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Quality management: A new challenge for the Greek construction industry

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Summary This paper focuses on the meaning of quality and the structure of a quality assurance system in a very important business sector like the construction industry. Traditional quality control techniques seem today to be unable to ensure construction firms a competitive position in the emerging international market with the fierce competition and demanding customers. We present the results of a survey conducted among leading companies from the Greek construction industry. The survey examined the status of quality management and quality assurance system elements in these firms. The purpose of this examination was to investigate the main barriers that Greek managers and consultants face in their effort to introduce quality assurance successfully in this leading sector of the national economy in the context of the European market.

Introduction

For more than three decades, the meaning of quality and the implementation of effective and efficient quality control systems have been the main concern for the management of companies that are today leaders in the international market. Today, with the globalization of economy and the rapid development of technology, international competition is fierce and the quality of both products and services has become a matter of survival. This is the reason that has led to the systematic and rapid development, implementation and spreading of modern and flexible quality systems. These systems have already offered a great deal of support to the competence and profitability of the companies that have managed to apply them successfully.

Recently, considerable effort has been expended in the implementation of quality assurance systems in the construction industry. The construction industry is a business sector that plays a substantial role in a country’s national economy. This role is even more important in countries like Greece whose infrastructure appears to have serious problems. In such cases, the construction industry can offer substantial support to both the rational and systematic development of the various business sectors, and the basic economic measures of the national economy. To succeed in this task, the management of construction companies need to work very hard and take into consideration criteria like quality, cost and time.

Recently, in Greece, the role of the construction industry has become more important than ever. The European Union (EU) has decided to fund member countries which, like Greece, have problems either with their economy or with their infrastructures. This funding represents a large amount of money to Greece, to be used for the restoration and development
of its basic infrastructures (transportation, telecommunications, energy production, environmental protection, etc.). International experience shows that in order for the construction sector to use these funds in the most effective way, it has to employ in its operations all the available advanced methods for the management of production/operations, quality control and project activities. The projects to be undertaken are many, and are very important to the Greek economy. This fact must be realized by both the construction companies’ management and the public sector project auditors before it is too late.

The purpose of this article is three-fold. The next section provides an overview of the general basic characteristics of the construction industry, and describes the meaning of quality and the main characteristics of quality assurance systems in construction projects. The following section outlines the general characteristics of the Greek construction industry and the legal frame that applies to its activities. The final section provides the results from a study investigating the attitudes and actions of some major Greek construction firms towards quality and quality control.

Profile of the construction industry

General characteristics

The construction industry is characterized by a number of elements which differentiate it from other known business sectors like manufacturing and services. The differences apply to products, technology and organization, product market and competition structures, capital market, labour market and environmental effects.

Hart (1994) states that both manufacturing and construction are complex processes with the major difference between them lying in their end products. In construction projects, the production process ceases to exist after the project has been completed. At this point, the product of the construction project is the actual finished facility, building or other work product. Any improvement in that process is theoretically not possible, although data gathered may be used to improve any future relevant processes. There are many other characteristics of this sector whose importance may vary (Forecasting and Assessment in Science and Technology, 1993). These characteristics are summarized in the following.

For the products of this sector, we can point out the following:

- They tend to be unique because they are single, custom-made and not easily substitutable goods, built to specifications provided from the customer.
- They are produced on the location of consumption which means that they show territorial immobility.
- They have very long life-time or temporal immobility. The investments and usage of them are tied down for a long period of time.
- Even as they decay, construction products can still be repaired. Therefore, a large proportion of construction work is maintenance work.

For the technological and organizational characteristics of this sector, we can point out the following:

- Concentration of production at one location is impossible, as machinery and equipment have to be moved regularly.
- The use of traditional rationalization methods (standardization, series production and division of labour), as well as the application of specialized machinery and advanced technology, is limited mainly due to the uniqueness and immobility of the products.
- Labour intensity is high and capital intensity is low (the fixed capital investment is one
of the lowest among all industries). As a consequence, labour productivity is low in construction.

