Implementation of Total Quality Management (TQM) in the Libyan Construction Industry (LCI)

Shibani, A.
University of Coventry, UK
(email: shibania@coventry.ac.uk)
Soetanto, R.
University of Coventry, UK
(email: robby@coventry.ac.uk)
Ganjian, E.
University of Coventry, UK
(email: ganjian@coventry.ac.uk)

Abstract:

Purpose: The purpose of this paper is to present the main factors influencing the success of total quality management (TQM) implementation in the Libyan construction industries (LCI). And identify most important factors based on a survey of Libyan construction companies. **Methodology approach:** In order to achieve this objective literature review has been carried out to identify the main factors influencing the implementation of TQM in the Libyan construction industries. This was followed by a survey in the form of a number of questionnaire and interviews. **Survey and analysis:** A total of 130 fully completed questionnaires were returned giving a response of 65 percent. Among of these participating organizations about 36% to the private sector whereas 63% were government organization. The survey is analysed using IBM's SPSS software package (originally, Statistical Package for the Social Sciences). Based on principal component analysis (PCA) the results reveal the internal structure of the data in a way which best explains the variance in the data.

Keywords: TQM, Libyan construction industry, factor analysis, PCA

1. Introduction

Well-implemented Quality Management System (QMS) can be one of the most important forces leading to organizational growth and success in national and international construction markets. In the competitive business climate it is critical for construction companies to provide consistently high - quality products and added-value to their clients and customers.

The research investigates main factors influencing successful total quality management (TQM) implementation in the Libyan construction industries (LCI). The construction industry in Libya, like anywhere else, is affected by the country's economic cycle. However discovery of oil was a turning point in Libya for industries such as construction etc. It brought great development to the construction industry in general as the government was able to spend substantially on construction. On other word the construction industry in Libya suffers from a shortage of skilled labour and poor quality and low productivity however. Libya, as a developing country, has been through a number of problems concerning quality, however, it has recently started liberalising its economy and opening it to competition, both at the national level and the global level. (Sandholm,1999). A total of 200 fully completed questionnaires were returned giving a response of 65% among of these participating organisations 36.2% were from private sector whereas 63.8% were government organisation. The objectives of the present study to is to present the main factors influencing successful total quality management (TQM) implementation in the Libyan construction industries (LCI).

2. Research methods

The objective of the research was to assess TQM implementation initiative in a number of contracting organisations to explain and identifying the main factors influencing the TQM implementation, on the other hand As Arabic is the main language spoken in Libya, not many people can speak English especially in the construction industry, it is necessary to provide the questionnaire in Arabic, However, some English terms are commonly used in the construction industry in Libya, and there are only a small number of non-Arabic speakers working in this sector. To speed up the response, the questionnaires will be distributed and collected personally by hand during the interviews. This method is effective because there is direct communication between the researcher and the respondent. On the Other hand the City of Tripoli was employed as the location where the research was conducted, Data were obtained through questionnaires supported by a set of interviews, this was achieved by visiting firms and projects under construction in Tripoli then the data gathered was analysed by using Statistical Package Social Science (SPSS package) 16.0 windows.

3. Questionnaire & interviews

As the first step of delivering the questionnaires, a formal letter was sent to all organisation providing a general idea about the survey in addition the research encourage the participants to complete the questionnaires on time

However 200 hard copies of the survey questionnaires were distributed to the construction companies in Tripoli (Libya). Each copy of the questionnaires was accompanied with another letter from the researcher providing explanation about the idea outcomes beyond conducting this survey. A total of 130 fully completed questionnaires were returned giving a response of 65% among these participating organisations 36.2% were from private sector whereas 63.8% were government organisation. So the research made number of interviews conducted at the preliminary literature review stage to support the preliminary review where the interviews helps in identifying the major problems in the (LCI) such as lack of top management commitment, culture and employees barriers, and managerial barriers. The preliminary stage of this research focused on the observation and analysis of the construction industry in Libya at this stage of identifying the problems this approach also used to collect data of TQM in Libyan construction industry.

