Assessing the Quality Culture in Client Organizations in Pakistan Construction Industry – A Way Forward to Total Quality Management Implementation in Pakistan

Rizwan U. Farooqui

(Assistant Professor, Department of Civil Engineering, NED University of Engineering and Technology, Karachi, Pakistan & Ph.D. Scholar, Department of Construction Management, Florida International University, Miami, Florida, USA)

Sarosh H. Lodi

(Professor and Chair, Department of Civil Engineering, NED University of engineering & Technology, Karachi, Sind, Pakistan)

S.F.A. Rafeeqi

(Professor and Dean, Faculty of Civil Engineering & Architecture, NED University of engineering & Technology, Karachi, Sind, Pakistan)

Kamalesh Panthi

(Ph.D. Candidate, Department of Construction Management, Florida International University, Miami, Florida, USA)

Abstract

This paper attempts to investigate the existing quality culture, policies, procedures and formal quality management practices in construction client organizations in Pakistan with the objective to assess the acceptability and suitability of these organizations toward adoption and implementation of Total Quality management (TQM). The investigation is performed via structured interviews targeted to major public clients. Data was collected in seven key areas namely clients' knowledge of TQM, their perception of quality, quality-related data acquisition methods used by them, partnering and teamwork approaches adopted by them, quality management and improvement strategies in their organizations, quality-related training provided to their employees, and the obstacles faced by them in implementing TQM in their businesses. Willingness and preparedness of clients as well as suitability of implementation of TQM in Pakistan construction industry is gauged from the research results. It was found that the client organizations in Pakistan are generally neither willing nor prepared to adopt TQM as a management philosophy within their organizations. The major obstacles to implementing TQM in the Pakistan construction industry were found to be lack of expertise/resources in TQM, rigid attitude and behavior of executive management toward quality, minimal management and employees' commitment toward quality, lack of education and training to drive the improvement process, and tendency to cure symptom rather than get to the root cause of a problem. It is recommended that extensive awareness and training programs be initiated to improve the clients' understanding and approach toward quality and hence increase their willingness to implement TQM, which would in turn improve coordination, teamwork, productivity and industry performance in the long run.

Key Words

Total Quality Management, Quality Management, Quality Assurance, Quality Control, Pakistan

1. Introduction

The objective of this study is to assess the current state of adoption and implementation of quality management practices in the construction industry of Pakistan with particular emphasis on the culture existing in client organizations. It is expected that this study will provide the basis to evaluate the suitability and acceptability of the industry toward

adopting Total Quality Management (TQM) as a continuous improvement philosophy as well as identify the major obstacles faced by the industry toward successful implementation of TQM methodology.

Acceptability and suitability of TQM culture in Pakistan construction industry has not been formally researched as yet. Before getting into the reasons for this, it is suitable to define briefly the culture of Pakistani society. Pakistan is a multi-ethnic and multi-linguistic state; it has six (6) ethnic groups and eight (8) regional languages. Pakistani culture, like that of many developing countries, has been characterized as collectivist, inclined toward moderate masculinity, high uncertainty avoidance and high power distance (Hofstede, 1980, 1994; Khilji, 2001). These characteristics imply that, within such a culture, there is a general unquestioning respect for authority, people integrate in the form of cohesive groups, and are emotional. In her study, Khilji (1999) describes Pakistani culture as a mixture of religion (Islam), origins (Indian), and inheritance (British), with some American influence. Significantly, one reason often cited for TQM to be an alien culture to Pakistani society is that it is not relevant to the social norms and cultural background of Pakistan. However, considering the ethical and religious values of the Islamic society of Pakistan, this is a completely wrong perception as it ignores the basic ethical norms and religious perceptions of the society, not withstanding that some of them may not be very much in practice at the present time. Several religious injunctions from the Holy Scriptures insist on "fulfilling promises and contracts" as a pre-requisite to becoming a pious Muslim. Therefore, it would be incorrect to say that the TQM philosophy is alien to our cultural or religious norms. Another reason often cited for non-adoption of TQM is that the stakeholders of Pakistan construction industry are not yet ready to accept the TQM concept. This may be true and is an aspect to be diagnosed by the current study.

(Low and Peh, 1996) outlined that the very basic step in implementing TQM in construction projects is to obtain client commitment to quality. (Biggar, 1990) suggested that, due to the complex nature and ever-changing environment of construction projects, 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. Moreover, in developing a total quality culture in construction, one important step is to develop a construction team of a main contractor, subcontractors and suppliers who would commit to the quality process and develop a true quality attitude (Low and Peh 1996). In this, the most important role is to be played by the project "top management" i.e. the project client. This is because TQM culture cannot exist until the project owner understands the significance, accepts the philosophy, nurtures the culture, demands the commitment as well as infiltrates the philosophy in the underlying layers of project execution support by initiating different systems and tools to propagate and facilitate TQM philosophy based culture in the construction project. Thus, the client would require the main contractor to only select subcontractors who have demonstrated quality attitude and work performance on previous jobs, and so on. (Brah et al., 2002) also reports that all successful TQM initiatives come from the top management i.e. the project client.

This study will therefore explore the current state of adoption of quality culture in Pakistan construction industry with respect to acceptability and suitability toward implementing TQM in the near future. Client organizations are chosen for this study since they, as identified above, are the most important agents in encouraging the implementation of TQM in the construction sector.

2. Background

Quality is one of the critical factors in the success of construction projects. Quality of construction projects, as well as project success, can be regarded as the fulfillment of expectations (i.e. the satisfaction) of the project participants. Total Quality Management (TQM) is a human resource driven quality philosophy, which, through emphasis on productivity enhancement, aims at providing excellence in satisfaction of project participants through continuous improvements of products and processes by the total involvement and dedication of each individual who is in any way, a part of that product/ process.

TQM is often termed a journey, not a destination (Burati and Oswald, 1993). 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 of an organization in implementing TQM is its ability to translate, integrate, and ultimately institutionalize TQM behaviors into everyday practice on the job (Motwani, 2001). 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).

Developing a TQ culture within an organization is not an easy task. Yet the rewards are extremely high. Many studies have established a definite positive association between the introduction of TQM and improved performance and

conclude that firms that have effectively implemented TQM outperform non-TQM firms on measures such as profitability, revenues, costs, capital expenditure, total assets and number of employees (Hendricks and Singhal, 1997; Idris et al. ,1996; McCabe, 1996; Culp, 1993).

