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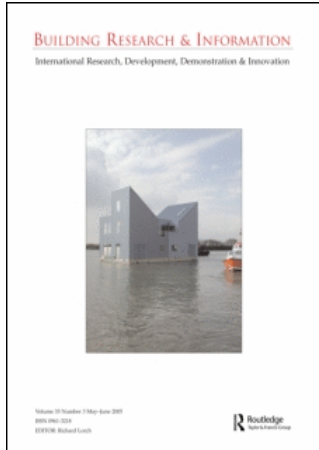
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Do quality systems really make a difference?

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Do quality systems really make a difference?

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The purposes of this study were to ascertain whether Swedish construction companies measure the impact of their quality systems (such as ISO 9000) and, if so, whether the 'balanced scorecard' approach is a useful technique as a measure of performance. The balanced scorecard approach requires each organization to look at itself from four different perspectives to provide a more comprehensive view of organizational performance: the financial perspective, the customer perspective, the process perspective, the innovation and learning perspective. Twelve Swedish construction sector companies (clients, architectural-engineering consultants, contractors) with well-established quality systems were studied. The results indicate two important points. First, the balanced scorecard can be successfully used to measure the performance of quality systems in the construction process. Second, the organization and learning perspective is neglected in the Swedish construction process. The use of the balanced scorecard highlighted the fact that a lack of balance often exists between the four perspectives. While it is tempting to conclude that investments in quality systems increase organizational performance, there is little (if any) evidence that this is the case. Many investments in quality systems appear to be based more on blind faith than on facts. Tools are only valuable if they improve results, there is a need for further understanding the costs and benefits of quality systems in engineering and construction organizations.

Keywords: management systems, balanced scorecard, ISO 9000, quality assessment, organizational performance, Sweden

Les objectifs de cette étude étaient de vérifier comment les sociétés de construction suédoises mesurent l'impact de leurs systèmes de qualité (comme ISO 9000) et, dans ce cas, si l'utilisation de la 'carte de pointage équilibrée' constitue une technique utile pour mesurer ces performances. La méthode de la carte de pointage équilibrée oblige chaque société à procéder à une introspection à partir de quatre points de vue différents afin de fournir une vue globale des performances de l'organisation: perspectives financières, commerciales, au niveau des processus, et du point de vue de l'innovation et de l'apprentissage. Douze sociétés suédoises du secteur de la construction (clients, ingénieurs-conseils architectes et ingénierie, contractants) disposant de systèmes de qualité reconnus ont été examinées. Les résultats font ressortir deux points importants. En premier lieu, la carte de pointage équilibrée peut servir à mesurer les performances des systèmes de qualité dans les processus de construction. En second lieu, les paramètres 'organisation' et 'apprentissage' sont négligés dans le processus de construction suédois. L'utilisation des cartes de pointage équilibrées a mis en lumière le fait qu'il existait souvent un déséquilibre entre ces quatre points de vue. Alors que l'on serait tenté de conclure que les investissements dans des systèmes de qualité augmentent les performances de l'organisation, on dispose de peu, voire d'aucune preuve dans ce sens. De nombreux investissements dans des systèmes de qualité semblent reposer davantage sur une foi aveugle que sur des faits. Les outils n'ont de la valeur que s'ils améliorent les résultats; il faut donc mieux comprendre les coûts et les avantages des systèmes de qualité tels qu'ils existent dans l'ingénierie et la construction.

Mots clés: systèmes de gestion, carte de pointage équilibrée, ISO 9000, évaluation de la qualité, performances de l'organisation, Suède

Introduction

The use of ISO 9000 for quality management is spreading from the manufacturing industry to other sectors such as the construction sector. The overall purpose of introducing ISO 9000 in a company is to increase the performance of the organization. However, there is little evidence linking quality management investments to improvements in organizational performance. Another management tool aimed at controlling organizational performance is 'the balanced scorecard'. Neither method is well understood in the construction industry, but may prove useful in managing such companies at the business unit level.

Research concerning control systems in the construction sector have been traditionally focused on the project level, thus omitting a comprehensive view of the company. This study addresses the issues at the company, or business unit, level.

In this study, the impact of the implementation of ISO 9000 quality management systems in several companies in the construction sector was analysed with a balanced scorecard. The purpose of the study was to improve our understanding of the relationship between quality system implementation and organizational performance at the business unit level.

