

TQEM IN THE UK CONSTRUCTION INDUSTRY: SOME KEY FINDINGS FROM A SURVEY

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As building projects get larger and more complex, clients are also increasingly demanding higher standards for their delivery. Total Quality Environmental Management (TQEM) has been recognized as a successful management philosophy in the manufacturing industries. TQEM can likewise be embraced in the construction industry to help raise its environmental standards, quality and productivity. Construction firms have been continually struggling with TQEM implementation. Historically, construction has been an industry reluctant to implement change. Consequently, it has remained behind where it should be on the implementation of TQEM. Generally, the principles of TQEM are not applied beyond management levels within general contractors. This paper reports on a study to identify those factors that hinder the implementation of TQEM principles in the actual field operations of a construction jobsite. This paper presents a survey result on UK construction companies. It investigates the key successful factor, barriers, benefits that may result from implementing TQEM. The results illustrate TQEM can be successfully implemented in the construction industry towards sustainable development (SD). 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. TQEM 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 conceptual framework for implementing TQEM in construction is recommended.

Keywords: construction, environment, quality, total quality environmental management (TQEM).

INTRODUCTION

Total quality environmental management (TQEM) is a philosophy and presents a business system that companies should adopt to achieve organisational excellence (Zhang 2001, Pheng and Teo 2004). The adoption and implementation of TQEM initiatives have, in the main, been spearheaded by the manufacturing sector; the UK construction industry has lagged behind under-achieving (Egan 1998, Barrett 2008).

Integrating TQEM in construction industry is a relatively new field, especially in the UK (Pheng & Teo 2004). TQEM could be a solution for better and sustainable construction (Egan 1998, Lahndt 1999). Thereby, it is necessary to translate TQM

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principles, practices and techniques in manufacturing to construction. Few studies can be found on implementing separate TQEM initiatives in an attempt to tie a TQEM approach to other, existing construction management systems, such as project-management, partnership, Quality-Assurance Plan (QAP), Life Cycle Analysis (LCA), Quality Function Deployment (QFD), Jobsite Quality Planning (JQP), Just in Time (JIT), ISO 9000 and 14000 standards (Love et al 2002).

This paper contributes to that debate by suggesting the importance of starting from investigating the UK construction companies' current approaches on TQEM. It presents a survey results and discussion performed in 2007 as part of a multi-level research project for developing TQEM framework for the UK construction industry. The paper begins with a description of the methodology employed. The survey result presented illustrates construction companies TQEM different approaches, performances, initiatives implemented, demand for TQEM, the key factors for implementation, key performance indicators, the benefits that may occurred, limitations, barriers, performance measurement systems. The paper discusses the main findings and concludes further research suggestions.

RESEARCH METHODOLOGY

There has been considerable debate in the Construction Management (CM) literature as to which research methodology is the most appropriate to CM research problems (Naoum 1998). This section discusses the methodology this study undertakes.

Data Collection Method

The objective is to investigate to what extent UK construction industry has implemented TQEM initiatives and to examine the key factors affecting this implementation. This requires a broad and deep data collection. An analytical survey that covers the breadth required to a certain extent (Love et al; 2002).

On one hand, the survey is more suitable for answering the "what" question rather than the "how" one (Naoum 1998). Therefore, an analytical survey is appropriate to the research objectives. A statistical web designed questionnaire was used which carried more weight compared to normal style questionnaire in the respondents eyes. Its easy to use and submit resulted in a higher response rate. The data entry and tabulation, in this method, can be done easily with statistical software packages such as Statistical Package for Statistical Scientist (SPSS), Adobe Acrobat 8.5 and Excel XP.

E-mailed questionnaires are not without weaknesses. In mail questionnaires, all the questions are presented to the respondent at the same time and the investigator has no control over the order on which the questions are answered as in interview situation. In this sense, the interview offers more flexibility, terms can be clarified, and further details can be obtained. In emailed questionnaires only sample questions can be asked (Yin1994). The degree of detailed investigation carried out in case studies is unattainable in a mail questionnaire. Another disadvantage is that the response rate of mail questionnaires is generally lower than other methods such as interviews (Yin1994). Because of this, the questions were designed leaving spaces for the correspondents' comments and suggestions. While different multi-level research methodologies are implemented through out the mother project.