TQM is not without its critics who argue that it is just another management fad (Yong and Wilkinson, 2001)**.** Some studies have indicated that implementation of TQM does not result in a significant improvement in performance and in some cases resulted in a deterioration in performance. Reasons offered for TQM's failure to improve performance include ineffective implementation, lack of suitable corporate climate, poorly defined performance measurement, lack of management support, attempting to imitate successful programs without adapting them to the unique features of their organization, failure to integrate TQM with existing managerial systems, and lack of an appropriate reward and recognition system (Dobbs, 1994; Cameron and Quinn, 1999). The success and the eventual benefits due to TQM very much depend on organizational context, including the firm's size, the nature of its products, and industry characteristics (Brah et al., 2002).

Recently construction companies have increasingly adopted TQM as an initiative to solve quality problems and to meet the needs of the final customer (Kanji & Wong, 1998). As suggested by (Oakland and Aldridge, 1995) and supported by (Wong, 1999), if ever an industry needed to take up the concept of TQM it is the construction industry. (Wong, 1999) endorsed the view that construction probably promises a greater payback for performance improvement than any other service industry because of its magnitude. Many construction companies in the US, Singapore, UK, and other European countries have been using TQM successfully for a number of years now and reaping rich rewards in improved client, consultant, and supplier relations, reduced "cost of quality", on time and within budget project completions, and a well informed and highly motivated team of staff. Research (such as Burati et al.,1991; Contractor's Business Management Report's Contractor Management Survey, 1996; McIntyre, 2000; Chase and Federlo, 1998; Torbica & Stroh , 1999) concludes that there have been substantial economic and cultural benefits attained through the implementation of TQM.

Despite the above, construction generally has lagged behind other industries in implementing TQM. The major inhibiting factor, perhaps, is the perception that TQM is for manufacturing and service industries only (Arditi and Gunaydin, 1997). The other inhibiting factors have been: the notion that TQM is costly and requires a long time period for implementation, and the perception that TQM is another name for Quality Assurance (QA). (Kanji & Wong, 1998) mentioned that most organizations and companies involved in the construction industry view TQM as an enigmatic proposition. To some, it is nothing more than a buzzword, while to others, it is difficult to implement. (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.

3. Pakistan Construction Industry

The construction and engineering service sector is one of the most neglected sectors within Pakistan, although Pakistan's construction industry contributes greatly toward the GDP and employs about 9% of the total labor force (Labour Force Survey Report-Government of Pakistan, 2001). The industry is more labor intensive, with moderately less use of mechanization. Therefore, compared with other industries in Pakistan (like the manufacturing industry) this industry is labeled as being backward because of its relative lack of use of the latest advances in technology, management styles and procedures. Indeed it invests very meager amounts in research and development, which hinders the industry's ability to adopt new technology and processes.

Despite the use of less mechanization, Pakistan's construction industry is still characterized as pressured and adversarial, with long working hours comprising underpaid jobs. Further, construction projects in Pakistan generally: run over time and over cost schedules; do not necessarily meet user expectations; and often require remedial works due to construction defects. Usually finance, time schedules and quality standards of work are the main conflicting issues, leading to project disputes and thus litigation.

Compared to the past, the current decade is witnessing massive infrastructure growth in Pakistan. There are numerous infrastructure development projects in progress as well as under planning. All of these projects have the potential to lead the local industry to gain glory, status and international recognition but only when appropriate efforts are extended to achieve the same. With the stage set for a golden era for development, the challenges are still higher. A cultural and behavioral shift in the mind-set of all participants in the construction process (Kanji and Wong, 1998; Love and Heng,

2000) especially top management is necessary if the construction industry is to improve its performance and competitiveness. Ironically, research conducted by others such as (Zantanidis and Tsiotras, 1998) identified quality as being the most significant provider of competitive advantage. Construction industry in Pakistan clearly has not bought into this finding in their routine operations. The "boom cycle" and corresponding shortage of labor trades has increased the need for industry participants to adopt and apply TQM philosophy, tools and techniques to help them manage the industry performance and productivity in a sustainable long-term mode.

4. Objectives and Scope

The research work reported in this paper is part of an on-going research project under Pakistan-US Science and Technology Cooperative Program (STCP), with funds provided jointly by the United States Agency for International Development (USAID), USA and Ministry of Science and Technology (MoST), Pakistan. The above-mentioned project has four main objectives:

1. Assess the current state of Pakistan construction industry through quantitative research with specific reference to the status of construction management education, research and practice.
2. Develop a strategic model for the improvement and strengthening of construction management education, research and practice in Pakistan.
3. Devise a framework to standardize the construction industry practices for achieving improved performance on cost, time, quality, productivity and safety.
4. Capacity building of academia, industry, owners and government in the area of construction management so as to improve the overall efficiency and productivity of the construction industry.

Since no accurate information regarding the extent of construction management application in the Pakistan construction industry was available, the first objective of the research project was set as the investigation of the adoption and implementation of construction management practices in Pakistan construction industry. While this paper will focus only on the assessment of the quality culture in public client (owner) organizations in Pakistan construction industry as a way forward to TQM implementation in Pakistan, the remaining research work will be reported in further papers.

It is expected that this study will be of a pioneering nature. For the local construction industry, this research has the potential of demonstrating tangible benefits of using quality management in their organizations. This will be done by showing that quality improvement efforts can be quantified, measured and analyzed – thereby enabling a company to continuously improve its working environment as well as meet and even exceed stakeholder requirements.

5. Methodology

The research methodology consists of the following steps:

1. Development of a questionnaire to elicit information about quality management practices of public owners.
2. Conducting questionnaire survey through personal interviews.
3. Assessment of feedback from questionnaire survey to identify the current state of quality management practices in owner organizations

The steps are explained as follows.