In ISO 9004-1 (1994) 'Quality Management and Quality System Elements – Part 1: Guidelines', which describes the basic goals in establishing a quality system, the following is stated (Chapter 6.1, Financial Considerations of Quality Systems):

It is important that the effectiveness of a quality system be measured in financial terms. The impact of an effective quality system upon the organization's profit and loss statement can be highly significant, particularly by improvement of operations, resulting in reduced losses due to error and by making a contribution to customer satisfaction.

Such measurement and reporting can provide a means for identifying inefficient activities, and initiating internal improvement activities.

By reporting quality system activities and effectiveness in financial terms, management will receive the results in a common business language from all departments.

Measuring the impact of a quality system solely from a financial perspective may not be sufficient. Traditional financial measures can give misleading signals, encouraging companies to achieve short-term financial results at the expense of long-term objectives. In the manufacturing industry, these problems have been observed in the form of reduced investments and neglected maintenance. One solution to the problem during the second half of the 1990s has been the balanced scorecard (Kaplan and Norton, 1992).

The use of the balanced scorecard in business is well established in large and sophisticated firms. The use of scorecards in an organization is strongly driven by a strategic view of the mission of the organization and the vision of how this will be achieved. A good model of the business and the interrelationships between different activities and functions is essential. The balanced scorecard is a management system which can bring about sustained profitability and breakthrough improvements in critical performance (Newing, 1994). The model integrates long-range strategic plans with short-term measurable objectives (Kaplan, 1994). The scorecard is not a replacement for financial measures, it provides a more comprehensive view of the company in which the *financial perspective* is one of four perspectives. The other perspectives are the *customer perspective*, based on the marketing strategy, the *process perspective*, based on the manufacturing strategy and the *innovation and learning perspective*, which deals with the ability to cope with changing circumstances. Balancing the scorecard implies that these perspectives are afforded approximately equal importance. Furthermore, balancing is also pursued within each perspective. All perspectives consist of approximately three to five different measures, providing a nuanced picture of the company's performance but two to three measures per perspective may provide a more transparent tool for the organization (Nilsson, 1997).

Theoretical review

Quality systems such as ISO 9001 are gradually being implemented in the construction industry, but their purpose is not fully understood at any level of many companies in this sector. Other novel management systems such as the balanced scorecard are also not well understood. Therefore, a brief review of the underlying philosophies is presented.

Quality systems

All of the standards in the International Standards in the ISO 9000 family are generic and independent of any specific industry or economic sector. A quality system can focus on one or several of the following: the input to the process, the process itself, or the output. For instance, the quality of the fruit and vegetable stand in a supermarket is primarily dependent on the input, cold and fresh vegetables and fruits, while the quality of vegetables served with a meal at a restaurant is dependent on the input as well as the production process at the restaurant. Some car manufacturers during the 1970s and 1980s maintained a high quality by monitoring and checking each car before delivery. This output-focused quality system was deemed too costly, and an alternative is ISO 9000, which focuses on the production process. When ISO 9000 is implemented, it controls operations such that they run, not at a maximum quality level, but at a predefined, constant satisfactory level. While a constant level of quality is the essence of ISO 9000, it is also the

major drawback that critics of the system call attention to, i.e. continuous improvements of the production processes are not encouraged. In the next version of ISO 9000, to be released in 2000 this 'bug' should have been removed.

Collectively, the ISO 9000 standards provide guidance for quality management and quality assurance. An effective quality system should be designed to satisfy customer needs and expectations, while serving to protect the organization's interests (ISO 9004-1, 1994). A quality system is a tool for steering and improving the quality of a company's products. Systematic work on quality improvements requires well-planned routines and, in this respect, the standards in the ISO 9000 family serve an important purpose.

The balanced scorecard

During the late 1980s, a group of managers of major US companies gathered together with Professor Robert Kaplan from Harvard Business School (one of the managers was David Norton from a consultancy firm). The objective was to answer the question: are we managing our businesses with suitable tools for long-term prosperity? If not, how should such a tool operate? The answer to the second question is the balanced scorecard.

