-wide. Its products are sold to many countries around the world and the company enjoys a very good reputation. The profitability of the business is very good. The company in question has approximately 2,000 employees and annual sales of some three billion kronor.

The various processes in the business, from customer to supplier, were analysed as a means of determining the company's poor quality costs. The work of mapping the poor quality costs took the form of interviews with responsible personnel in the processes. The extent of the non-conformities and production disturbances which were discovered was established using existing data obtained from the information system and from estimates made by the interviewees. The result was then priced by applying the relevant standard rates and hourly costs.

The assessment identified total internal poor quality costs of some 400 million SEK, i.e., around 12 per cent of total turnover. The technique used for assessing poor quality costs was found to be very useful. It provided important information about the business for a relatively modest work input. All in all, around three man-weeks were used for the work.

Company C

Company C is a service enterprise with annual sales just over 30 billion SEK and more than 20,000 employees. Not so long ago the company was regarded as one of the best in its industry, but in recent years serious problems with both quality and profitability have arisen.

The study would concentrate on certain selected areas which were typical of the business. The sales process, the execution process, the front office personnel, returns, lost goods, complaints and unserved customers were selected.

The poor quality costs measured correspond in total to some 10 per cent of the total turnover of the business. In this context it should be taken into account that several areas of the business were not analysed and that many of the external losses were not included. The actual cost of poor quality is probably therefore far higher than that.

Experience from the use of the assessment technique was very encouraging. It was considered that mapping costs in this way is the only possible method of approach as the personnel in a service organisation are not in the habit of reporting information of this type. The assessments prompted the provision of useful information about the business for a modest input in terms of man-hours. The project lasted for about four months and the total amount of work is estimated at approximately one man-month. To this may be added the work delegated within the organisation.

Company D

Company D manufactures electronic products in the form of complex technical systems. Its customers are other manufacturing enterprises. The company has 1,000 employees and annual sales of approximately one billion SEK.

The most likely poor quality costs were identified by means of interviews and brainstorming sessions with key individuals drawn from the whole business. The appraisal costs were established by means of estimates made by the relevant area managers and discussions with the financial control department. Many of these costs could also be obtained from the financial accounting system. External quality failure costs were restricted to the cost of complaints, repairs, penalties and guarantees which were included in the financial accounting system. The internal failure costs could also be obtained to a certain extent from the financial accounting system and other internal reports, in the cost of scrap, breakdowns and adjustments, for example. In order to add depth to

this information the costs of reworking, additional work and waiting time were also measured for a limited period of time.

Extrapolation of the results from the three selected areas indicated that the poor quality costs for the business as a whole amounted to 66 million SEK, i.e., approximately 7 per cent of the company's turnover. When this figure was adjusted for internal failure costs in the form of scrap, breakdowns, rework and adjustments, and for external failure costs and appraisal costs as above, the total poor quality costs were estimated to represent some 16 per cent of the annual turnover.

Company E

The case studies show that assessments provide useful results for a relatively modest work input. The method of approach is favourably received among both the members of the project groups and other employees.

Poor quality costs in the region of 9-16 per cent of total turnover of various businesses have been measured. Despite this, a large proportion of the actual poor quality costs are omitted as they cannot be measured.

The results have aroused considerable interest among the management groups at the companies in question. All the companies have moved on to action plans and further measurement of poor quality costs. In some cases even starting reductions in poor quality costs have been achieved.

Learned from the case studies

What the case studies show can be summarised as follows:

- The case studies show that assessments provide useful results for a relatively modest work input.

- This method of approach is favourably received among both the members of the project groups and other employees.
- Poor quality costs in the magnitude of 9-16 per cent of total turnover of various businesses have been measured. Despite this, a large proportion of the actual poor quality costs are not included as they cannot be measured.
- The results have created considerable interest among top management. All the companies have started action plans and further measurement of poor quality costs.
- In some cases work to reduce poor quality costs have started.

REDUCING COST OF POOR QUALITY

Most companies underestimate the importance of improvements. This is because their top managers have not achieved the understanding and maturity required in this field. Consequently, quality activities are not given the correct priorities. If it is kept in mind that poor quality costs correspond to a large proportion of the total turnover of the business, even though market effects are not included, it becomes immediately apparent that the improvement investments which are justified can be immense.

Historically one finds that companies are often driven into an absolutely critical crisis before high priority being given by management to quality improvement activities. To achieve this level of maturity without being exposed to a serious crisis is a process which takes a long time.

A change of culture in the quality field can be accelerated if some of the vast economic potential which can be attained as a result of effective improvement activities can be demonstrated. This can be done by assessing poor quality costs, which makes it possible to describe improvement activities in such financial terms as return on investment, pay-off times, etc.

However, often this is not enough to generate the necessary conviction among top management.

To reach that point, what is required is to be able to demonstrate, repeatedly, the financial benefits already achieved in their business by means of successful improvement activities. These successes can then, in the long-range, lead to a total change of attitude, and improving quality then naturally becomes a high priority part of the work. In the ideal situation, quality activities can be likened to a positive spiral, where achieved successes stimulate further interest in improvements among both management and personnel, investments in quality are steadily increased, and inertia and resistance are steadily reduced. This in turn leads to even higher financial benefits, etc.

During the early stages, internal quality activities should focus mainly on bringing about this change in corporate culture. In many cases this is ignored, and companies go straight to methods and applications. The really worthwhile benefits have often failed to materialise.

In order to influence attitudes towards quality it is essential that the work is planned tactically with this as the primary goal. Improvement projects are initially chosen to have the maximum chances of success. Difficult projects requiring substantial resources, however profitable they may be, should be saved until later. Poor quality costs must be measured before and after the improvements so that the financial benefits can be demonstrated. The results are then used actively in internal marketing to strengthen favourable opinions. Attention is drawn to individuals as well as groups whose improvement activities have been particularly successful. Reward systems for both management and personnel are based on the benefits generated by the improvement activities. Quality work thus takes on positive attributes in the eyes of the personnel.

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