Implementing Total Quality Management in Construction Firms

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Abstract: As building projects get larger and more complex, clients are also increasingly demanding higher standards for their delivery. Total quality management (TQM) has been recognized as a successful management philosophy in the manufacturing and service industries. TQM can likewise be embraced in the construction industry to help raise quality and productivity. Two case studies of construction companies showed how TQM can be successfully implemented in the construction industry. The benefits experienced include reduction in quality costs, better employee job satisfaction because they do not need to attend to defects and client complaints, recognition by clients, work carried out correctly right from the start, subcontractors with proper quality management systems, and closer relationships with subcontractors and suppliers. TQM performance measures were also reflected through top management commitment, customer involvement and satisfaction, employee involvement and empowerment, customer–supplier relationships, and process improvement and management. Finally, a framework for implementing TQM in construction is recommended.


CE Database subject headings: Quality control; Project management; Construction industry; Engineering firms.

Introduction

Total quality management (TQM) is often termed a journey, not a destination (Burati and Oswald 1993). Much research has been done with regard to the implementation of TQM and it is believed that the benefits of higher customer satisfaction, better quality products, and higher market share are often obtained following the adoption of TQM by construction companies. It requires a complete turnaround in corporate culture and management approach (Quazi and Padibjo 1997) as compared to the traditional way of top management giving orders and employees merely obeying them.

It is believed that the single most important determinant of the success an organization in implementing TQM is its ability to translate, integrate, and ultimately institutionalize TQM behaviors into everyday practice on the job. TQM is a way of thinking about goals, organizations, processes, and people to ensure that the right things are done right the first time. Motwani (2001) feels that implementing TQM is a major organizational change that requires a transformation in the culture, process, strategic priorities, beliefs, etc. of an organization.

TQM is an approach to improving the competitiveness, effectiveness, and flexibility of the whole organization. Oakland (1995) observed that it is essentially a way of planning, organizing, and understanding each activity that depends on each individual at each level. Ideas of continuous learning allied to concepts such as empowerment and partnership, which are facets of TQM, also imply that a change in behavior and culture is required if construction firms are to become learning organizations (Love et al. 2000).

Idris et al. (1996) showed that the electrical and electronic engineering industry in Malaysia has widely adopted TQM and the main benefits that resulted were improved customer satisfaction, teamwork, productivity, communication, and efficiency. McCabe (1996) reported a study of UK companies from different industries which have already implemented TQM. The results showed that a majority had achieved greater success against performance indicators than was the average for their respective industries. Culp (1993) cited an example of HDR Inc., Omaha, Nebraska, a large engineering firm that has implemented TQM. The experience of applying TQM concepts provided the organization with improvements, information, and learning that occurred only because of the TQM process. This is in addition to positive customer responses and client referrals that the organization received as a result of implementing TQM.

There are also other means of achieving TQM success. Ford Motor Company has found success by implementing its own Ford’s Q1 Award process which, in essence, involves the implementation of many quality principles and tools that are often associated with a TQM organization (Stephens 1997).

According to Ghosh and Wee (1996), manufacturing companies in Singapore have reached a certain state of development with regard to TQM and, hence, are on their way to world-class manufacturing. However, their survey indicated that Japanese manufacturing companies showed a greater commitment to TQM than their local/regional counterparts. In a survey carried out by the National Productivity Board in Singapore, Quazi and Padibjo (1997) reported that out of the 300 firms surveyed, only one-third of the manufacturing companies and one-fourth of the services and construction companies had implemented TQM programs. Of those companies that have implemented TQM, most were of...
foreign origin. This appears to suggest that local companies were lagging behind their foreign competitors.

The aim of this paper is to examine how TQM can be applied more actively in the construction industry. It seeks to assist contractors in identifying the steps necessary for the implementation of TQM. For this purpose, a comparison of the benefits experienced and the TQM performance measures in two case studies are presented.