The balanced scorecard rests on two basic assumptions:

- Running a business is a complex task, so much so that one measure, e.g. return on capital, is not enough to guide anybody in the company. Several indicators are needed, preferably from several perspectives.
- Measuring something is a way of directing attention to it, or put more popularly; what you measure is what you get.

Implementation of the balanced scorecard starts with the company's vision and strategy. Based on the vision and strategy, the same four questions are posed in turn, for each of the four perspectives: financial, customer, process and innovation and learning.

For the *financial* perspective the questions are:

- How will we appear as a company if we reach our *financial* goals?
- What are the key success factors for reaching our *financial* goals?
- What actions have to be taken in order to reach our *financial* goals?
- What is it critical to measure in order to reach our *financial* goals?

For each of the remaining perspective the word *financial* is

substituted for in term: *customer*, *process* and *innovation and learning*.

The balanced scorecard is usually presented in the form of four boxes around a circle, see Figure 1. The perspectives are arranged in three horizontal layers, from top to bottom:

- The past: financial perspective
- The present: process and customer perspectives
- The future: innovation and learning perspective

These layers provide a balanced time horizon, some very short-sighted measures, such as financial measures, and some medium- and long-term measures.

Furthermore, the perspectives are related in a logical manner, as indicated by the arrows. For example in order to achieve financially good results the customers have to be satisfied. How do we keep customers satisfied? The answer is: Through a well-organized internal process and by continuously learning more and upgrading the processes and innovating new products.

In general, the balanced scorecard has been recognized and met with enthusiasm in several industries. Since the mid-1990s, many larger corporations have implemented the balanced scorecard; Ericsson, Atlas Copco and Scandia, to mention a few. Many medium-sized and small companies are presently implementing balanced scorecards.

The primary criticism of the model so far is related to:

- The problems of coordinating information gathering with several IT systems within a company
- Grasping scorecards with many parameters (systems with 20 different measures)
- The four perspectives not being sufficient (common additional perspectives are the employee perspective and the environmental perspective)

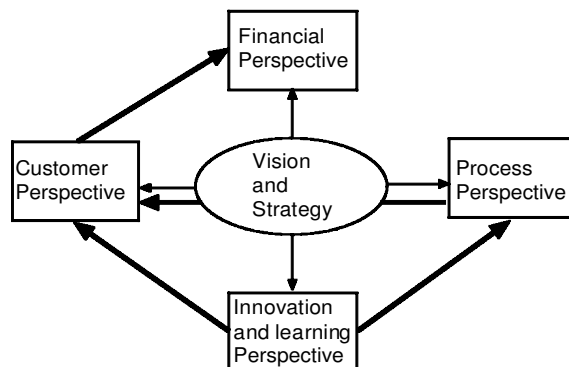


Figure 1 The balanced scorecard strategy and perspective causality

Method

An investigation was carried out of the indicators used by 12 companies in Sweden to monitor the performance of their quality systems with the aim of determining how far these could be constituted as a balanced scorecard. The companies were selected so as to encompass various quality systems used within the construction process, and were judged to be at the forefront of quality assurance with considerable experience of the Swedish construction industry. The criteria for the selection of the companies were:

- They must have had a quality system in the company for at least three years
- The quality system adopted should be equal to the quality standard of ISO 9000
- They should have a genuine interest in quality issues, as evidenced by, e.g. active participation in conferences or debates
- They should be able to show a quality plan for a project

The project was limited to companies in Sweden within the construction sector, and among the companies, four clients, four architectural/engineering-businesses, and four contractors were represented. These categories were judged to represent the construction process, see Figure 2.

The numbers of employees and the sales volumes of the companies are listed in Table 1. Interview data were collected from 27 individuals during 1994. The respondents held positions in the companies such as CEO, regional manager or quality manager. During each interview, notes were taken, so as to capture the most salient details, views and nuances. The material that appeared to be particularly representative and pertinent was then selected for further analysis. The study was not intended to provide answers such as: 27% of the companies did this or that. Such information is of little practical relevance (McCloskey, 1992). Instead, a qualitative methodological approach was considered more apt for this study. Although no quantitative conclusions can be drawn, a deeper understanding of the subject is obtained (Yin, 1981; Eisenhart, 1989). The data from the companies representing the various agents within the construction process were used as the basis for the interpretations arrived at. The interviews involved open questions concerning different aspects of the quality system (Landin, 2000). A qualitative method was em-