- The technology of the sector has always been characterized by what Piore and Sabel (1984) have called ‘flexible specialization’.
- Because production takes place at the location of consumption and these locations are territorially dispersed, the industry itself is also one of the most territorially dispersed ones.
- The low degree of capital intensity implies limited specialization of firms with regard to the types of products.
- The small average firm size and fierce mutual competition, resulting in narrow profit margins, do not allow the great majority of firms to invest in research and development activities.
- Firms often form temporary joint ventures for bidding and executing of large projects.

For the product market of this sector, we can point out the following:

- The relationship between a construction firm and its customer is one of executor and instructor.
- Typical for the industry is the separation of product design and construction.
- A construction firm has to sell something which has yet to be built, often under conditions which are partly beyond its control, such as the weather, the situation of the construction site, etc.
- The market structure is asymmetric, often with a series of temporary monopsonies, since tendering is the predominant way of getting a project.
- The limited degree of product specialization makes functional market segmentation limited. However, regional market segmentation is quite significant.
- Competition is based more on price and less on quality and time-span of delivery.
- Competition is often fierce, even destructive, forcing firms to bid under price, depending on the business cycle.
- Quality control is necessary but difficult. Fierce competition has induced entrepreneurs occasionally to use cheaper and lower quality building materials or to ‘adulterate’ their products in other ways.

For the capital market of this sector, we can point out the following:

- Construction products tend to be very expensive goods and therefore it is rare that they are paid for in cash. They have to be financed.
- Interest rates and more general developments on capital markets are a major factor influencing the demand for construction industry products.

For the environmental effects of this sector, we can point out the following:

- The construction industry is generally a producer of large amounts of waste materials. However, it is also a user of these materials.
- The products are directly connected with the location where they are produced.

For the labour market of this sector, we can point out the following:

- Labour is an important cost factor in this industry. This fact encourages the use of ‘black’ labour and also labour subcontracting.
- There is high labour mobility due to on-site-production, low capital intensity and high entrepreneurial risk.
- The sector has significant health and safety problems.
Figure 1. Construction basic work-flow pattern.

Figure 1 presents the logical progression of the activities of a construction project in order to establish a clear and complete picture of the nature of the construction activities (Hart, 1994).

The concept of quality

As stated earlier, there is both a regional and international necessity for the introduction and implementation of advanced quality control systems in construction projects. This is for several reasons: fierce competition, the growing needs of the project owners (customers) and the need to comply to industry standards for safety and environmental protection.

According to Rahman (1993) and Rahman et al. (1996), the basic motives driving the introduction of quality in the construction industry are the following:

- reduction of production cost;
- improvement of safety;
• on-time completion of projects;
• establishment of a healthy framework of competition.

Before looking at the basic elements of quality control in the construction industry, it is important to define the meaning of quality for this business sector. Quality has a three-fold meaning in construction (Hart, 1994): it means getting the job done on time; it means ensuring that the basic characteristics of the final project fall within the required specifications; it means getting the job done within budget. A quality construction project has to comprise all these dimensions. Actually, quality in construction is directly connected with conformance to specifications and fitness for use.

It is well known that with more affluent, educated and quality-conscious customers, the expectations for quality construction projects will continue to grow rapidly. These expectations include the following:

• protection of the environment of the project;
• functional and practical design;
• products that are defect free during all stages of the project;
• close cooperation with both suppliers and subcontractors;
• improved relation between cost and value;
• maximized return on investment (ROI).

The nature of these quality characteristics shows that the quality issue in the construction industry can be considered from two different levels. These levels are the industry level and the project level.

According to Hart (1994), it is very important to define the quality requirements of the whole project, as well as each step within the project, early on in the project. The identification and compliance with applicable codes, standards and customer requirements is best addressed early in the conceptual design phase of the project. Such a practice best prepares a construction firm both in bidding procedures (where they are applicable) and in having time to prepare a better and more functional design.

Quality assurance

Aggressive competition, both at the regional and international level, has imposed higher quality levels in almost all business activities and sectors. To ensure their position in the emerging international market, construction firms in many countries are actively engaged in trying to achieve internationally accepted quality levels. Terms like quality control, quality assurance and quality management are more or less a part of the normal terminology of the construction industry.