The objectives of this paper are as follows:
1. To address the issue of applying TQM in the construction industry;
2. To examine possible steps for restructuring an organization for TQM; and
3. To propose an implementation framework for TQM.

Restructuring for Total Quality Management

TQM is generally perceived to de-emphasize status distinctions while emphasizing employee empowerment (Plutat 1994). TQM gurus preach horizontal coordination based on the flow of work processes and linkages with suppliers and customers. Hunt and Daniel (1993) envisage a TQM-oriented organization to have process rather than function as the basic fundamental unit of analysis.

Since a TQM organization is basically a customer-oriented organization, Brown et al. (1994) suggested organizing to maximize customer satisfaction rather than internal efficiency. Each person within the organization must consider the needs of the next person in line who uses his output. Measurements must be made to find out how well the organization is meeting its customer needs and expectations.

Without upper-management involvement, commitment, and leadership, a TQM program cannot succeed. Chase (1993) suggested that teams should consist of employees from various parts of the company to work together to improve processes. The organization should always look toward 100% customer satisfaction and error-free performance. The focus should not be on the 80% that is doing well, but rather on the 20% that is not. Strange and Vaughan (1993) further stressed that constantly measuring and analyzing factors that truly impact performance and then creating channels to communicate the lessons learned will result in performance improvement.

Employees need to be trained and shown how to reallocate their time and energy to studying their processes in teams, searching for causes of problems, and correcting the causes, not the symptoms, once and for all. Quality improvement teams should be set up (Baden-Hallard 1993; Costin 1994; Dale 1994; Oakland 1995) to ensure that the quality mentality is instilled in everyone within the organization and that there is continuous improvement in the quality systems.

The organization should also integrate suppliers into its TQM process. Williams (1997) stated that supplier relations should progress in the direction of supplier partnerships with both parties benefiting from the relationship. Both parties should seek to improve quality and work toward the intention of forming long-term relationships.

In summary, the requirements for restructuring for an organization wanting to implement TQM would include consideration to be given to the following (Chase 1993; Dale 1994): customer focus, continuous improvement, leadership, employee involvement, teamwork, customer–supplier relationship, and process improvement.

Resistance to Total Quality Management in Construction

The factors which may cause resistance in the implementation of TQM in construction are discussed below.

Product Diversity

All buildings constructed are unique. Quality is seen as consisting of those product features which meet the personalized needs of the customers and thereby provide product satisfaction, supplemented with a proviso of freedom from deficiencies (Sommerville and Robertson 2000).

Organizational Stability

The construction industry has a high number of organizational collapses, especially during a downturn in the economy (Sommerville and Robertson 2000). Thus, commitment toward TQM strategies and policies that may take several years to provide “pay offs” may be perceived as futile or a misdirection of resources. As compared to the head office, the building site is transitory. Teams specially formed for a project may cease to exist after contractual obligations end.

Misconception of the Cost of Quality

Baden-Hallard (1993) defined the cost of quality as costs associated with conformance to requirements and costs associated with nonconformance to requirements. Costs in the construction industry are being compounded by prevention and appraisal costs coupled with nonconformance costs.

Contractors often perceive TQM as an extra cost, but they do not realize that it is not the quality that costs but rather the non-conformance to quality that is expensive. The sources of costs associated with the nonachievement of quality include the costs of rework, correcting errors, reacting to customer complaints, having deficient project budgets due to poor planning, and missing deadlines (Culp 1993).

Biggar (1990) argues that the costs associated with implementing a TQM system could be substantial, depending on the size and nature of the company. However, Biggar (1990) pointed out that the costs incurred from not achieving quality can cost owners up to 12% of the total project cost.