4. The chart of TQM questionnaire

The design of the questionnaires and the selection of the statement resulted from two sources where the first source was conducting a comprehensive study of total quality management and its principles and the second source was the field study and interviews.

The figure represents the flow chart of the TQM questionnaire, showing the demographic questions and the TQM questions regarding to the key elements implementing of TQM such as management commitment and leadership (MCL), communication (COM), training and education (TRA), teamwork (TEA), employees empowerment (EMP), culture (CUL).

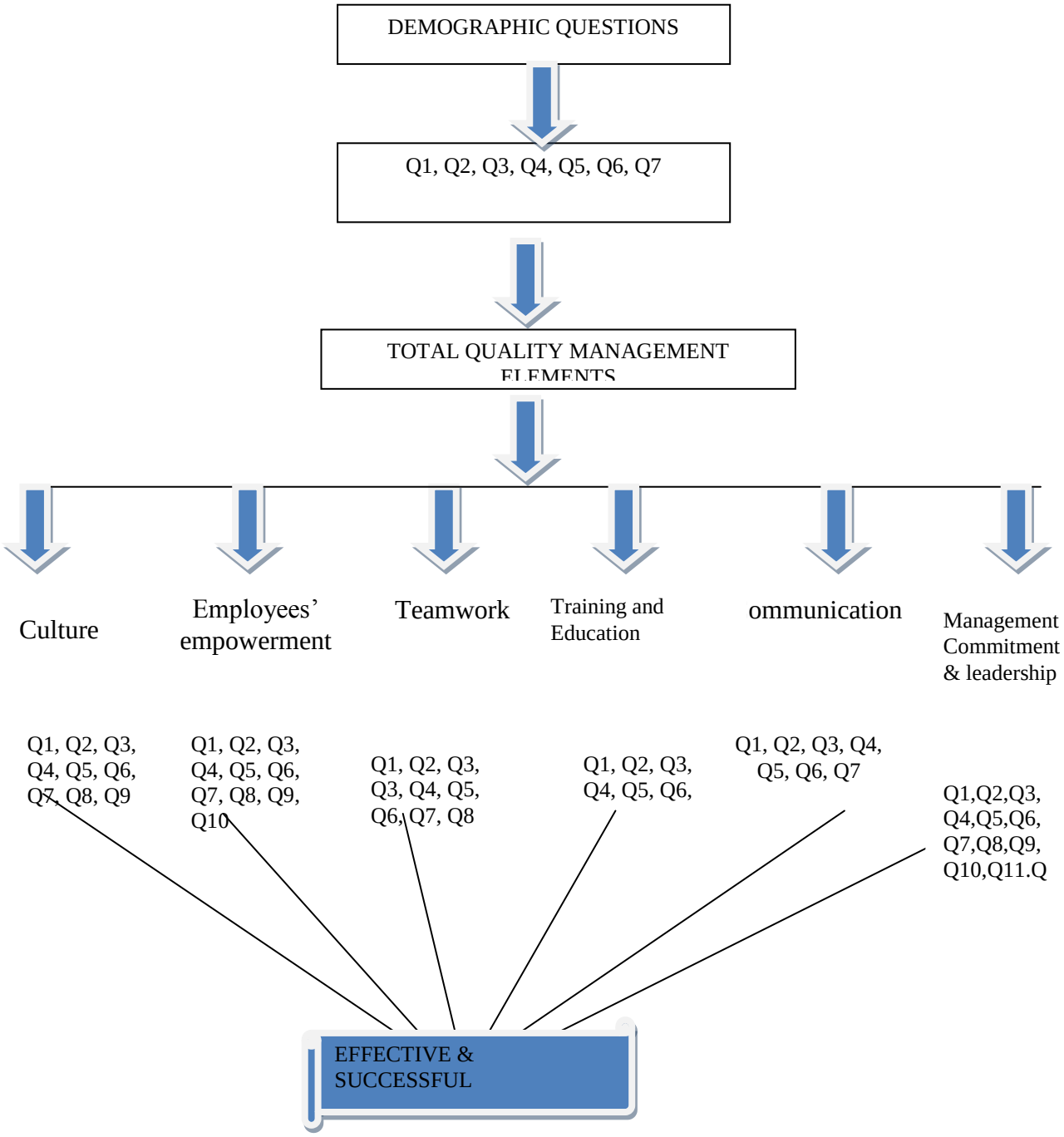

Figure 1: Chart of TQM questionnaire

5. Demography questions

To identify the demographic data of the key factors in the Libyan construction industry (LCI) respondents were asked questions related to their gender, age, education, qualification, years of experiences, size of company and number of employees and so on. Therefore, participants were asked to indicate their gender by placing a tick to the relevant options provides (male or female). All 130 participants responded. Of the 130 respondents 106 (81.5%) were male and 24 (18.5%) were female. This is indicates majority of respondents who working in the construction industries were male. Frothy three percent of the overall respondents had first degrees, thirty percent of the total respondents had a master, and 13 percent had a secondary school. Ten of the respondents had a PhD. This demonstrates that the respondents were educated workforce having sufficient technical knowledge.

The respondents were asked to indicate the length of time they had been working in the construction industry and their current firms or organisations they work at. The purpose of these questions was to identify the respondents experience and the stability in their work background. 16 percent of the sample had been working in construction Industry for 6-10 years and 26 percent had been working in the construction for 11-15 years in and about 23 percent worked in the construction industry between 16-21 years, and only 6 % less than 5 years. also 27 percent more than 21 years. These results indicate that most respondents were experienced in the construction activities and operations.