For the construction industry, ISO 9000 series for quality assurance systems certification represents a framework for improvement of its organization and quality. The development of the quality assurance system follows a parallel orbit with that of manufacturing industry. Of course, the developmental procedure has certain fundamental differences as compared to that of manufacturing, but these are mainly due to the different characteristics of the construction production process and other operational activities. The critical characteristics that differentiate quality assurance implementation are the following:

• the great differentiation of products and production processes;
• the long life cycles of construction projects;
• the wide use of subcontracting;
The Greek construction industry

General characteristics

The construction industry is one of the most important business sectors of the Greek economy (Attikat, 1994; Gener, 1996). In the past 10 years, its contribution to the gross national product has been in the range 5.2–5.8%. From the first years after World War II until today, Greek construction firms have made a significant contribution to all reconstruction and development efforts. Especially, in the years between 1960 and 1970, construction firms played a catalytic role in the country’s economic development. However, their development did not parallel the growth (quantitative and qualitative) of the projects’ needs and require-
ments. Today, the country's development in the context of the EU reserves a key role for the construction sector, which also represents for it a major challenge.

Currently, there are about 250,000 people employed in the construction industry, i.e. 6.5% of the country's total workforce. The sector consists of about 2250 firms, most of which are family owned, and of small to medium size. There are only about 250 large firms, and only 30 of them have assets valued at more than $4 million (Attikat, 1994; Gener, 1996).

In addition to the general characteristics of the construction industry which were outlined earlier, the Greek construction industry has the following specific characteristics:

- small size both as a whole and as units;
- significant geographical dispersion as a result of the country's topography;
- lack of stable and quantitatively significant activities abroad.

Greek construction activities can be classified into two main categories (Attikat, 1994; Gener, 1996):

- **Building construction activities**: This class comprises 70% of all construction activities and also represents the main source of work for a number of firms. Activities of this type experienced a significant growth in the period 1989–1990 but declined thereafter, to the current time. The main reasons for this are the following:
  1. high interest rates;
  2. economic recession that has decreased real net incomes;
  3. tax legislation which created negativity in the housing market;
  4. limited and slow development of housing credit.

The main products of building construction activities are buildings for schools, hospitals, hotels, houses, stores, public services and industrial plants.

- **Engineering construction activities**: This class comprises 30% of all construction activities and only represents a small proportion of the work for a number of firms. The main characteristic of activities in this class is that the great majority (more than 90%) are financed by the public sector. Therefore, governmental and political regulations play an important role in the main production process by influencing current and future activities, and strategic planning. Firms qualify for a project by bidding. There are several criteria that public authorities examine before signing a contract with a construction firm. The main products of engineering construction activities are the following: land reclamation, farming (agriculture, fishery and forestry), irrigation, energy production, telecommunications, transportation (highways, bridges, ports and airports) and drainage works.

The prospects for engineering construction activities in Greece appear to be positive for a number of reasons, the most significant being the problems with the country's basic infrastructures and the funding from the EU and national funds for the improvement of these infrastructures. In this context, several Greek construction firms have already initiated efforts for their re-organization and re-engineering. These efforts include the following activities: improvement of production technology by purchasing new equipment and advanced know-how; implementation of modern techniques and methods for production and project management; training of personnel; and introduction of modern techniques for quality, cost and time control.

**Quality management in the Greek construction industry**

**Research methodology**

A special questionnaire was used to obtain data and information on the understanding of the meaning of quality, the implementation of quality control systems, quality and production
problems, and the investigation of the general quality management status of Greek construction firms. The questions were designed so that the status of the firms with regard to the following elements could be assessed:

- parameters for productivity assessment;
- competition status and intensity;
- firms’ weaknesses;
- definition of quality policy;
- employees and management training on quality control and quality assurance techniques;
- awareness and understanding of the term ‘quality assurance’;
- methods applied for materials and production quality control;
- barriers to the implementation of advanced quality control techniques;
- policy for the improvement of quality;
- policy for the implementation of a quality assurance system and certification according to ISO 9000 series of standards.