Implementing Total Quality Management in Construction

In developing a total quality culture in construction, one important step is to develop a construction team of a main contractor and subcontractors who would commit to the quality process and develop a true quality attitude (Low and Peh 1996). Thus, the main contractor should only select subcontractors who have demonstrated quality attitude and work performance on previous jobs. Low and Peh (1996) outlined the following basic steps to implementing TQM in construction projects: (1) Obtain the commitment of the client to quality; (2) generate awareness, educate, and change the attitudes of staff; (3) develop a process approach toward TQM; (4) prepare project quality plans for all levels of work; (5) institute continuous improvement; (6) promote staff participation and contribution using quality control circles and motivation programs; and (7) review quality plans and measure performance.
Burati and Oswald (1993) explained that TQM may be implemented in an organization in the following three phases: The exploration and commitment phase, the planning and preparation phase, and the implementation phase. Chileshe (1996) showed that most organizations in the construction industry were reluctant to implement TQM because they felt that the ISO 9000 series was enough and that they did not want to subject their employees to anymore “cultural shock.” Organizations also felt that there were other pressing issues to consider, such as survival. In addition, Love et al. (2000) noted that organizations in the construction industry have abstained from implementing TQM practices because they feel that the short-term benefits are relatively minimal. Due to the complex nature and ever-changing environment of construction projects, Biggar (1990) suggested that the management system must be flexible, sensitive to effective communication, and continually improving.

Clients should move away from the usual practice of awarding tenders to the lowest price and advocate rewarding the best designers and suppliers who could provide the best service. Mohrman et al. (1995) established a correlation between various market conditions and the application of TQM practices. This suggests that competitive pressures will lead to the adoption of TQM. Organizations should create supplier partnerships by choosing suppliers based on quality rather than price.

Background of Case Studies

Two construction companies in Singapore who have implemented TQM in their organizations were studied. The case studies aim to examine how each organization practices TQM and the tools used to assist in doing so. In addition, the methods of measuring the performance of TQM within each organization are presented. The two case studies were conducted in late 2001. The studies made use of interviews and reviews of relevant company publications in Singapore.

Organization A

Organization A is a G8 Japanese contractor who has involved in local construction projects for more than 22 years. (Note: Construction companies in Singapore are registered with the Building and Construction Authority’s Central Registry of Public Sector Contractors in one of eight financial categories. These range from G1, the smallest, to G8, the largest financial category.) The Management Representative, who has worked for the firm for 19 years, was interviewed for this case study. Organization A has won several quality awards before, including one from a Japanese client for quality workmanship for a chemical plant project. This is not surprising because the quality mission of the company has incorporated certain aspects of TQM that is to: “Provide quality construction that meets customer requirements and continual improvement to enhance customer satisfaction.”

At the time of this study, Organization A was audited and awaiting certification to the ISO 9001:2000 standard. The Management Representative highlighted that the ISO 9001:2000 standard emphasizes continual improvement and is more systematic than the old ISO 9001:1994 standard which concentrated on documentation. Nevertheless, the Management Representative admitted that the reason behind ISO 9001:2000 certification was largely motivated by regulatory requirements in Singapore and not because it will help in TQM implementation in the first instance. He added that the benefits of ISO 9001:2000 certification would be enjoyed most by organizations that were not already certified to the ISO 9001:1994 standard.

Organization B

A local G8 construction firm, Organization B is known for its high-quality standards in design-and-build projects. The personnel interviewed was the Quality Systems Manager who has worked for Organization B for three years. The firm seeks to adopt the “do it right the first time” approach and to strive for zero wastage and zero defects. Like Organization A, Organization B is also committed to understanding the needs of its customers to deliver quality products through a continual improvement process.

At the time of this study, Organization B was expected to obtain their certification to the ISO 9001:2000 standard in the third quarter of 2002. It was then preparing for the ISO 9001:2000 audit. The Quality System Manager agreed that certification to the ISO 9001:2000 standard will help in facilitating continual improvement to allow Organization B to respond more positively toward client needs and expectations. The Quality System Manager opined that organizations will only carry out TQM principles that are required in the ISO 9001:2000 standard, and that unless an organization is aware of these principles, TQM will not be implemented in totality. The quality system manager noted that the new ISO 9001:2000 standard focuses on process flow that can help to identify what needs to be controlled. This is unlike the old ISO 9001:1994 standard which focused on individual quality elements, thus failing to highlight the relationship between them.