Table 1 The size of the companies included in the study

	Number of employees	Sales volume (US\$m)
Clients		
1	7000	1295
2	197	121
3	71	7
4	8249	712
Architectural/Engineering-companies		
5	734	75
6	162	31
7	119	14
8	88	10
Contractors		
9	6891	1163
10	38322	4191
11	2367	195
12	101	20

ployed to classify the data and to gain insight into the problem, see Figure 3. Three investigators were present at each interview. The use of multiple investigators has two key advantages (Eisenhardt, 1989):

- They enhance the creative potential of the study because team members often have complementary insights which add to the richness of the data.
- The convergence of observations from multiple investigators enhances confidence in the findings.

First, the remarks made by the respondents concerning the effects of the quality system they employed and the measurements used, were identified, and listed. The data were divided into different categories depending on the subject. The interview data were then analysed and sorted into different categories or key factors several times until all of the data had been fitted into one of the categories. The key factors were settled when the content in each reached a balance. The results reported here represent a collective analysis of all cases organized according to the key factors emerging from the interviews. Each key factor was evaluated in terms of both its importance and its use in practice as indicated by the respondents. Finally, the key factors that emerged were fitted into the four traditional categories of a balanced scorecard.

Empirical findings

The analysis of the results of the interviews at 12 different companies covering the whole construction process showed the companies to be strongly convinced that it was both beneficial and profitable to employ a quality