6. Factor analysis (FA)

According to (Kirlinger, 1996) factor analysis is "powerful and indispensable method of construct validation" Factor analysis can be defined as a group of statistical techniques whose common objective is to represent a set of variable in term of a smaller number of hypothetical variables or factors.

Chatfield and Collin, (1992) define the factor analysis (FA) is a data reduction techniques that uses the correlation between data variables. The underlying assumption of factor analysis is that a number of factors exist to be explaining the correlation or inter relationships between observed variables. Firstly the FA performed on all the variables (53) variables using principle component extraction (Tabachnick and Fidell, 1999), the main objective for this technique to extract the maximum variance from the data set within each factors. However, each statement on the questionnaires was coded as VAR1, VAR2, and VAR3 and so on.

7. Results of factor analysis

The result of the output obtained in this could be presented a followed:

The 53 items in the survey were made on a four point likert scale where 1 implied strongly disagree and 4 Indicated the respondent strongly agree with the statements. The 53 item of the questionnaires were inter

correlated and subjected to an exploratory factor analysis (EFA) based on the principle component analysis (PCA) with Promax rotation was conducted using SPSS package version 16.0 to detect the factor structure in the variable .

Inspection of the correlation matrix reveals the presence coefficient of 0.3 and above the Kaiser Meyer Oklin (KMO).

The BARTLETT`S TEST OF SPHERICITY (APPROX.CHI-SQUARE) as shown in the Tables 7.19 reached statistical significance, supporting the factorability of the correlation matrix.

Table 7.16: show KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		*.728*
Bartlett's Test of Sphericity	*Approx. Chi-Square*	*15910.220*
	df	*1378.000*
	Sig.	*.000*

(Kaiser, 1974) "recommended accepting value greater than 0.5 as barely acceptable, value between 0.5 and 0.7 are mediocre, value between 0.7 and 0.8 are good, value between 0.8 and 0.9 are great and value above 0.9 are superb. (Field, 2005). This indicates the value in our case 0.728 that indicate good.