A questionnaire was developed consisting of two parts – A and B. Part A consisted of requesting personal information (e.g. work experience, position in company) and company information (e.g. types of construction works performed, years in business, annual volume of work, number of employees). Part B consisted of 41 questions laid out in 7 key areas:

1. Knowledge of TQM (6 questions),
2. Perception of quality (5 questions),
3. Data acquisition methods (8 questions),
4. Partnering and Teamwork (3 questions),
5. Quality management and improvement strategies (14 questions),
6. Training (4 questions),
7. Obstacles in implementing TQM (1 question)

The questionnaire was used to conduct personal interviews with representatives from 15 major public client organizations working in major cities of Pakistan so as to get their feedback on the prevailing culture in their organizations with respect to quality implementation. Almost all of the firms approached were large size organizations (based on their annual volume of work and number of employees). The questionnaires were completed by their top management who were involved in the quality management programs. Almost all of them (more than 90%) had over 10 years of construction experience. On the basis of their position, education, work experience and professional background, it can be inferred that the respondents had adequate knowledge of the quality management activities in their organizations. The survey response is analyzed in the following section.

6. Analysis and Discussion

The analysis and discussion about the questionnaire survey is organized in seven key areas identified in section 5 above. In line with the format of the questionnaire, the results are reported in seven sections. Due to the small sample size, the respondents' responses are indicated in numbers. Percentage values are reported only when they represent more meaningful results.

6.1 Knowledge of TQM

In this section, six questions were asked to evaluate the client organizations' knowledge about TQM. The results are as follows.

1. *In your view, which of these words best define quality? (not limited to one answer)*

Option	No. of Responses
Meeting technical specifications	12
Exceeding technical specifications	3
Satisfying internal customer (within the organization, e.g. management layers)	11
Satisfying external customer (outside the organization, e.g. end users)	8
Appearance	3
Increased profit	3
Value for money	10
Teamwork	2
Partnership between organization and suppliers	2

The results indicate that the majority of the client organizations define quality as meeting technical specifications, which seems to them as a means to satisfy external and internal customers and to provide value for money. It is important to note here that very few respondents consider quality as improving on (exceeding) the technical specifications and a still lesser percentage consider teamwork and partnership as ways of achieving quality. Also, perhaps owing to the nature of respondents (project clients), majority define quality as satisfying internal customer as compared to satisfying external customer. This also highlights an important concern that end-user satisfaction is not a very major concern to most public clients, which is of course contradictory to the TQM philosophy. It could be perceived that customer satisfaction must become the focus of corporate thinking in improving quality.

2. *Do you think that TQM will (or does) work in your organization? (Very well/ To some extent/ Won't work/ Can't say)*

Nine respondents (60%) felt that TQM will work only to some extent in their organizations. Four respondents (26%) felt that it will not work at all while two respondents (14%) were unsure about their final opinion. From the results, it can be inferred that majority of respondents feel that the culture within their organization is not well-suited for TQM implementation. This is not surprising at all considering the lack of quality consciousness prevalent in the local industry.

3. *Would a TQM program be beneficial to your organization?*

Encouragingly, thirteen respondents (87%) said that the TQM program would be beneficial. Only two respondents (14%) were undecided while only one respondent indicated that it is not going to be beneficial.

4. *Which of the following factors may/ will provide the motivation to start TQM? Check all that apply.*

Option	No. of Responses
Self motivation toward continuous improvement	4
Competitive Pressure	1
Demanding customers/ end users	2
Your company's chief executive	3
Environmental issues/considerations	2
Need to reduce costs and improve performance	15
TQM is already being implemented in the company	0

TQM is a relatively new concept in Pakistan; therefore market pressure is not the prime force driving clients to adopt it. Unanimous results identified that the need to reduce costs and improve performance on projects was the major factor that might motivate to start a TQM program; self motivation may be another factor. All other factors, including customer demand, top management commitment and environmental issues were found to be the least contributing factors toward starting a TQM program. The results clearly depict the major local industry problem (project performance) and the lack of appropriate response (improvement of perceptions, trends and practices).

5. *TQM would be used to improve project performance in terms of: (not limited to one answer)*

Option	No. of Responses
Project economy	9
Project productivity	3
Project design	3
Project cost estimating and control	13
Project health, safety and environment	2
Stakeholder relations, coordination and tolerance	4
Reduced number of change order	3
Warranty claims	11
Reduced number of claims	3
Reduced litigation/ lawsuits	3

Most of the clients feel that TQM will be largely beneficial in improving cost estimation and control, warranty claims and project economy. Comparatively, a relatively smaller number of respondents felt that TQM can be beneficial otherwise.

6. *Are you aware of the relationship between ISO 9000 and TQM?*

Majority of the respondents (twelve respondents) were of the opinion that ISO 9000 is a necessary first step toward implementing TQM. Only two respondents mentioned that ISO 9000 can be one way of implementing TQM philosophy. One respondent considered both ISO 9000 and TQM as the same. These results identify the lack of understanding of the respondents of the relationship between ISO 9000, which is a quality assurance program, and TQM, which is a continuous improvement philosophy.

The results of this section indicate that the majority of clients perceive quality as meeting technical specifications in order to satisfy customers and provide value for money. These clients felt that TQM will not work very well in their organizations because of current culture. However they are aware of the benefits of implementing TQM in their organizations and feel that it will be highly beneficial if it can be implemented. Most of them think that TQM is a means for improving cost estimating, warranty claims and project economy. Most of them could not highlight the difference between ISO 9000 and TQM. Such opinions and results show their lack of knowledge about TQM and their unawareness about potential benefits which may by achieved by implementing TQM.

6.2 Perception of Quality

In this section, five questions were asked to evaluate the client organizations' perception of quality.

7. *Has your organization developed a clear definition of quality?*

The response indicated that only 6 organizations (40%) have developed a clear definition of quality.

8. *What is your organization's perception of quality? Select the most appropriate in terms of organizational perspective.*

Option	No. of Responses
Elimination of defects	7
An industry advantage	1
A tool to increase project economy	2
Continuous improvement	1
Satisfaction at all ends of the project	1
A set of specifications contained in a quality manual	3

The majority of the respondents perceived quality either as a means to eliminate defects in the products or services (47%). Very few respondents considered quality as a tool to increase project economy, or to gain competitive advantage, or to improve continuously. Only one client organization felt that quality implies that no one suffers a loss and all parties walk out of the project satisfied. It is interesting to note, however, that three client organizations (20%) perceive quality as a set of specifications contained in a quality manual.