Questionnaire Design

In designing the questionnaire, attention was paid to the types, format, sequence and clarity of the questions. Initially, it consisted of four parts, starting with the company background including the annual turnover, number of employees, company's construction activities and the respondent title. The second section of the questionnaire was used to determine the demand, and the level of implementing or addressing TQEM. Third section involves in examining the standards and techniques enhanced by construction companies and the associated benefits and barriers they have experienced. Finally, asking about the performance measurement and what does sustainability means to their business. The closing question asked the respondent to indicate whether he is prepared for further research. The questionnaire first draft was tested and revised.

The Sample Selection

Two groups of companies were selected. First, through the university date contacts, 60 construction companies. A sample of 40 companies was selected from (www.hbf.co.uk) website. 100 questionnaires were posted with a cover letter to the companies that share the following criteria:

- All have branches in the Midlands (since this make them more approachable for further research).
- All companies are in the construction sector (companies with varied construction activities, size and building sectors).

THE RESULTS

The survey result presented in this section highlights construction companies TQEM different approaches, performances, initiatives implemented, demand for TQEM, the key factors for implementation, key performance indicators, the benefits that may occurred, limitations, barriers, performance measurement systems.

Response rate

57 respondents were returned by the specified deadline. However, 50 questionnaires only are considered for the following reasons:

- Three were not fully completed.
- Four were service from companies with no relevant construction activities.

Therefore, 50 responses were considered 50 percent response rate. The high response rate which was anticipated as 10 to 20 percent (Love et al 2002), may be due to contacts provided from the Nottingham Trent University. This high percentage, according to Love, enables the research from generalizing the results on UK construction companies.

Respondents' characteristics

Out of 50 respondents, 10 percent were general managers and 76.6 percent others. Four respondents indicated their title as quality manager.

The second and third questions were concerned with the company's size and lassification to ensure the research scope on TQEM in construction companies based in the UK.

Table 1: Respondents' characteristics

MD	Director Executive	Quality/Environmental/ Operations Manager	Others
10%	3.30%	10%	76.60%

Awareness of TQEM

Although, it was hypothesized that construction companies would not be aware of TQEM. fig:2 presents that respondents have been involved in TQEM recently. The highest percentage was 63 percent for 1-2 years involvement in TQEM. On other hand no company in the sample has been involved in TQEM for more than ten years. 6.6 percent of the responses are neither aware nor addressing TQEM, with no demand for EM techniques in their activities as their answers for questions six and seven indicate. This suggests that construction companies' awareness of TQEM is immature.

Table 2: Awareness of TQEM

Not yet	<1	1-2	3-5	5-10	>10
7%	13%	63%	10%	7%	0%

Strategic levels of integrating TQEM

The correspondents were asked to rate their TQEM implementation using the following definitions;

- **Compliant:** which is the minimum level an organisation can adopt for being in compliance with quality, environmental, health and safety regulations.
- **Informed:** spending time and resources collecting information, as key activities to go beyond compliance and participate in external activities as a trade association.
- **Market-Driven:** in this sense, the response is not only to regulatory requirements, but also is "reactive" to clients' quality/environmental expectations in terms of providing leading product/services and operational performance.
- **Competitive Advantages:** within this level, an organisation understands its quality/environmental market opportunities and navigates to leadership market position by proactively using knowledge.
- **Sustainable:** the highest level when an organisation proactively integrates economic growth; quality, environmental, health and safety and social well-being.

63.1 percent of the respondents evaluate their TQEM performance in the compliance level. That matched the previous results which indicate their recent involvement with TQEM. 16.4 percent claim to be at the informed or market driven level.