According to (Norusis, 1994) the value of Kaiser-Meyer-Olkin (KMO) below 0.5 that indicated this value unacceptable and the high KMO measures allows more meaningful analysis to be obtained , this can be confirmed by Bartlett's Test of Sphericity which tested and Chi-Square test was significant this indicating that principle component analysis PCA can be meaningful applied

(Torbico, 1997) PCA used to produce a structure matrix of variables after rotation where the number of component determined was based on the criterion that the Eigen value for each component must be more that one this method can be referred also as Kaise`s criterion however this derived five principle component which explain 83 percent of variation in the variable Table shows

Table 7.17: Eigen value, percentage and total variance explained

Component	*Initial Eigen values*		
	Total	*% of Variance*	*Cumulative %*
1	*34.940*	*65.924*	*65.924*
2	*3.058*	*5.770*	*71.694*
3	*2.817*	*5.315*	*77.009*
4	*1.758*	*3.316*	*80.325*
5	*1.532*	*2.890*	*83.215*
6	*.965*	*1.821*	
7	*.893*	*1.686*	
8	*.849*	*1.601*	
9	*.780*	*1.472*	
10	*.760*	*1.434*	
11	*.594*	*1.121*	
12	*.540*	*1.018*	
13	*.442*	*.835*	
14	*.347*	*.655*	

15	*.318*	*.600*	
16	*.277*	*.523*	
17	*.264*	*.498*	

Note: components 18-53 are not shown

8. Factor Extraction

Factor analysis with principal component extraction, using a promax rotation, was performed on the fifty -three management practice items to determine the number of factors. Besides using the scree plot as a guide to decide on the number of factors to be extracted, the KMO method (Eigen value greater than 1) was used, explaining 66%, 5.7%, 5.3%, 3.3%, and 2.8% of the variance respectively. Five factors were extracted which are bolded in Table 7.20

Table 7.20: Eigen values and % of total variance explained of TQM elements:

Total Variance Explained						
Component	*Initial Eigen values*			*Extraction Sums of Squared Loadings*		
	Total	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*
1	*34.940*	*65.924*	*65.924*	***34.940***	***65.924***	***65.924***
2	*3.058*	*5.770*	*71.694*	***3.058***	***5.770***	***71.694***
3	*2.817*	*5.315*	*77.009*	***2.817***	***5.315***	***77.009***
4	*1.758*	*3.316*	*80.325*	***1.758***	***3.316***	***80.325***
5	*1.532*	*2.890*	*83.215*	***1.532***	***2.890***	***83.215***
6	*.965*	*1.821*	*85.036*			

7	*.893*	*1.686*	*86.722*			
8	*.849*	*1.601*	*88.323*			
9	*.780*	*1.472*	*89.795*			
10	*.760*	*1.434*	*91.229*			
11	*.594*	*1.121*	*92.350*			
12	*.540*	*1.018*	*93.368*			
13	*.442*	*.835*	*94.203*			
14	*.347*	*.655*	*94.857*			
Extraction Method: Principal Component Analysis.						

Note components from 15 - 53 are not shown.

We can see that the first few factor explain relatively large amount of variance (especially factor 1 where the factor 1 equal 34.940%. SPSS extract all factors with Eigen value greater than 1 and the percentage of variance explained in the column which labelled Extraction sums of squared loading.

Table 7.22 shows the Correlation between component are medium high Interco relation between component, this indicate that variable in one component are also highly correlated with variables in other component

Table 7.22 shows components correlation matrix

Component Correlation Matrix

Component	*1*	*2*	*3*	*4*	*5*
1	*1.000*	*.736*	*.676*	*.624*	*.433*
2	*.736*	*1.000*	*.750*	*.690*	*.580*

3	*.676*	*.750*	*1.000*	*.696*	*.417*
4	*.624*	*.690*	*.696*	*1.000*	*.392*
5	*.433*	*.580*	*.417*	*.392*	*1.000*

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.

The final part of the out put is correlation matrix between the factors (SPSS output 7.22). This matrix contains the correlation coefficient between factors. as predicted from the structure matrix, factor 2 has high relation with any other factors (correlation coefficient are high)

9. Conclusion

- From the interviews the researcher found that there was a clear lack of implementation of the critical success factors CSFs of TQM demonstrated through features such as, lack of knowledge of QM and lack of management commitment

- In my view the Libyan organisation are still in the early stage where most of the, Libyan companies was introduced ISO9000 only just prestige because some of local companies have been certified ISO9000.