9. *Please rank in the order of importance (Cost, Scope, Time, Quality, Safety):*

One of the most interesting discoveries was when the companies were asked to rank in the order of importance the following parameters: *Cost, Scope, Time (Schedule), Quality and Safety* within the construction field, they ranked quality at the second position. The following is the order of importance according to the survey:

1. Cost   2. Quality   3. Time   4. Scope   5. Safety

This fact indicates that most clients consider cost as their top priory. If observed from the local industry perspective from the point of view of the prevalent bidding environment which allows only for lowest bidding in the public sector projects coupled with the fact that public clients utilize public funds, the result that cost is a client top priority is understandable. It also illustrates that quality, since not a top priority, in most of the cases, as observed from local practice, is compromised.

10. *Do you set your quality goals to the level of:*

Option	Response Rate
The leading company in your field	13%
The competition in general	13%
To a level set internally	67%
No response	7%

When the clients were asked to identify the level to which they set their quality goals, majority (67%) answered that they set their quality level internally. This indicates that many clients are working with their own set of standards. This would have been a good practice had the industry been mature enough to allow isolation; however, considering the current immature state of construction industry in Pakistan, this trend has led to lack of competition as well as lack of industry level accountability.

11. Please rate the potential for improvement within the following processes (Scale 1 to 5, 1:Low 5:High):

Process	Respondents' Opinion Average values (High = 5, Low = 1)
On-site project management	4. 34
Close-out of projects	4. 24
Coordination with project members	4. 18
Administration of change orders	3. 77
On-site quality control	3. 60
Personnel management of employees	3. 54
Redesign	2. 95
Testing procedures at job sites	2. 90
Certification of materials	2.54

The table above delineates that the top three processes which have a large potential for improvement are "On-site project management", "Close-out of projects", "Coordination with project members", "Administration of change orders" and "On-site quality control". These processes can be improved through proper quality management programs as mentioned in the following sections.

The analysis of this section indicates that the majority of the client organizations perceive quality as a means to eliminate defects. Interestingly, when they were asked to rank in the order of importance the following attributes: Quality, Safety, Time, Cost and Scope; they ranked cost as the top priority followed by quality. Clients not demanding quality as their most important criterion is a significantly painful finding. Many clients work in isolation and have their own set of standards. This would not have been harmful if the industry maturity level was high. Most of the above findings, if not all, identify major flaws in the definition of client priorities as well as major misconceptions in the organizational perception of quality and its long-term effectiveness.

6.3 Quality-Related Data Acquisition Methods

In this section, eight questions were asked to find out how the client organizations gather data about quality.

12. Do you collect data to measure the performance of (company and projects) operations?

Nine (60%) respondents said 'Yes' while six (40%) said 'No'. The results show that a slight majority of clients do collect some data to measure the performance of operations.

13. How does your Organization solve quality-related problems?

Option	No of Responses
Assign individuals to solve	3
Set up a multi-disciplinary team for each problem	2
Functional managers are responsible for coordination and resolution of issues	1
Project managers are responsible for coordination and resolution of issues	4
A permanent team/ department is available	4
No response	1

When the clients were asked how their organization solved quality-related problems, the response was varying in nature: four (26%) of them said that project managers are responsible for resolution of quality-related issues, while another four (26%) said that a permanent team is available while a smaller percentage identified that they resort to assigning it to an individual or a multidisciplinary team. A somehow encouraging finding is that few client organizations have formed a permanent team in their organizations to solve such problems. This is encouraging in the sense that these organizations at least give priority to quality-related issues. However, this is not encouraging in the sense because it also identifies that these companies do face quality related issues significantly and frequently and require maintaining a permanent team to tackle such issues.

14. Do you have a system for gathering and incorporating customer (end user) suggestions into project development?

The results indicated that only four (26%) of the responding companies have a system for gathering and incorporating customer suggestions into project development. This is an alarming statistic and shows the insignificance given to customer requirements and hence customer satisfaction.

15. How do you measure customer (end user) satisfaction?

Only three (20%) organizations measure customer satisfaction through questionnaire surveys, six (40%) measure by the number of complaints and three (20%) measure by various other methods such as telephonic calls, on-site conversations and informal business meetings. Three (20%) companies do not measure customer satisfaction at all. A majority focus on complaints identifies the "elimination of defects" approach toward quality followed by the organizations rather than the "process improvement" approach, which is the core concept of TQM.

16. How do you gather employee suggestions?

Six (40%) organizations gather employee suggestions through anonymous means such as questionnaire surveys and drop box, another two (13%) gather suggestions via informal gatherings, while another two (13%) gather suggestions in formal meetings. Five (34%) companies do not gather employee suggestions at all. Please note that employee feedback forms an important aspect of the human resource driven quality philosophy of TQM.

17. Are employees empowered to make significant changes to operations?

When respondents were asked whether their employees are empowered to make significant changes to operations, twelve (80%) of them said that only certain key personnel are empowered in their organization to make any significant changes whereas two (13%) of them said that all employees are fully empowered. One (7%) respondent did not answer this question. Employee empowerment is a major pillar of TQM philosophy and seems to be missing in most client organizations in Pakistan.

18. Do you formally evaluate and appraise employee performance? If yes, when and how?

It was interesting to find that ten (67%) respondents identified that their companies have formal employee performance evaluation and appraisal procedures in place but those are rarely implemented. Two respondents (13%) said that employee performance is both project based as well as operational and is evaluated periodically and appraised as such. This shows that these companies have a dual performance evaluation and appraisal mechanism – based on project performance as well as functional performance. One respondent (7%) answered that the company has an employee evaluation and appraisal system based on project performance only, which is evaluated at the end of each project.

19. Do you do post-project ratings for the following?

Option	No of Responses
Contractors	7
Consultants	4
Subcontractors/suppliers to contractors	0
Your suppliers (other than service)	11

Results indicate that most client organizations (73%) rate their suppliers. However, a lesser percentage (47%) has a mechanism for rating their contractors, and an even lesser percentage (27%) rate their consultants. It is interesting to note (and rather expected) that none of the client organizations has a post-project rating mechanism for subcontractors or suppliers to contractors.

The results of this section highlight that a slight majority of client organizations do collect data to measure the performance of operations. The quality-related problems are handled by various means, with more problem-solving input given by project managers and permanent teams. Neither customer suggestions nor customer satisfaction are given due significance and are rarely incorporated or evaluated. Employee suggestions are rarely taken by substantial percentage of client organizations; neither employee empowerment exists in majority of firms. Also, most of the companies, although have formal performance evaluation and appraisal procedures, do not formally evaluate and appraise employee performance. Most of the companies rate their suppliers (other-than-service) after project

completion; however, only about half of them rate contractors – their major service providers and major contributors to project quality, and none of them rate subcontractor performances.