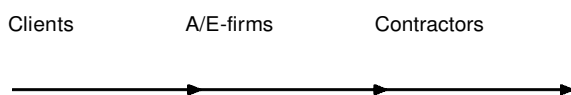


Figure 2 The chosen categories cover the construction process

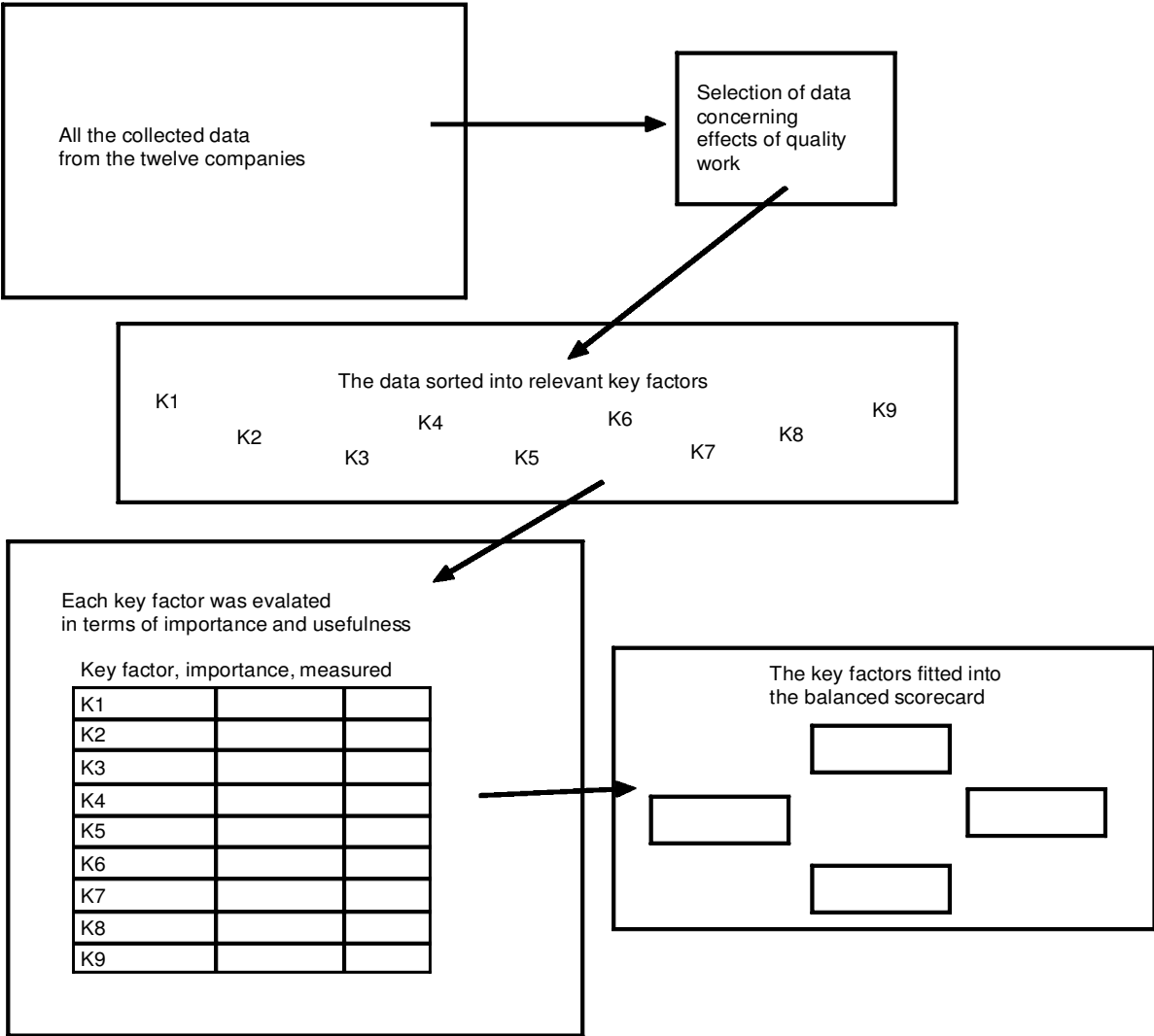


Figure 3 Methodology

system. Reasons of a logical character were commonly referred to in connection with quality techniques.

It was reasoned that taking the correct action from the beginning through conscious and effective planning, and putting this into practice through sound management, would result in lower costs than if erroneous actions had to be corrected. Although this line of reasoning is simple and obvious, and constitutes a strong argument for the use of a quality system, it is by no means certain that a quality system used in real life fulfils the purpose for which it was designed, especially if the effects are not examined properly, and if it fails to be linked with specific goals.

The danger was thus seen that the implementation of a quality system could involve the introduction of routines that had no positive effect on the organization and were simply a waste of time.

The result was nine key factors as follows:

- Time required for quality work
- Control of inspections
- Certification cost
- Customer satisfaction
- ISO 9000 certification
- Zero defects at delivery
- Competitiveness
- Efficiency
- Follow-up

The 'time required for quality work' denotes the time spent by management and the employees on the quality system in the company. 'Control of inspections' means that the inspections that should be made must be planned

so that they are relevant and not too costly in each project. A certificate from a third party costs a certain sum of money, depending on different factors such as the size of the company and line of business, and this is included in the key factor 'certification cost'. However, when a company introduces a quality system according to a standard, one of the goals can be to obtain third-party certification and this is covered in the key factor 'ISO 9000 certification'.

The key factors were fitted into the different perspectives in the balanced scorecard and the results follow.

Financial perspective

Time required for quality work

All the companies set aside time for quality work. None of the companies measured the amount of time, but the data revealed the following. In one of the large companies, four or five people were engaged full time. In one of the medium-sized companies, higher management devoted some 30–40% of their time to quality work. In another of the medium-sized companies two people were engaged in quality matters full-time and every employee underwent a half-day training course in quality techniques. The time required for quality work was judged to be of great importance but was only partly measured.

Control of inspections

Inspections were not viewed as an effective approach to quality management. In seven of the companies, efforts were made to minimize inspections and to concentrate quality efforts to early stages of the process. It was felt that the inspections carried out should be as close as possible to the activity involved. These companies also stressed the point that quality assurance is not the same as making inspections. The respondents noted for example, 'Inspections are costly' and 'Checklists do not help'. Control of inspections was deemed to be of high importance but was not measured.

Certification cost

The direct costs were those connected to certification, i.e. the costs associated with engaging an accredited certification agency. The calculated cost varied between three of the companies from US\$ 100 to 1000 per employee. The rest of the companies merely stated that certification 'is not inexpensive'. Eight of the 12 companies wanted to gain certification. The certification cost was judged to be highly important, but was only partly measured.

Customer perspective

Customer satisfaction

Although the interest in measuring customer satisfaction was evident in six of the 12 companies, only one of the companies made any genuine effort to actually measure it. Customer questionnaires were used and the results

analysed with statistical models. Only a few of the companies had received demands from customers for quality assurance. Nevertheless, all the companies were convinced that the maintenance of a quality system was worthwhile. However, customer satisfaction was judged to be of moderate importance and was seldom measured.