The questionnaire consisted of 28 questions: seven questions were related to the status of the company, the competition and the market; 16 questions to the meaning of quality and the quality control system; and five questions to quality assurance. The questionnaire was sent by mail to the 160 largest Greek construction firms, kindly asking them to fill it in and return it within 30 days. This sample consisted of firms that:

- participate in bids for large public projects;
- have more than 30 employees;
- are classified in classes Z and H, which means that they have the right to bid autonomously for public projects with a budget in the range $3.6–24 million (class Z) or $24–48 million (class H);
- are headquartered in Greece.

Responses were taken from approximately 35% of the firms asked. The questionnaires were directed at managers from the middle management levels of the firms.

Research hypotheses

The objective of this research project was to determine the current status of the Greek construction industry in relation to its understanding of the meaning and critical characteristics of quality, methods used for quality control, quality and production problems, and understanding of the meaning and attitude towards quality assurance.

The hypothesis that was tested was that the main barriers and difficulties to rational and effective quality assurance implementation in the Greek construction industry accrue from certain elements of their organization and from the general context they operate in. These elements are the following:

- there is confusion on the meaning of quality;
- defined and documented quality policy is absent;
- quality assurance certification is viewed both as a marketing tool and as a means to improve organization and quality of the production systems;
- systematic vocational training on quality is almost absent;
- the main elements of a well-organized quality control system are absent;
there is no national strategy for the promotion of quality as a competitive advantage;
governmental regulations heavily affect construction firms’ operations.

Research results

In this section, we provide the main results from the research on quality policy and quality control methods that are applied in the Greek construction industry. These results are presented along with relevant analyses, comments and graphs. It must be pointed out that the respondents to the questionnaires were from middle management of these firms and had different levels of academic backgrounds and experience.

The main measures (parameters) that firms use for the assessment of productivity of their production systems are the cost of production and project delivery time (Fig. 2 graphically presents the proportion of responses given for each parameter).

The three most important competitive advantages of firms (Fig. 3) are quality, price and guarantee (Fig. 3 graphically presents the proportion of responses given for each advantage).

These responses show that, in a broad sense, management believes that construction

![Figure 2. The most important parameters for the assessment of productivity.](image)

![Figure 3. The most important competitive advantages.](image)
firms offer products of acceptable quality, at least as concerning the needs of the Greek market.

The three most important weaknesses of firms are the following:

- implementation of advanced production/operations management techniques;
- difficulty in employing highly qualified personnel (both at the managerial and shopfloor level);
- inflexible and dysfunctional organization.

All respondents agree that governmental regulations and general planning heavily affect most of their firms’ operational activities.

The main barriers on Greek construction firms’ production activities are the following (Fig. 4):

- problems in telecommunications–transportation;
- high interest rates;
- unfair/illegal competition;
- high production cost;
- bureaucracy;
- inefficient decentralization;
- vague and undefined governmental planning;
- fierce foreign competition.

Only 50% of the responding firms have documented and clearly defined quality policy. Only 50% of the responding firms had organized vocational training programmes for their personnel on quality awareness and quality control subjects. This is probably the main reason why only 60% of the management is properly informed and aware of the real meaning
of quality and its critical dimensions. It is apparent that training on quality management and quality control systems and techniques has to be one of the top priorities for construction firms that are determined to implement quality assurance systems.

Even though the awareness on the meaning of quality is low, management appears to be well informed on the meaning and structure of quality assurance systems. This can be explained by the wide application of quality assurance systems in Greek manufacturing industry. According to management’s point of view, the main benefits for their firms from the introduction and implementation of quality assurance are the following:

- improved organization of the production system;
- improved quality control and quality of both products and services;
- growth of sales;
- improved productivity;
- modern know-how acquisition;
- better organization in research and development and more innovations;
- lower production cost and cost of quality;
- improved personnel performance and satisfaction;
- better performance on bidding activities;
- improved relations with public authorities;
- ability to bid for projects with higher budgets and special quality requirements;
- better production/operations planning and scheduling;
- improved performance on problem-solving and non-conformance detection.

The general conclusion with regard to management’s point of view on the benefits of quality assurance is that its implementation can improve profitability, competitiveness and the general corporate image. It is obvious that management is well aware of what quality assurance means for a construction company and also has a clear positive attitude towards it.