6.4 Partnering and Teamwork

In this section, three questions were asked to find out to what extent the client organizations use partnering and teamwork approaches in their projects, if any.

20. *Under what type of delivery system/ contracting strategy do you procure work? Check all that apply.*

Option	No of Responses
Traditional (Design-Bid-Construction)	15
Design-Build (single contract with a firm that designs and constructs)	0
Design-Manage (a.k.a. EPC: Engineer-Procure-Construct)	3
Construction Management-at-Risk	0
Partnering (total project team is involved in project development and signs a project charter)	0
Build-Operate-Transfer (BOT) or its variation	2

This question was put up to investigate the extent of teamwork demanded by client organizations through their procurement procedures. (Some delivery systems, especially design-build, do inherently promote partnering and teamwork). The response indicates that all client organizations typically procure work under traditional delivery system of design-bid-build. Only few clients, 20% and 13% respectively, use alternate delivery system of design-manage and BOT. Construction Management-at-Risk is a non-existent delivery system for public projects. Partnering, as a contracting strategy, is not practiced by any client.

21. *On your projects, are contractors involved in the conceptual phase of a project? If yes, in what activities? Check all that apply.*

The response was negative by all fifteen (100%) respondents. That is, no client organization involves contractors in any of the following conceptual planning activities, each of which can extract substantial input from contractors in terms of quality improvement on projects:

- Advice in the establishment of the project goals and objectives
- Execution of feasibility studies and advice in selection of site
- Advice in the contracting strategy
- Assist owner in finalizing bid work packages
- Suggest structural systems
- Selection of major construction method and materials
- Provide input to program risk analysis and identify potential major construction problems
- Assist in development of capital budgets and cash flow projections
- Assist in preparation of control schedules, estimates and budgets

22. *On your projects, are contractors involved in the design-procurement phase of a project? If yes, in what activities? Check all that apply.*

Activity	No of Responses
Review design to facilitate efficient construction	2
Review design to facilitate accessibility of personnel, materials and equipment	2
Promote designs that facilitate construction under adverse weather conditions	0
Preparation of construction schedules, estimates and budgets	3
Analysis/ revision of specifications to allow easy construction	2
Provide value engineering input	1
Advice design team about sources of materials and engineered equipment	0
Submission of alternate bid proposals (for value engineering input)	0

The response was mostly negative. Only a few clients (20% or less) involve contractors in the design-procurement phase in activities such as design review, preparation of schedules, estimates and budgets, specifications revision and

value engineering input. All of the above activities have the potential of extracting quality improvement input from contractor in the project development. It is worth noting here that the client organizations who indicated that they do use design-manage as an alternate delivery system were the ones to identify that they have some mechanism of involving contractors in the design-procurement phase.

The findings of this section indicate that most of the clients use the traditional design-bid-build delivery system, which, by nature, leads to lack of trust and confidence, adversarial relations, and increased arbitration and litigation, hence rendering the system devoid of effective communication and teamwork. Also, partnering, as a contracting strategy, is not practiced by any client. Contractors are traditionally not involved in any of the conceptual stage activities. Only a few clients (one-fifth) involve contractors in the design-procurement phase in activities such as design review, preparation of schedules, estimates and budgets, specifications revision and value engineering input.

6.5 Quality Management and Improvement Strategies

In this section, respondents were asked fourteen questions to explore facts about quality management and improvement strategies in their organizations.

23. Do you pre-qualify contractors in terms of: (check all that apply)

Option	No of Responses
Safety	0
Quality	0
Past performance ratings with your company	5
Past performance in industry	8
Financial Stability	8
Technical Capability	8
No process of pre-qualification	7

None of the clients have a mechanism to pre-qualify contractors in terms of either quality or safety. Majority of clients use financial stability, technical capability and industry past performance of contractor as the major pre-qualification criteria. Most of the clients (53%), who identified in response to a query in the previous section that they do have a process of maintaining post-project ratings for contractors, indicated also that they use this rating as part of their pre-qualification criteria. Interesting to note, however, is that almost half of the clients (47%) do not have a process of pre-qualification at all. This is mostly evident because in majority of public projects, in Pakistan, open competitive bidding with contract awarded to lowest price bidder, is the order of the state. This system, inherently, does not promote pre-qualification.

24. Do you develop quality requirements/ specifications specific to each project?

Keeping in view the above results, the response to this question was rather expected. A majority of clients (11 numbers) answered that their quality specifications document is a standard company document developed for the long-term that defines major quality requirements of the company and is mostly applicable/ reusable on all company projects (with minor or no modifications). Two clients responded that it is used as a medium-term standard company document that is updated from time to time with changing industry standards and requirements. Only one client said that the quality specifications document is developed and used as a distinct project document that defines the minimum quality standards for that particular project as per project specific requirements.

25. Does your organization have a formal code of ethics?

Twelve respondents (80%) answered affirmatively while the rest (20%) said that they do no not have a formal code of ethics.

26. Do you have a disciplinary process of implementing your code of ethics?

This response was not applicable to the 20% who responded negatively to the previous question. However, an interesting finding was that ten respondents (83% of the respondents to which this question was applicable) responded negatively. Following from this response and the response of the previous question, a major conclusion can be drawn here: majority of public clients either do not have a code of ethics or even if they do have, the implementation of this code is highly questionable because they do not have any disciplinary process for its implementation.

27. *Do you have a formal or informal program for quality management/ improvement on your projects?*

Option	No of Responses
Such a program is under consideration	0
A quality management program has been implemented recently	3
A quality management program has been a part of corporate policy for some time now	9
We have an informal quality management program	3
No formal or informal program (even under consideration)	0

The results showed that nine (60%) organizations have a quality management/ improvement program as part of the corporate policy, while three (20%) have recently implemented such a program while the remaining three (20%) have informal quality management programs. It is encouraging to find that all organizations have some kind of formal or informal quality management program.

28. *What type of quality management/ improvement program do you have?*

Option	No of Responses
Total Quality Management	0
ISO 9000	2
Quality Assurance/ Quality Control	10
Customized/ Informal methods	3

The results indicated that ten organizations (67%) are using Quality Assurance/ Quality Control (QA/QC) procedures for quality management, two (13%) organizations are using ISO 9000 standards while none is using Total Quality Management (TQM). Three organizations (20%) mentioned that they use their own customized methods or informal quality management programs.