History of Total Quality Management Implementation

Since Organization A is a branch company of a large Japanese firm, TQM was implemented right from the start. Its headquarters in Japan sent 30 of its staff to Singapore to help with the implementation of TQM initially. The locals then learned from the Japanese with on-the-job training and other routines. There were only four Japanese employees in the organization at the time of the study. All employees were sent for TQM training when they first joined the firm. The successful implementation of TQM was largely due to the commitment of the top management. In terms of employee empowerment, employees are aware of their responsibilities and obligations, including aspects of TQM. This is one of the ways in which the organization cultivates the TQM culture among its people. The organization gives the project manager full authority to handle the cost and quality matters of the project but with an obligation to ensure that the budget is not exceeded. To date, there has not been any major rework on construction sites and this is due, in no small way, to the well-coordinated shop drawings. When asked if there was any formal measurement system for the cost of quality, the Management Representative explained that they had a system to measure the costs of defects by means of an index. This ensures that preventive actions are taken before defects occur. The client attends a progress and quality meeting at least once a month to ensure that customer satisfaction is attained. Organization A recently set up an objective for all projects: There should not be more than six complaints from clients within 6 months and this is followed up by a customer survey form. The Management Representative has the responsibility to maintain the quality management system and to ensure that quality processes are carried out properly.
the yearly management review. Top management attends this meeting to see if there is a need for improvement. Quality meetings are held once a week in the head office to study the progress of all sites. In addition, quality meetings are held on site everyday to allow staff to highlight problem areas on site and to make sure that these are rectified immediately. These meetings also act as team-building sessions for the personnel on site. There are no specific task teams formed especially for TQM. It was understood that everyone in the organization is involved in running the needs of TQM through their daily activities. Employees who contribute to the quality objectives of the company are rewarded through the staff appraisal system and this gives them more incentives to carry out their responsibilities according to TQM principles.

Six years ago, Organization B implemented TQM for a period of only six months before the system was abandoned. Even then, not all the TQM principles were implemented. What Organization B lacked was top management commitment. When the person in charge of implementing TQM left the company, the director decided to forgo its implementation. Thus, TQM training was carried out only for the directors of the organization. The quality systems manager mentioned that many contractors have the view that quality would cost money, take up time, and that there is no TQM mindset in the Singapore construction industry as yet. The staff of Organization B found it difficult to grasp TQM concepts and would only apply what was relevant for their work. Top management was not willing to commit resources for training staff, as they perceived it to be time consuming. The quality system manager stated that contractors are already competing with time to complete projects and even if the TQM system is in place, there is no guarantee that there will be substantial results. An interesting comment made by the quality system manager was that Japanese firms do not multitask their employees; thus employees can concentrate on their specific jobs. Japanese firms employ more staff compared to the local firms, and that is probably why Japanese firms can “afford quality.” With regard to a formal measurement system for the cost of quality, Organization B also used the measurement of defect works as a guide for quality and takes into account the cost of material used for rework. But the quality systems manager noted that this form of measurement is difficult to undertake during construction and that it is more suited during the defects liability period. Organization B has formed long-term relationships with a few suppliers and subcontractors who know what Organization B expects from them in terms of quality. When new partners are required, through design-and-build prequalification exercises by the client, the firm will take steps to ensure that the partner selected has a good track record for quality. An evaluation is conducted at the end of every contract.

Benefits Experienced

Organization A experienced a reduction in quality costs by ensuring that the defect cost indices meet the requirements stated in the project quality manual. Employees can achieve job satisfaction as they do not have to attend to defects or complaints from clients. The greatest benefit is recognition by clients. Clients are aware that Organization A had implemented TQM and subsequently recommended it to other clients. The Management Representative felt that top management commitment is essential for the decision to implement TQM. Top management should not create an impression of placing an additional burden on the employees. Like Organization A, firms should convince staff that TQM would be beneficial because everything will be done correctly right from the start. The Management Representative also felt that subcontractors should be selected with care and that the main contractor should always ensure that the subcontractors have proper quality management systems in place.