ISO 9000 certification

Certification of the quality system was the goal of eight of the 12 companies. According to the respondents, a quality system should encompass the whole company, not simply a particular section, or a particular department. It appeared that repeated internal auditing of a quality system was something all the companies were basically in favour of. Some of the companies were, on the one hand, suspicious of the certification procedure but, on the other hand, thought that those of their suppliers that had a certificate were better than those who did not. ISO 9000 certification was judged to be highly important and was easily measured.

Zero defects at delivery

Four of the 12 companies had the goal of achieving zero defects. Actually, for one of the companies, this was the only goal mentioned. The reason that this key factor was mentioned could be that it is easy to measure, although none of the companies could verify a trend towards fewer defects. Zero defects at delivery was judged to be of moderate importance and was seldom measured.

Process perspective

Competitiveness

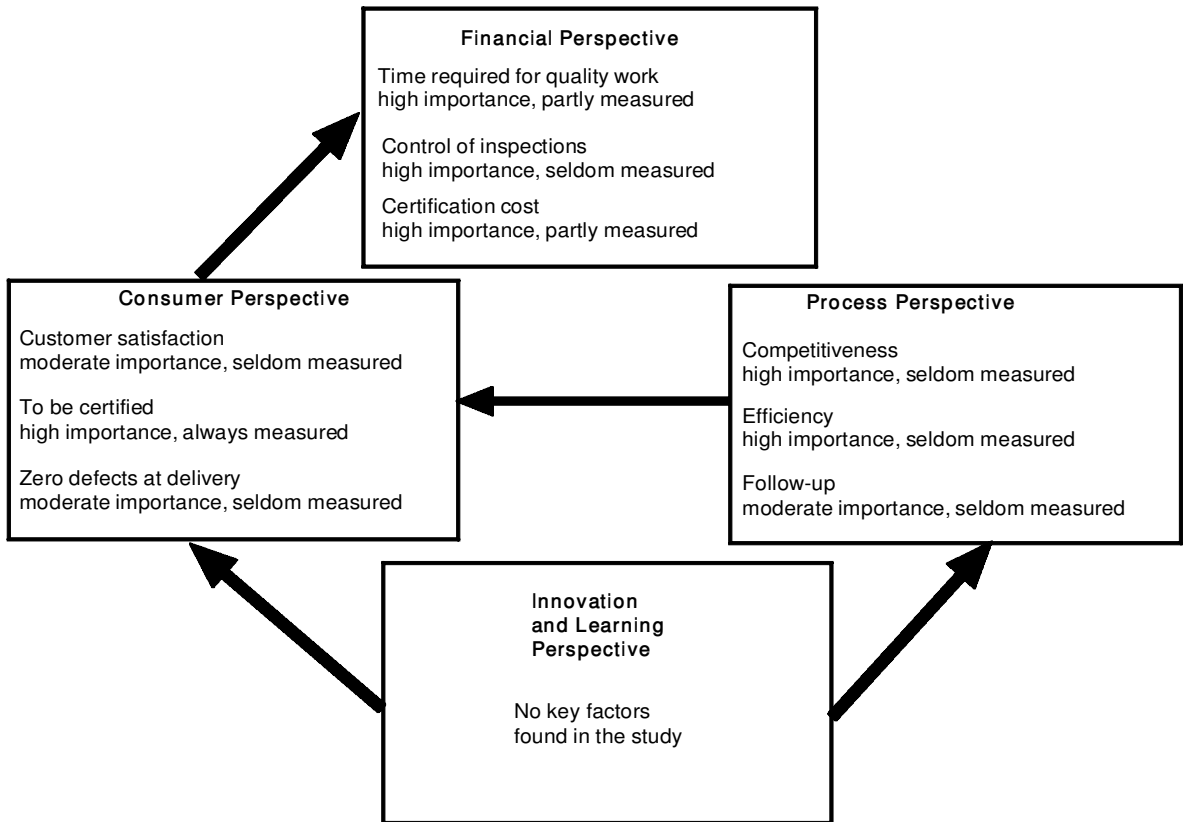
There were high expectations that the implementation of a quality system would increase the company's competitiveness. Although no one provided any concrete example of this, there was a strong belief in the relationship between quality systems and competitiveness. Respondents maintained, for example; 'A quality system makes the product better and cheaper', 'A quality system generates more projects', and 'Quality assurance is a matter of survival'. Competitiveness was judged to be of great importance but was not measured.