It is worth mentioning that the 6.6 per cent of responses at the competitive level are two medium size companies with environmental management and quality management departments.

Table 3: Strategic levels of integrating TQEM

Compliant	Informed	Market Driven	Competitive	Sustainable
63%	16%	13%	7%	0%

The demand for TQEM

The results tend to show TQEM as a critical issue for UK construction industry. Out of 76.6 percent of the companies who anticipate a demand for TQEM in their activities, 65,2 percent said that TQEM is required for all their activities whereas 34.8 percent found a demand in specific activities, required by legislation in many cases.

In an effort to translate this demand for TQEM to actions, most of the companies seem to seek the quality and environmental frameworks given by the standards such as ISO9001 and ISO14001 thinking that it is the solution. Tab:4 illustrates the significant trend to register for ISO 9001 with 40% compared to ISO 14001 with 3% only.

Yet, only 6 percent of the responses appear to be neither accredited nor addressing any standard. Hence, their response to the questionnaire, as well as some conducted interviews, show that they feel it's increasingly importance but not making sense for their business yet.

Table 4: Construction companies and the standards

Accredited				
ISO:9001	ISO:14001	BS	Non	Other
40%	3%	0%	0%	3%
Addressing				
ISO:9001	ISO:14001	BS	Non	Other
37%	7%	3%	7%	6%

In conclusion, there appears to be increasing awareness of ISO9001, in contrast to the ISO 14001, among construction companies indicating the shallow awareness towards environmental management comparing to quality management. To this point the question is what benefits may be achieved through these systems, which leads to next results

The Benefits

Unsurprisingly, cost saving was rated as the first benefit. Moreover, most of the respondents appear to use the ISOs as a tool for measuring their performance. Interestingly, 43.3% of the respondents consider it as a customer satisfaction tool. 23.1% consider environmental standards are a way for increasing quality. Competitive advantages, market driven and more efficient operations are considered to be vital benefits.

Table 6: The benefits realized as a result of the TQEM implementation

Benefits from TQEM						
Cost Saving	Customer Satisfaction	Market recognition	Increase Efficiency	Competitiveness	Profitability	Measuring Performance
57%	43%	23%	23%	20%	7%	50%

In order to determine the impact of the TQEM on the construction industry, the mean values for the benefits are shown in tab:6. A mean value above 2.5 was taken to indicate the positive impact on the given benefit. The values from tab:7 suggest that most of the given variables have a positive impact on the construction industry.

As illustrated in Tab:7, apart from cost saving, most of these factors may be anticipated as potential benefits for integrating implementation of TQEM. The question here is, if the benefits are so obvious why TQEM is not fully integrated yet. This leads to presenting the TQEM barriers.

Table 7: Mean values of derived benefits

Variable	Mean
Reduce construction costs	3.96
Better measuring performance methods	3.77
More customer focused through environmental and quality improvement	3.70
Speeding up the construction work	3.68
Construction quality improvements	3.68
Gaining competitive advantages	3.61
Improved methods of working	3.56
Better control over the construction process	3.54
Decreasing waste and rework during construction operation	3.43
Market recognition	3.23
Increase efficiency	3.23
Competitive advantages	3.22
Increase profitability	2.75
Better communication between stakeholders	2.68
Better coordination of activities	2.25
Reduction in lead time	2.20

The Barriers:

The main difficulties that cause the large gap to sustainable level in integrating TQEM from the respondent's point of view can be classified into critical barriers, namely;

- The lack of understanding of SD concept is presented in 46.6 percent of the respondents written answers. It indicates that SD appears to be a vague concept to construction industry.
- Getting senior management commitment seems a significant barrier 23.1 percent of responses claim that SD as well as TQEM does not make sense from business point of view.
- 20 percent of the respondents indicate that the real integration of TQEM appears to be difficult and not clear to their organisations.
- 10 percent suggested that construction companies do not find any customer demand for environment management. This percentage casts doubt on around Porter's hypothesis presented in the second chapter.
- Lack of resources was considered to be a barrier with 20 percent of responses.
- Not finding time for such concepts was suggested by 10 percent.