Since Organization B is no longer implementing TQM, it is difficult to see if it had benefited from its six months of initial implementation. But the organization has kept some of the TQM principles within its company policy: Customer satisfaction, continual improvement, and close relationships with a number of subcontractors and suppliers. The quality systems manager agreed that if TQM is properly implemented, it would require monetary and manpower resources as well as top management commitment.

Total Quality Management Performance Measures

Organizations A and B have different ways of measuring the performance of TQM. These are discussed below.

Top Management Commitment

The degree of visibility and support that management takes in implementing a total quality environment is critical to the success of TQM implementation. Organization B lacked that commitment from top management, which was why TQM was unable to be implemented in its entirety. There were no commitments to replace the person responsible for implementing TQM and there was no sharing of TQM knowledge. In Organization A, top management supported TQM through the allocation of budgets, planning for change (right at the beginning of implementation), and providing methods of monitoring progress of construction works. The main support came from the visibility of this commitment. The staff from its headquarters believed that if it is clearly visible that top management was committed to implementing TQM, employees would naturally follow suit. Management also reduced traditionally structured operational levels and unnecessary positions within the organization. This can be seen in the lean organization chart of Organization A in Fig. 1 when compared with that of Organization B in Fig. 2. They believed that simplifying the organization would lead to the establishment of an infrastructure of integrated business functions participating as a team and supporting the strategic vision of the company.

Customer Involvement and Satisfaction

Organizations A and B both have customer feedback forms to assess the level of customer satisfaction for each project. In addition to that, timely and dependable deliveries are ensured. Organization A aims to provide customers with timely information and quick responses to complaints, whilst maintaining the corporate goal of reducing the number of complaints. Organization B utilizes customer surveys, measures the percentage of repeat customers, and uses this information to assess customer satisfaction. Within the project structure, customer satisfaction is achieved by ensuring that drawings and specifications are communicated to the rest of the parties should there be any changes. The parties affected by the changes can then promptly adjust their information and help to reduce the amount of time wasted.

Employee Involvement and Empowerment

Organization A demonstrates empowerment by allowing its project managers to take full responsibility and make decisions
for their project. Project managers are allowed to make financial decisions but must ensure that the project budget is not exceeded. They should refer the issue back to the top management of Organization A if they are not sure of the appropriate decision. Employees are encouraged to present improvement and cost saving suggestions to management and to a certain degree, are allowed to self-implement solutions. However, the quality systems manager of Organization B mentioned that this system of feedback and suggestions did not work for them. This was because the ideas were either not substantial enough to warrant change or nobody made any suggestions. When employees first joined Organization A, they were oriented to the philosophy of the company of commitment to never-ending improvement. They were informed of the strategic goals of the company and made to feel that they are part of a team. Training was extended to the employees of Organization A as opposed to the case of Organization B where training was only extended to top management. As Organization A had resources from its headquarters in Japan, they were more willing to spend time and money on training employees in the management of TQM principles, problem-solving, and most importantly, teamwork. The quality systems manager of Organization B did not have the details of the training program implemented for top management except that the training was to educate them about TQM concepts and principles. The employees of Organization B were not sent for training as the decision against implementing TQM was made before training could commence.

Customer–Supplier Relationship

As for evaluating suppliers in order to identify if the organization should offer more jobs to them in the future, Organizations A and B monitor the percentage or the number of orders that were delivered late. Organization B has a vendor evaluation form for all suppliers and subcontractors in terms of delivery and work performance. Both organizations have a few suppliers with whom they work closely. These partnerships are based on the quality of their work and their actions in documenting improvement processes for continuous improvement in quality standards.