29. *Your organization's quality management/ improvement program on projects can be described as:*

Option	No of Responses
Periodic short-range solutions or motivational program	11
A formal long-term program is underway with widespread employee awareness	4

Eleven (73%) organizations indicated that their quality improvement plan is short-term while only four (27%) organizations mentioned that they have implemented a long-term solution. This also strengthens the fact that the approach of the industry has not been favoring TQM implementation which focuses on long-term sustainable improvement. However, this also emphasizes the need and room for improvement if TQM can be adopted.

30. *Does your quality management/ improvement program have the full support of top management?*

Eight organizations (53%) indicated that their program has full support of top management while five (33%) of them answered 'No'. The remaining two (13%) respondents were unsure. Client top management not demanding/ supporting quality programs for one-third of the client organizations is a strange finding and also emphasizes the need for awareness of top management toward the implementation effectiveness of formal quality management systems.

31. *The major objectives of your quality program are (check all that apply):*

Option	No of Responses
Compliance with specifications	15
Process improvement	4
Productivity improvement	4
Cost reduction	3
Involvement of employees in the quality building effort	8
Compliance with statutory, environment and safety requirements	3

All fifteen (100%) respondents mentioned that their company's main objective behind the quality programs is compliance with specifications. This response would have been rather more acceptable if the respondents were contractors rather than clients; research studies in developing countries have shown that process and productivity improvement have been the major client objectives rather than only compliance with specifications. This is surely not the trend of the state of affairs in Pakistan construction industry. Almost half of the respondents (53%) indicated that one of the main objectives is also involvement of employees in the quality building effort. This is an encouraging response. Only few responses indicated that process improvement, productivity improvement, cost reduction and compliance with statutory requirements are also objectives of the company's quality program.

32. *Steps taken in your quality management/ improvement program include (not limited to one answer):*

Option	No of Responses
Organized a multi-disciplinary team	2
Data has been collected to identify defects in products	14
Data has been collected to measure the process	0
A monetary value has been assigned to the cost of quality	0
An internal awareness program is underway	12
An educational program has been implemented	3
Quality problems have been identified	10
Have defined benchmarks for improvement	0

The respondents' opinions indicated that collecting data to identify defects, creating an internal awareness program and identifying quality problems were the three major steps taken in their quality improvement program. The "cost of quality" is still an unknown term for dient organizations. Ironically, data collection wit the objective of process improvement rather than identification of defects is non-existent. Moreover, none of the client organizations has defined benchmarks for quality improvement. All above indicate that a reactive approach rather than a proactive approach is under way for quality improvement. It is more of a quality control approach rather than a quality improvement method.

33. *Does your quality management/ improvement program include quality requirements for:*

Option	No of Responses
Consultants	10
Contractors	13
Subcontractors/ suppliers to contractors	0
Your suppliers	12

The responses indicate that majority of respondents have quality requirements for consultants, contractors and suppliers. However, none of the clients, as part of their quality program, have quality requirements for subcontractors or suppliers to contractors.

34. *Do you require the contractor to submit a project quality plan during preconstruction phase?*

Only two (13%) respondents answered affirmatively. This indicates that most of the organizations have a weak mechanism of quality assurance on projects.

35. *After the implementation of your quality management/ improvement program, project quality has:*

Option	No of Responses
Drastically improved	1
Improved	3
Remained the same	7
Decreased	1
Unsure	3

One-fifth of the respondents indicated that the service/product quality of their projects has 'improved' while almost half (47%) mentioned that the quality has 'remained the same' after the implementation of the quality management/ improvement program. It is interesting to note that one respondent felt that the quality on projects has deteriorated after

implementation of quality program. Relating the above responses to the previous responses given by the clients, it is not hard to interpret that the success of quality management program has not been observed by majority of firms because of the nature of the program itself, which has been largely oriented toward the approach of "inspection" and "elimination of defects" rather than "process improvement", "employee empowerment", "awareness", "training", "long-term commitment" and "long-term improvement focus".

36. After the implementation of your quality management/ improvement program, relationships with your consultants, contractors and suppliers have:

Option	No of Responses
Drastically improved	0
Improved	2
Remained the same	7
Deteriorated	2
Unsure	4

Majority of the respondents indicated that, after the implementation of their quality program, relationship with their consultants, contractors and suppliers has 'remained the same'. Two respondents felt that the relationship has 'deteriorated'. This is understandable from the context of previous responses and inferences, which clearly assert that the reason for non-improvement from implementation of quality program may be the approach and culture of the organization, which has not been conducive to bring long-term improvement in quality, such as building better relations.

In summary, it is observed that none of the clients have a mechanism to pre-qualify contractors in terms quality. A majority of clients use quality specifications document as a standard company document which is neither updated frequently nor distinctly developed for each particular project. Rather it is reused on majority of projects (with minor or no modifications). Majority of public clients either do not have a code of ethics or even if they do have, the implementation of this code is highly questionable because they do not have any disciplinary process for its implementation. Besides organizations with formal quality improvement programs such as QA/QC and ISO 9000, a number of firms have informal quality programs in place. It is encouraging to find that all organizations have some kind of quality management program, mostly as part of their corporate policy. However, no organization has TQM implemented as their quality policy. Majority of the organizations indicated that their quality improvement plan is short-term, whereas TQM focuses on long-term sustainable improvement. Only half of the organizations indicated that their program has full support of top management. Historically, all successful TQM initiatives have come from the top management. The main objectives of the quality program were found to be compliance with specifications followed by employees' involvement. Process and productivity improvement have not been the major client objectives. Majority of the client organizations have a quality program which is based more on a quality control approach rather than a quality improvement method. Majority of respondents have quality requirements for consultants, contractors and suppliers, but not so for subcontractors. However, very few clients require their contractors to submit a project specific quality plan during preconstruction phase. Almost half of the clients mentioned that the quality has 'remained the same' after the implementation of the quality management/ improvement program, while the majority felt that relationship with their consultants, contractors and suppliers has also 'remained the same'. The reason for non-improvement from implementation of quality program can be attributed to the findings that most of the organizations have a weak mechanism of quality assurance on projects, as well as an organizational culture (particularly top management commitment and employee empowerment) which is not conducive to quality improvement.

6.6 TQM related Training Programs for Employees

In this section, respondents were asked four questions to explore about TQM related training programs designed for the employees.