Table 10: TQEM barriers

No difficulties	Senior management commitment	Understanding TQEM and SD concepts	Implementati on of EM	No customer demand	Limited time and resources	Measuring Performance
10%	23%	65%	20%	10%	20%	10%

As presented in tab:10, 10 per cent claim to find no difficulties in integrating TQEM although they are still not at a low level of TQEM. The lack of innovation was described in different ways within this open answer. Getting people engaged and committed appears to be a difficult task to them.

Construction companies and the SD concept

Various degree of understanding of SD were found when asking about the extent to which company's strategic planning considers SD risks and opportunities, 36.4 from the respondents indicated that SD threats and opportunities are addressed at the broad discussion level. While 19.8 percent presents dealing with SD as a routine evaluation of social, environmental and economical risk. 43.2 percent skipped this question, keeping the question open on whether SD is a clear concept to business yet (Table 9).

Table 9: Construction companies and SD

Board discussion on integrating sustainable development for the business	Board discussion on integrating sustainable development for the business	Other
47%	17%	27%

Measuring construction companies TQEM performance

When asking about the their main indicators regarding measuring the company performance, most of the respondents appear to depend on financial indicators as can be seen in Tab:10. While as, the quarterly review appear to be common among the respondent as presented in Tab:9.

Table 10: Measuring construction companies TQEM performance

Financial	Non financial	Both	Social and Environmental Accounting Framework	Other
47%	17%	27%	3%	7%

Table 11: Measuring construction companies performance frequency

Monthly	Quarterly	Yearly	Others
37%	40.00%	20%	3.30%

The previous three sections suggest that the TQEM problems, wither it source is external on internal, from a construction company perspective can be classified into, Tangible difficulties e.g. the limited resources, time, expertise and capabilities. This should be linked to the company size.

Intangible barriers that appear to add another invisible wall such as;

- Construction industry considers itself cost, time and quality focus with a little interest towards environment and sustainability issues
- Stockholder lack of awareness;
- Lack of quality and environmental performance indicators;
- Acceptable culture of prioritizing cost and time as client demand;
- Understanding TQEM and SD concepts.

CONCLUDING REMARKS AND FUTURE RESEARCH

This paper has presented a survey undertaken in 2007 on implementing TQEM in the UK construction sector. The main findings illustrate construction companies' awareness, demand, practices, barriers and the benefits that may occur from integrating TQEM's initiatives. It highlights the areas that should be given a high priority for successful integration e.g. senior management commitment, the need for a phased approach for effective integration.

The survey illustrates the benefits construction companies have experienced out of implementing separate quality and environmental initiatives. Thus, TQEM barriers in the UK construction industry are attributed to external factors such as poor building materials or purchased parts as well as the problems stem from internal sources such as management commitment, workforce, maintenance or adjustment of equipment or processes. The construction managers tend to subordinate quality and environmental objectives to the drive to meet project schedules. The basic approach of TQEM puts customer satisfaction as the driving force behind quality and environmental practices. Thereby, the internal and external customer focus of the construction or service becomes the main consideration for determining standards and measuring performance.

Another important characteristic of the TQEM approach is continuous improvement. In general, TQEM organization should be dynamic and constantly striving to improve. This highlights the need for better performance measurement system that comprise aggregated quality and environmental performance indicators. Achieving TQEM excellence requires a framework for construction industry. A phased approach is suggested to translate the concepts of TQEM and SD into business language through adding value approach and construction industry nature consideration. Failure is doomed if a design is not geared toward customer needs, or if the project is not geared toward meeting design specifications for example. TQM practices require the cooperation across all construction procurement stages, even though each department has a different understanding about TQEM practices. Based on this survey a framework for implementing TQEM will be developed and tested through various case studies considering two-dimensional grid (internal-external focus and measures) to facilitate construction companies achieving more sustainable competitive advantages through TQEM.

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