- There are weakness in communication and information system in the LCI ,the present system in the LCI are based on paper and verbal formats this result low quality and low flow of information

- Libya is not yet ready to accept and adopt TQM because the lack of infrastructure, top management are not keen to be involved in adopting TQM due to lack of education, skills, By this reasons the implementing of the quality management in Libyan construction industry difficult and take long time to understanding the exactly meaning of quality management system and how to implementing.

- Unfortunately some managers working in companies mentioned the policy of the company and government does not allowed the willing to get employees involve delegate them some authority, in this case the employees could not take a decision until back to the management (leadership, supervisors).

References

Ahire, S., Waller, M., Galhar, D. (1996), "Quality management in TQM versus non-TQM firms: an empirical investigation", *International Journal of Quality & Reliability Management*, Vol. 13 No.8, pp.8-27.

Al-Hamdany, A. H. (1999) the managerial problems in Yemen, The Second

Economical Conference of Yemen, A l-Thawabit Publication Institute.

Al-Khalifa, N. and Aspinwall, E. M. (2000) The development of total quality management in Qatar, TQM,V12,N3.PP.194-204

Baidoun, S. (2003) An empirical study of critical factors of TQM in Palestinian Organizations logisticsI nformation Management,1 6, pp 156-171

Dean, J., Evans, J. (1994), *Total Quality Management, Organization and Strategy*, West Publishing, St Paul, MN

Evans, J., Lindsay, W. (1993), *The Management and Control of Quality*, 2nd ed., West Publishing, St Paul, MN

Hesham A.E. Magd. 2006 An investigation of ISO 9000 adoption in Saudi Arabia

Vol. 21 No. 2, pp. 132-147

Kanji, G. K. and Tambi, A. M. (2002) Business excellence in Higher Education, Comwall, UK,

Kerlinger, F.N. 1994. *Foundations of Behavioural Research*. 3rd Edition. New York: Holt, Rinehart and Winston.

Norussis, M.J. (1998), *SPSS 8.0 Guide to Data Analysis*, Prentice-Hall, Englewood Cliffs, NJ

Oakland, J. (1996), *Total Quality Management, Text with Cases*, Butterworth-Heinemann, Oxford

Pallant, J.2007. SPSS survival manual a step by step to data analysis using SPSS for windows .

Sandholm, L. (1999). Section 37. Quality in Developing Countries. In Juran, J.M. and Godfrey, A.B. (Eds.) *Juran's Quality Handbook*. 5th Ed. New York: McGraw-Hill.

Sandholm, L. (1999), "Quality in developing countries", in Sinba, M. (Eds),*The Best on Quality*, ASQ Quality Press, Milwaukee, Vol. 10 pp.353-66

Tabachnick,B. Fidell,L.(1999) Using multivariate statistics, London

Thiagarajan, T. and Zairi, M. (1998) An empirical analysis of critical factors of TQM: a proposed tool for self-assessment and benchmarking purposes.

Benchmarking for Quality Management & Technology, 5, pp 291-303.

Torbica, Z.M. and Stroh, R.C. (1999), "Impact of total quality management on home buyer satisfaction", *Journal of Construction Engineering and Management*, Vol. 125 No. 3, pp. 198-203.

Torbica, Z. M., and Stroh, R.C. (1999). Impact of total quality management on home buyer satisfaction. *J. Construction Engineering and Management*, Vol.125, No. 3, pp 198-203

Zairi, M. (1993). *Total Quality Management for Engineers*. Houston, TX: Gulf.

Zairi, M. (1999). Managing excellence: leadership. *The TQM Magazine* 11(4): 215-220.

Zairi, M. and Youssef, M. (1995). Benchmarking critical factors for TQM. Part I: theory and foundations. *Benchmarking for Quality Management & Technology* 2(1): 5-20.