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Implementation of total quality management (TQM) in the Libyan construction industry (LCI)

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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.

Findings: the paper identified five reliable and valid TQM constructs which are Top management commitment, Communication to improve quality , Teamwork to improve structures for improvement , Employee's Empowerment and involvement and work environment and Culture.

Introduction:

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

In today's competitive market there are many challenges facing Libyan construction industries. The ability of Libyan companies of effectively introducing quality management approaches such as Total Quality Management (TQM) is one of the major challenges to Libyan industries. TQM can empower employees and improve the organizations ability to respond to international competition.

The research investigates main factors influencing successful total quality management (TQM) implementation in the Libyan construction industries (LCI). The construction industry in Libya, similar the other developing countries, is affected by the country's economic cycle. The discovery of oil was a turning point in Libya for industries such as construction. It brought great development to the construction industry in general as the government was able to spend substantially on construction. However, the construction industry in Libya suffers from a shortage of skilled labour and poor quality and low productivity.

Literature Review

Libya, as a developing country, has experienced a number of problems concerning quality, Recently, as (Sandholm, 1999) observes, Libya has started liberalising its economy and opening up to competition, both at the national level and the global level. Sandholm based the research on a total of 130 fully completed questionnaires, which 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).

Arabic countries have made many efforts to implement Quality Management. These countries include Dubai, Bahrain, and Saudi Arabia. This is indicated by (AL-Omem, 2002), and (Al-Qahtani, 1993) in Saudi Arabia. Al Kalifa and aspinwall (2000) in Qatar. (Al Zamany *et al* 2002) in Yemen. (Al-Khawaldeh ,2002) in Jordan and Hesham and Magd (2003) in Egypt. The majority of Arabic countries are still in the early stage of implementing quality management initiatives QMS and TQM. They all share the same restrictions:

- “Lack of management commitment, vision and planning and lack of constancy of purpose” – this can lead to the business only being run for a limited amount of time.
- Lack of skill and ability from the top and middle managements in the quality management field.
- There was a minimum level of awareness and understanding of TQM.

According to (Zairi, 1996): *“ all Arabic countries have to deal with these levels of misconception and poor understanding. ISO 9000 is only a licence to practice and only represents one pillar of the TQM philosophy. It is essential elements but not sufficient on its own”*

So he mentioned, that Arab managers and government unfortunately believe that ISO 9000 registration will bring miracle with it and can lead to superior competitiveness.

Factors influencing TQM:

Saraph *et al* (1989) defined the critical factors for TQM as “critical areas of managerial planning and action that must be practiced to achieve effective quality management in business unit”.

Many studied has been done related to CSFs used different methodologies such as Porter and Parker (1993), Ahire *et al* (1996), and Tamimi and Gershon (1995),

using a different set of factors Ramirez and Loney (1993), Black and Porter (1996), Zairi 1996, Badri et. al (1995) however those authors has attempt to investigate the critical success factors in the TQM in different set of factors

table 3.1 shows the authors and factors.

Table 3.1 Comparative Analysis of Various TQM frameworks .

TQM frameworks	Critical Success Factors														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Deming prize (2004)			■	■	■	■		■			■				
MBNQA (2004)		■	■	■	■	■	■	■	■	■	■				
EQA(2004)		■	■	■		■	■	■	■	■	■		■	■	
Saraph et al (1989)		■	■	■	■	■	■		■		■				
Oakland (1993)		■	■	■		■	■	■		■	■			■	
Flynn et al. (1994)	■		■	■	■	■	■			■					
Babbar and Aspelin (1994)	■				■		■	■							

Ahire et al. (1996)	■	■	■	■	■	■	■	■	■	■	■			■	
Black and Porter (1996)		■	■	■	■	■	■	■	■						■
Pheng and Wei (1996)			■			■	■			■	■				
Ang et al. (2000)		■	■	■		■	■	■	■		■				
Zhang et al. (2000)	■		■	■	■	■	■	■		■					
Nwabueze (2001)		■	■	■	■	■	■	■	■		■				
Thiagarajan et al (2001)		■		■		■		■	■						
Motwani 2001	■				■	■	■		■		■				
Tamimi 1998	■	■			■	■	■	■				■			

Note : Critical Success Factors

1 - Top management commitment

3 - Process quality management

5 - Education and Training

7 - Customer satisfaction

9 - Business results

2- Strategic quality management

4 - Design quality management

6 - Supplier quality management

8 - Employee empowerment and involvement

10 - Information and Analysis

11 - Benchmarking

12 - Resources

13 - Impact on society and environment

14 - Statistical process control

15 - Culture.