Process Improvement and Management

TQM is also concerned with adding value to processes, increasing quality levels, and raising productivity. As for raising productivity, Organization A measures productivity on site by calculating the amount of finished work divided by the number of hours used to complete the work, using fewer but higher skilled workers. A defect cost index was set up to calculate the cost and number of defects for all completed projects to enable the organization to prevent such defects from occurring again. The costs of defects during the defect liability period and the estimated costs of defects during the project are added up. This is then divided by the direct costs of defects, including that of subcontractors and multiplied by 100. The index should not have a value larger than 3. So far, all projects of Organization A were below this value. Organization B also measures the amount of defects but they do not use a special index.

Conclusion

Construction organizations should realize that results cannot be gained overnight and that an organization needs time to adapt, change, and learn. The biggest hurdle for the organization is to change its status quo and develop a culture that will support TQM. A framework recommended for implementation is explained in Fig. 3. This consolidates research findings and suggests a routine to follow for TQM implementation. In relation to Fig. 3, it is evident that different TQM principles were implemented in Organizations A and B. It can be seen that the commitment of top management is crucial in decision making and for successful
TQM implementation. Organization B appears to lack this commitment, which was why TQM was not fully carried out. Both Organizations A and B have not used a statistical approach to TQM because they were not familiar with statistical tools and felt that the time and resources needed to train their employees would be long and tedious. When the decision to set up a company in Singapore was made, the headquarters of Organization A in Japan sent their employees to Singapore to help with TQM education. Hence, Organization A started the process of TQM implementation right from day one. It appears easier for a new organization to train its employees in TQM practices than one whose employees already have fixed ways of doing things. In the latter, TQM may be seen as an additional burden rather than to help them to improve quality. Hence, linking the two case studies with Fig. 3, it is clear that implementing TQM requires a major organizational change that would transform the culture, processes, strategic priorities, and beliefs of an organization. Apart from commitment, top management must educate its employees on the need for TQM and communicate clearly to them that TQM is not an additional burden to the organization. Instead, TQM will help to reduce the amount of work for employees if they no longer need to attend to customer complaints and defect problems. In summary, the two case studies confirmed that the following factors, as highlighted in Fig. 3, are important considerations for TQM implementation: An understanding of TQM requirements (including customer/supplier involvement, continuous improvement, top management commitment, etc.), strategic review of education and implementation plans, provision of ample budgets and resources, teamwork, training, and timely feedback.

Nevertheless, the limitation of the two case studies is that the two organizations were reluctant to divulge information relating to their strategy used to implement TQM and details of their training programs. In addition, the authors were also unable to interview the general managers of both organizations. Consequently, the Management Representative of Organization A and Quality Systems Manager of Organization B were interviewed instead. Although they may be able to provide appropriate information because of their in-depth knowledge of quality systems, they may not be able to articulate other information such as those relating to top management commitment.

Based on a literature review and case study interviews, the problems that construction firms may face during the implementation phase of TQM could include the following.

- **Managers fail to understand the concept and philosophy behind TQM.**
- **Unless the organization is very motivated, the impetus from the government authorities may be needed.** This may include government grants for companies to undergo training in TQM.
TQM has yet to be proven to work in the construction industry and organizations may be waiting for a "champion" to lead the way.

Contractors are usually more inclined toward profit generation rather than quality improvements, especially if they have already met the minimum requirements for quality.

In addition to the above, initial costs of implementing TQM are perceived to be high although these may be offset by lower quality costs in the long run.

TQM may not be so feasible for small firms.

It may be more difficult to implement TQM on a building site than within the organization because the other parties in the project team may resist this process.

Employees within the organization may be resistant to change, which will render TQM education and awareness more difficult.

In conclusion, in spite of these problems, TQM embraces the philosophy, principles, procedures, and practices necessary for providing customer satisfaction as well as achieving productivity and business performance in the construction industry. Commitment and perseverance are necessary when embarking on this journey.

Fig. 3. Framework for implementing total quality management

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