37. Is formal training in TQM or other quality improvement philosophies given to employees?

The results indicated that only three companies (20%) have developed formal training programs while nine (60%) companies provide 'some' training to their employees. The remaining three (20%) indicated that they do not have any training programs.

38. Percentage of managerial/supervisory staff who have undergone quality management training:

The companies that have a formal or informal training program indicated that on average 36% of their managerial/supervisory staff has undergone quality management training, which is a low percentage.

39. Percentage of non-managerial/technical staff who have undergone quality management training:

The companies that have a formal or informal training program indicated that on average only 15% of their non-managerial/ technical staff has undergone quality management training.

40. Training currently emphasizes (not limited to one answer):

Option	No of Responses
Specifications review	2
Process improvement	2
Quality control	12
Statistical analysis	1
Data gathering & analysis	6
Team work	3
Stakeholder relations	1
Communication	4
Customer (end user) satisfaction	2

The respondents had a unanimous opinion that the training programs mostly emphasize on quality control as a primary goal followed by data gathering and analysis (which, as inferred from previous responses, would most probably be related to identification of defects). This emphasizes again that the quality program as well as the training is not proactive in nature.

To summarize, in majority of the firms, their employees are not given a formal training about TQM or other quality management programs. On average, 36% of the managerial/supervisory staff and 15% of the non-managerial and non-technical staff had undergone quality management training, which is not acceptable considering the general significance of quality to client organizations. The training programs in these firms mostly emphasize on quality control as a primary goal followed by data gathering and analysis.

6.7 Obstacles in Implementing TQM Program

The obstacles in the implementation of TQM program, as indicated by the respondents, are shown below in descending order of responses (based on total number of responses received against each option).

1. Lack of expertise/resources in TQM
2. Rigid attitude and behavior of executive management toward quality
3. Lack of top-management commitment/understanding
4. Lack of employee commitment/understanding
5. Lack of education and training to drive the improvement process
6. Tendency to cure symptom rather than get to the root cause of a problem
7. Schedule and cost treated as the main priorities
8. Emphasis on short-term objectives
9. Fear of employee empowerment
10. Perception that too much documents are required (Lack of documentation ability)
11. Current tendering/ bidding climate
12. Changing behavior and attitude
13. Resistance from middle management
14. Cost and time of implementation
15. Adapting to changing trends
16. Perception that TQM is just another name for QA
17. Perception that TQM is for manufacturing and service industries only

An additional finding from the survey was that most public clients were unenthusiastic regarding TQM implementation and were unwilling to invest in it; in terms of both capital and time. Few clients identified the procedure for TQM implementation that should, through persistence, allow the Pakistan construction industry to adopt TQM philosophy successfully. These findings are discussed in the next section.

7. Conclusions and Recommendations

7.1 Conclusions

The major conclusions are summarized as follows.

1. Although the public clients in Pakistan are aware of the importance of quality, their knowledge about TQM is limited, as well as their perception about quality is of a 'curative nature' (a means to eliminate defects) rather than a 'preventive nature' (a process improvement approach). Majority of the clients perceive quality as meeting technical specifications in order to satisfy customers and provide value for money. These clients feel that TQM will not work in their organizations because of current organizational and industry culture. However they are aware, to some extent, of the benefits of implementing TQM in their organizations and feel that it will be highly beneficial if it can be implemented. Most of them think that TQM is a means for improving cost estimating, warranty claims and project economy.

2. Public clients in Pakistan are less focused on data acquisition. Neither customer suggestions nor customer satisfaction are given due significance and are rarely incorporated or evaluated. Employee suggestions are seldom taken; neither employee empowerment exists in majority of firms. This also refutes their claim that company policy invites employee participation in the quality building effort. Most of the companies do not rate post-project performance of their contractors – their major service providers and major contributors to project quality, and none of them rate subcontractors' performances.

3. Quality implementation on projects is not the highest priority to the clients; due to cost constraints, quality is mostly compromised by clients. Majority of public clients either do not have a code of ethics or even if they do have, the implementation of this code is highly questionable because they do not have any disciplinary process for its implementation. While no unique trend was found in those organizations who have implemented a quality management program, most organizations prefer QA/QC and informal quality management programs. No organization has TQM implemented as their quality policy. Most of the organizations are implementing periodic short-range solutions or motivational programs rather than more formal long-term programs.

4. Most of the client organizations do not provide any formal training to their employees about quality management systems.

A key conclusion is that the client organizations in Pakistan are generally neither willing nor prepared to adopt TQM as a management philosophy within their organizational cultures.

7.2 Recommendations

The major recommendations are summarized as follows.

1. Quality begins with client commitment; however, an appreciable percentage of client top management is not committed to quality programs implementation and improvement. Construction companies that embrace TQM would prefer all repeat clients with the same cooperative design team and sole-source subcontractor and supplier partners. However, such is not the case due to prevalent bidding practices. In reality, most projects are like a new company being formed to produce one unique product. The "new company," if it embraces TQM philosophy, needs to define its mission, and success requires everyone to work together to accomplish that mission. In this, the most important role is to be played by the project "top management" i.e. the project owner. This is because TQM cannot exist without complete acceptance of its philosophy by at least the top management. Once the basic philosophy is accepted by the owner then different systems and tools can be initiated to propagate and facilitate TQM philosophy based culture in the construction project. Unfortunately, this approach does not exist in Pakistan construction industry. This in turn influences the contractors' endeavor toward quality practices; for instance, most of the contractors do not submit a project specific quality plan during preconstruction phase. Although, the clients are partially willing to involve the contractors at the design

stage of the project, they practically don't invite them at the conceptual stage of the project. There is a dire need for awareness of client top management toward the implementation effectiveness of formal quality management systems.

2. Coordination is needed from initial phase to end phase among all stakeholders for successful TQM implementation. However, most of the clients use the traditional design-bid-build delivery system, which, by nature, leads to lack of trust and confidence, adversarial relations, and increased arbitration and litigation, hence rendering the system devoid of effective communication and teamwork. Also, partnering, as a contracting strategy, is not practiced by any client. The industry has become increasingly reliant on back-dated poorly defined specifications, which neither exactly say what the owner intends them to say, nor compel the contractor to improve performance. This has led the owners to shift more of the risks to the contractors. The net outcome is that the construction industry has been bogged down with paperwork, defensive posturing, and generally tends to have a hostile attitude toward the other participants. TQM can help reverse this trend. Although, not a magic pill or panacea for all illnesses, it will, if properly implemented, help construction companies improve and will help all the parties come closer that would bring long-term benefits.