Efficiency

Ten of the 12 companies regarded a quality system as being identical to a system aimed at attaining greater efficiency. Although the companies were convinced that work on quality led to an increase in efficiency, none of them had any definite concept of how great the gain was. There was also the fear that bureaucracy would increase and that the routines of a quality system were not completely realistic. Efficiency was judged to be of great importance but was not measured.

Follow-up

None of the companies could identify any concrete strategy for achieving positive effects in connection with



Interpretation of the use of the key factors:

The key factor's judged importance	low	moderate	high
How the key factor was measured	seldom	partly	always

Figure 4 Balanced scorecard with the key factors identified in the study

quality work, although some of the companies expressed the opinion that following-up the effects of a quality system was important. One of the respondents said: ‘You would not put millions into a project (like a quality system) if you did not believe that you get them, and more, back’. The only concrete measures employed were the number of negative assessments found in the final inspection protocol and the time required for correcting errors. Follow-up was judged to be of moderate importance and was not measured.

Innovation and learning

There were no key factors that indicated that the companies found the organization and learning perspective important or that they tried to measure any key factors associated with it. This may partly be explained by the lack of requirement for systematic improvements in the standard.

When the key factors were fitted into the balanced scorecard the results showed the measures used in the

different perspectives. Two main results could be identified:

- The balanced scorecard can be used to measure the performance of quality systems in the construction process.
- The innovation and learning perspective is not used in the Swedish construction process to the same extent as other sectors.

The results are illustrated in Figure 4. The figure also illustrates how important the key factors were judged to be, and to what extent they were measured.

Discussion and conclusions

The total effect of a quality system cannot be fully measured in practical or in theoretical terms. This is, in part, due to the complexity of the matter and to continuous changes occurring in the environment. Caution is thus called for in interpreting the results. However, this does not amount to giving up, and declaring it impossible to evaluate the effects. It is important that all routines in the quality system that fail to contribute to quality improvement and efficiency are removed. A management control system such as a quality system is not static, but must be altered and remoulded continuously based on changes that occur in the situation in which the company finds itself. Accordingly, the weight placed on a specific measure may, and should, change over time.

The question for the researcher/company is whether the implementation of quality systems really makes a difference. While it is tempting to conclude that investments in quality systems increase organizational performance, there is little (if any) evidence that this is the case. Many of reports in the popular press, as well as in academic journals, are based on success stories. Failures are seldom reported, hence the average report is skewed towards too optimistic a point of view. Unfortunately, many investments in quality systems appear to be based more on blind faith than on facts.

The cost of quality has many definitions; one is the cost of quality management plus the cost of rework (Neese, 1991). The cost of rework has been investigated and found to be considerable in relation to the contract sum in the construction process (Josephsson, 1994). Surprisingly enough, the rework cost was not mentioned by the respondents as a way of measuring the cost of quality.

The balanced scorecard is an interesting tool as a measure of the performance of quality systems. In this study, the balanced scorecard was very useful because it reveals a clear lack of balance between the four different perspectives. The companies in the construction industry must pay attention to the fact that the perspective of

innovation and learning is not used to its full potential. A balance between the four perspectives is important, otherwise there is a risk that these companies will not be able to compete on the market in the long run. Among the other perspectives in the balanced scorecard, the financial perspective seems to be deemed the most important since all three key factors were judged to be highly important. In spite of this the key factors were only partly measured, which is an interesting contradiction. Both the 'process' and the 'customer' perspectives seem to be of moderate importance to the companies.

The secret lies not in discovering one magic tool, but rather in learning which tools to use, how and when (Rigby, 1993). Most companies today operate in a turbulent environment with complex strategies that, though valid when they were launched, may lose their validity as business conditions change (Kaplan and Norton, 1996). Tools are only valuable if they improve results, and improved results will only occur when companies establish the capability to serve customer needs better than their competitors (Rigby, 1993). There is a need to develop knowledge through future research on the cost and benefits of quality systems in the engineering and construction industries.

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