The critical characteristics of the current status of quality control in the Greek construction industry are the following:

- The main criteria that firms use for supplier assessment and selection are (Fig. 5):
  (1) price;
  (2) quality;

![Figure 5. The main criteria firms use for the assessment of suppliers.](image-url)
(3) previous performance;
(4) delivery time;
(5) market name and reputation;
(6) other criteria such as: days of credit, supplier's quality control system and location of establishment.

- Quality control for in-coming materials is done mainly by using sampling and other relevant statistical techniques.
- Process quality control is carried out in a non-systematic way and by attributes measurement. The main reason for systematic quality control is customer's or public authorities' demand.
- Quality control is applied to both the production process and the end products, and it is carried out by either sampling or 100% testing (according to the corresponding circumstances).
- Approximately 67% of the responding firms do not have an autonomous quality control department.
- About 54% of the responding firms measure the cost of quality.

The picture of the organization that is directly related to quality assurance system consists of the following elements:

- 65% of the companies do not have a quality manual.
- 85% of the companies have information about quality assurance certification procedures (their main source of information is private consulting firms).
- 55% of the management are interested in ISO 9000 certification of their firms in the next two or three years, the main reason for this being that they want to be able to bid for large projects.
- The main steps that companies have taken towards the improvement of their quality control systems are the following:
  — purchasing of modern machinery;
  — use of modern techniques for the management and organization of quality control activities;
  — organization of training programmes on quality control;
  — assignment of responsibilities and authorities for quality control to lower level personnel (after giving them proper training).

Conclusions

The main conclusions of this research are directly related to the verification of the research hypothesis. Thus:

- There is indeed confusion among middle management in the construction industry regarding the meaning of quality and its real critical characteristics. Although quality is considered one of the most important competitive advantages of their firms, it is apparent that quality is viewed only in the context of Greek construction firms and not in comparison with leading European ones and in relation to applicable standards requirements.
- Only 20% of the firms who responded stated that they have clearly defined and documented quality policy. This suggests that management needs to work on the development and definition of its policy, objectives and commitment to a quality system in a documented statement. This statement should be published and made
available throughout the whole organization. In order to ensure that this policy is understood, an element of training may also be required.

- 100% of the firms stated that governmental regulations decisively affect their operations and strategic planning. This fact needs to be addressed by public authorities. It is obvious that rational strategic planning and stabilization of the existing legal framework can only have a positive effect on the construction industry’s competitiveness and profitability.

- Only 40% of the firms responded that their quality control efforts were systematic. Also, only 50% of the firms responded that they systematically organize training programmes on quality control. The elements of systematic and clearly defined quality control procedures and quality control training are very important ones for the successful implementation of a quality assurance system and so they should be top priorities in the quality assurance certification effort.

- Among the main elements of the quality assurance system are the quality assurance manual, quality procedures documentation and quality audits. These elements appear to be absent in most of the firms examined.

- All respondents appear to be properly informed on the structure of the quality assurance system and to have a positive attitude towards it. On the other hand, they seem to have different views as concerning the benefits that will result from its implementation. The views that seem to prevail as concerning the benefits verify the hypothesis that this system can support both company image and organization of production and operational activities.

In summary, these results suggest that the barriers to the effective introduction and implementation of quality assurance principles in the Greek construction industry are many and sometimes complex. In fact, these barriers are due to the inherent nature of the work, the traditional and legal framework of the operations in Greece, and the organizational structure and rapid growth of Greek construction firms. The sector would do well to try and learn from organizations in other sectors, in particular manufacturing industries and other European-wide construction firms that have been very successful in quality assurance implementation and certification. The need for short-term results should not be over-emphasized. Recognition of the long-term nature of quality assurance, and of total quality management, is essential, and this requires commitment from upper management and continuous education of all personnel. The way to success will be long and difficult but the effort will be worthwhile because it will mean survival for many companies.

Lack of experience in implementing quality management systems in this kind of business, and of specialists to support this effort, are the main problems management has to deal with. However, the challenge is serious and the advantages the companies will gain are many. The results of the implementation and wide acceptance of ISO 9000 certification in the Greek manufacturing sector during the last five years is a good example of what management can achieve with serious systematic and cooperative work, based on scientific knowledge.

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