3. It would be appropriate to arrange some form of formal and/or informal education and training. Formal education could be graduate studies in quality management systems or TQM. Informal education and training could take the form of career development programs (like quality awareness program) organized by academic institutions or professional organizations.

4. Successful implementation of TQM in Pakistan construction industry can be achieved through persistence, positive hands-on leadership, upfront preparation and continuous maintenance of a sensible plan. The following basic steps are identified to implementing TQM in the Pakistan construction industry:

    i. Obtain client commitment to quality. This is crucial to success.
    ii. Generate awareness, educate project staff and change attitude.
    iii. Develop and document approach to TQM of projects but do not degenerate into paper bureaucracy.
    iv. Prepare project quality plans for all levels of work.
    v. Install organization and managing bodies.
    vi. Institute continuous improvement.
    vii. Promote staff participation and contribution by quality control circles and initiate motivation program.
    viii. Review quality plans and measure performance.

8. References

Ahmad, I.U. and Sein, M.K. (1997). "*Construction Project Teams For TQM:A Factor-Element Impact Model*"

Arditi D. & Gunaydin H.M. 1997, Total quality management in the construction process, International

Biggar, J. L(1990). ''Total quality management in construction.'' *Trans.Am. Assn. Cost Eng., August,* 14(1), 1–4.

Brah, S. A.,. Tee S.L, and Rao, M. (2002). "Relationship Between TQM and Performance Of Singapore Companies". *International Journal of Quality and Reliability Management,* Vol. 19, No. 4, pp. 356-379.

Burati J.L., Matthews M.F., Kalindi S.N. 1991, Quality management in construction Industry, Journal of construction Engineering and Management 117(2): 341-359

Burati Jr., James L., (1993). "*Implementing TQM In Engineering And Construction*"

C. McIntyre and M. Kirschenman. (2000). "Survey of TQM in construction industry in upper Midwest", *Journal of Management in Engineering*, 16(5), 67-70

Cameron, Kim S., and Robert E. Quinn, 1999. Diagnosing and Changing Organizational Culture. Reading, Mass.: Addison Wasley Longman.

Chase, G.E. and Federle, M.O. (1998). "*Implementation Of TQM In Building Design And Construction*"

Chileshe, N. (1996) ''An investigation into the problematic issues associated with the implementation of Total Quality Management within a constructional operational environment and the advocacy of their solutions.'' MSc dissertation, Sheffield Hallam University, U.K.

Culp, G. (1993). ''Implementing total quality management in consulting engineering firm.'' *J. Manage. Eng.,* 9(4), 340–355.

Dobbs, Matti F. (1994). 'Continuous Improvement as Continuos Implementation: Implementing TQM in the City of Santana', Public Productivity and Management Review, Fall 1994, pp 89 to 100.

Hendricks, K.B. and Singhal, V.R. (1997). "Does Implementing an Effective TQM Program Actually Improve Operating Performance? Empirical Evidence from Firms That Have Won Quality Awards". *Management and Science,* Vol. 43, No. 9, pp. 1258-1274.

Hofstede. G, (1980), "Culture' consequences, International Differences in Work Related Values", *Vol. 5, Cross Culture Research and Methodology Series*, SAGE Publications, London

Hofstede. G, (1994), *Culture and Organization: Software of Mind. Harper,* Collins Publishers, London

Idris, M. A., McEwan, W., and Belavendram, N. (1996). ''The adoption of ISO 9000 and total quality management in Malaysia.'' *The TQM Magazine,* 8(5), 65–68. Journal of Project Management 15: 235-243

Kanji, G. and Wong, A. (1998). "Quality Culture in the Construction Industry." *Total Quality Management and Business Excellence,* Vol. 9, No. 4&5, pp. 133-140.

Khilji S.E. (1990), "Management in Pakistan", *International Encyclopedia of Business and Management.* Warner M (ed). International Thosmson, London.

Khilji S.E. (2001), "Human Resource Management in Pakistana". In P Budhwar and D. Yaw (eds) *Human Resource management in Developing Countries*, Routlede London.

Love, P. E. D., Li, H., Irani, Z., and Holt, G. D. (2000). ''Rethinking total quality management: Toward a framework for facilitating learning and change in construction organizations.'' *The TQM Magazine,* 12(2), 107–116.

Love, P.E.D. and Heng, L. (2000), "Total quality management and the learning organization: a dialogue for change in construction", *Construction Management and Economics*, Vol. 18 No. 3, pp. 321-31.

Low, S. P., and Peh, K. W.(1996) ''A framework for implementing total quality management in construction.'' *The TQM Magazine,* 8(5), 39–46.

McCabe, S. (1996). ''Creating excellence in construction companies: UK contractors' experiences of quality initiatives.'' *The TQM Magazine,* 8(6), 14–19.

Motwani, J. (2001).''Critical factors and performance measures of total quality management.'' *The TQM Magazine,* 13(4), 292–300.

Oakland, J.S. and Aldridge, A.J. (1995). "Quality Management in Civil and Structural Engineering Consulting". *International Journal of Quality and Reliability Management,* Vol. 12, No. 3, pp. 32-48.

Quazi, H. A., and Padibjo, S. R.(1997). ''A journey toward total quality management through ISO 9000 certification-a Singapore experience.'' *The TQM Magazine,* 9(5), 364–371.

Torbica, Z.M. and Stroh, R.C. (1999) "Impact of Total Quality Management on Home-Buyer Satisfaction", *Journal of Construction Engineering and Management*, 125(3), 198-203

Wong, A. (1999). "Total Quality Management in the Construction Industry in Hong Kong: A Supply Chain Management Perspective". *Total Quality Management and Business Excellence,* Vol. 10, No. 2, pp. 199-208.

Yong, J, and Wilkinson, A. (2001). "In Search of Quality: The Quality Management Experience in Singapore". *International Journal of Quality and Reliability Management,* Vol. 18, No. 8, pp. 813-835.

Zantanidis, S. and Tsiotras, G. (1998), "Quality management: a new challenge for the Greek construction industry", Total Quality Management, Vol. 9 No. 7, pp. 619-32.