Critical Success Factors OF TQM in Arabic Countries

Many studies of TQM have been carried out in Arabic countries such as Saudi Arabia, Dubai, Bahrain and so on to study the total quality management implementation and these studies have measured the critical factors for TQM implementation in the Arabic countries some of them are:

(Baidoun, 2003), conducted an empirical study of critical factors for TQM in Palestinian organizations. The main focus of the study was to identify the critical quality factors for effective TQM implementation and to understand how they were implemented by Palestinian organizations.

The study revealed that nineteen quality factors were perceived as being critical for the successful implementation of TQM. These factors were identified and stratified into three tiers of criticality. Nine of them were addressed in the early stages of the implementation process. These nine most critical factors are:

Shown in the Table 4.1.

(Al-Nofal, 2004), conducted an empirical study of CSFs of TQM implementation in Kuwait. The study revealed that nineteen quality factors were perceived as being both critical and absolutely essential for the successful implementation of TQM. These factors were identified and stratified into three tiers of criticality, where nine of them were found to be critical: are shown in table

(Al-Omair, 2002), conducted research to find out how TQM is understood, received, and deployed in Saudi Arabia. The organizations which participated in his study identified twenty one factors as being critical for TQM implementation. These were classified into three tiers of criticality, with seven factors identified as critical. *Table 4.1 shows TQM critical success factors in Arabic countries.*

Table 4.1 TQM critical success factors in Arabic countries :

TQM frameworks	Country	Critical success factors*														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Baidoun 2003	Palestinian			X	X	X	X		X			X				
Al- Nofal	Kuwait		X	X	X	X	X	X	X	X	X	X				
Al- Omair	Saudi Arabia		X	X	X		X	X	X	X	X	X		X	X	
Al-Khalifa	Qatar		X	X	X		X	X	X		X	X			X	
Al- Anazi	Saudi Arabia	X		X	X	X	X	X			X					
Badri 1995	UAE	X				X		X	X							
Bubshait	Saudi Arabia	X				X		X	X				X			

After a thorough review of the perspective, partitioned and empirical literature on quality management, the author select six factors (53 variables) of critical quality factors, the critical factors that have been identified are:

1. Management Commitment and Leadership (MCL)
2. Communication (COM)
3. Training and education (TRA).
4. Teamwork (TEA)
5. Employees empowerment (EMP).
6. Culture (CUL).

Research Methods:

As Arabic is the main language spoken in Libya, not many people can speak English especially in the construction industry. It is, therefore, 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 were distributed and collected personally by hand during the interviews. This method is effective because there is direct communication between the researcher and the respondent. The City of Tripoli was designated 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 for Windows.

Data collection:

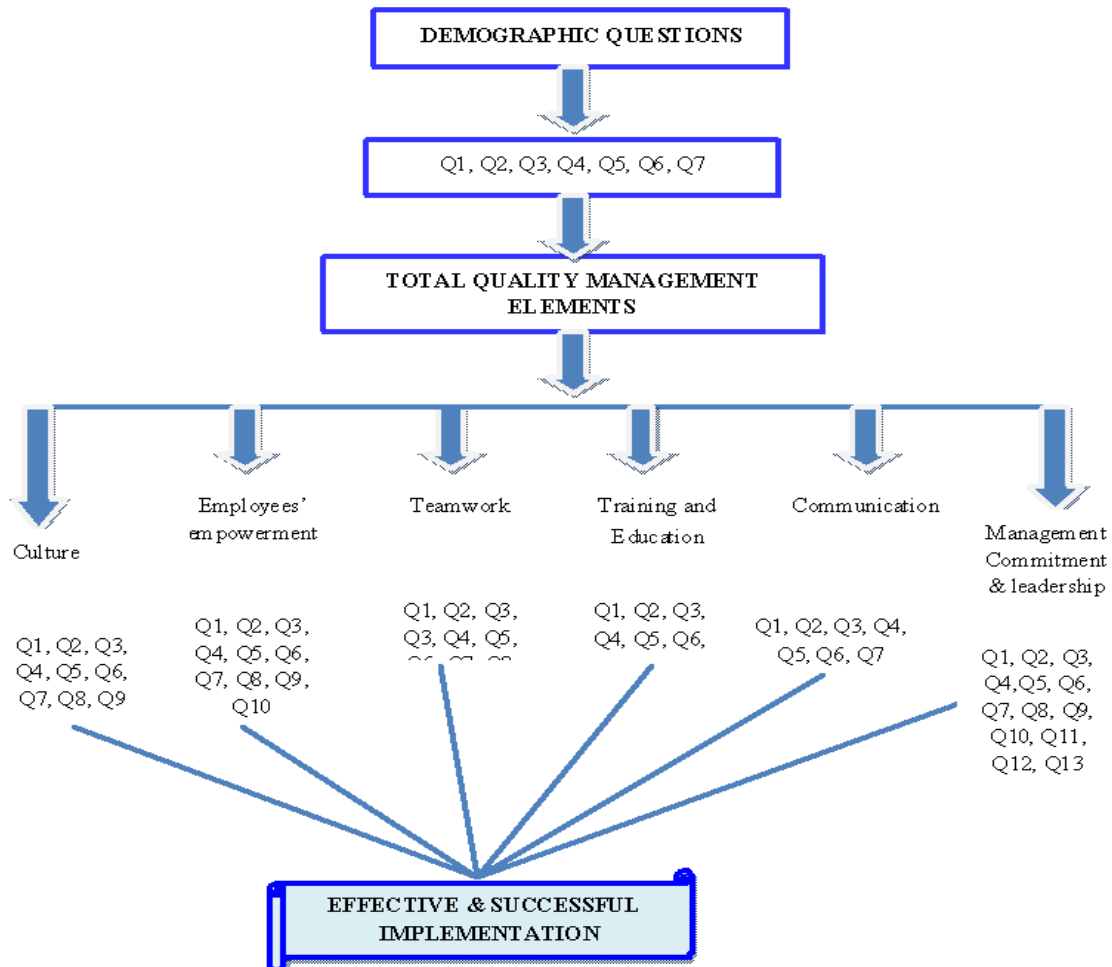
As the first step of delivering the questionnaires, a formal letter was sent to all organisation providing a general outline about the survey. In addition, the letter emphasised the importance for the participants to complete the questionnaires on time.

200 hard copies of the survey questionnaires were distributed to the construction companies in Tripoli (Libya). Each copy of the questionnaire was accompanied with a letter from the researcher providing explanation about the outcomes expected after conducting this survey. A total of 130 fully completed questionnaires were returned giving a response of 65 percent. Among the

participating organisations, 36.2% were from private sector and 63.8% were government organisations. The research questionnaires and interviews were sufficient to support the preliminary review. The interviews helped in identifying the major problems in the industry (LCI), such as lack of top management commitment, culture and employees barriers, and managerial barriers. The

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 chart of the TQM questionnaire. It shows the demographic questions and the TQM questions relating to the key elements for implementing of TQM such as, the following:

- Management commitment and leadership (MCL),
- Communication (COM),
- Training and education (TRA),
- Teamwork (TEA),
- Employees empowerment (EMP),
- Culture (CUL).

Respondent background:

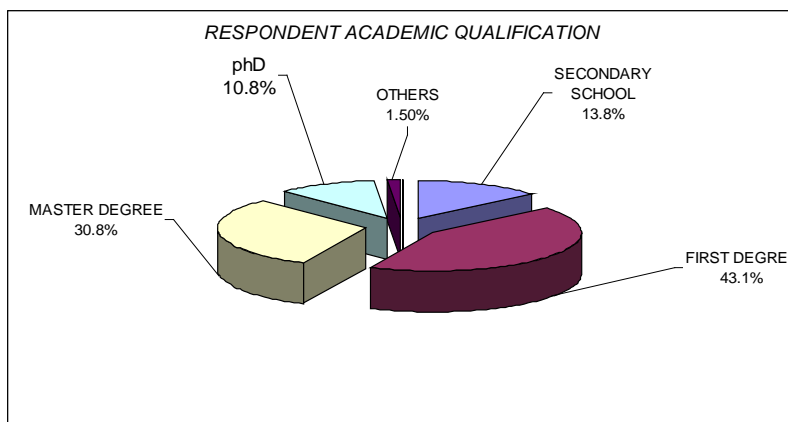
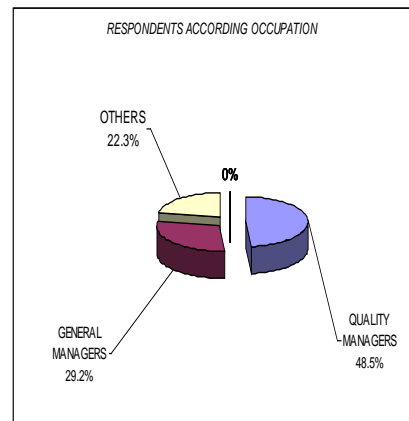
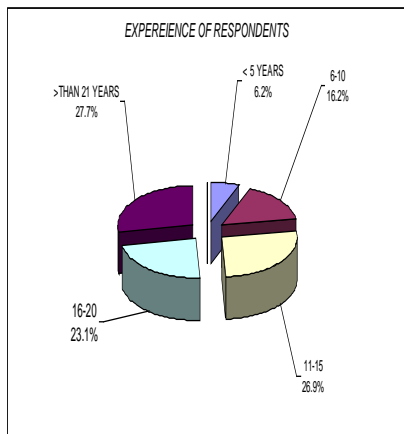
To identify the demographic data of the key factors in the Libyan construction industry (LCI) respondents were asked questions relating to their gender, age, education, qualification, years of experiences, size of company and number of employees and so on. Participants were asked to indicate their gender by placing a tick to the relevant options (male or female). All 130 participants responded. Of the 130 respondents 106 (81.5%) were male and 24 (18.5%) were female. This indicates majority of respondents who working in the construction industries were male.

Forty 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 an educated workforce having a high level of literacy and numeracy ability.

The respondents were asked to indicate the length of time they had been working in the construction industry and their current firms or organisations for whom they had worked. The purpose of these questions was to identify the respondents experience and the stability in their work background.

- 6 % less than 5 years
- 16 percent of the sample had been working in construction Industry for 6-10 years
- 26 percent had been working in the construction for 11-15 years
- about 23 percent worked in the construction industry between 16-21 years,
- 27 percent more than 21 years.

These results indicate that most respondents were experienced in the construction activities and operations. The number does not add up to 100 percent due to rounding errors.



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) as ‘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 explain 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.

Therefore the main goal of this analysis is to extract maximum variance from the data set with each factor.

Reliability and validity

Whatever procedures for collecting data are selected, they must be always tested critically to assess to what extent they are likely to be reliable and valid

However reliability is the extent to which a test or procedures produces similar results under constant conditions on all occasions. Saps Ford and (Jupp 1996)

Validity is an altogether more complex concept and the usual definition of validity is that it tells us whether an item or instrument measures. (Bell,2005) Cronbach`s alpha scores were computed for each of the categories (Management Commitment and Leadership, Communication, Training and Education, Team work, Employees empowerment, and Culture and Environment Work) to measure the internal consistency and to indicate how different items

Can be reliably measure the categories. (Kline 1998) pointed out that a reliability coefficient of around .090 can be considered as an “excellent” value around 0.80 as very good and a value of 0.70 as adequate. In this study all scales have reliability coefficient ranging. See Table 5.1.

The calculated value of Cranbach Alpha was found .979. According to (pallant 2001), a Cronbach`s Alpha coefficient of .070 or above is considered adequate for testing the reliability of the entire questionnaire, giving proof that the questionnaires for the present survey can be considered as reliable for the used sample (Salaheldin ,2009

Table 5.1 shows the reliability for all items

Reliability Statistics	
Cronbach's Alpha	NUMBER OF ITEMS
.979	53

Identification of critical success factors using factor analysis:

The result of the output obtained in this could be presented as follows:

The Likert Scale is an ordered, one-dimensional scale from which respondents choose one option that best aligns with their view. 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. EFA is recommended when researchers have no hypotheses about the nature of the underlying factor structure of their measure.

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 7.16 reached statistical significance, supporting the factorability of the correlation m.

Table 1 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 a value greater than 0.5 as barely acceptable; values 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) indicates the value, in our case 0.728, are good.

According to (Norusis, 1994) the value of Kaiser-Meyer-Olkin (KMO) below 0.5 are 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, indicating that principle component analysis PCA can be meaningfully applied

(Torbica, 1997) PCA was 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 than one. This method can be referred also as Kaiser's criterion. However, this derived five principle component explains 83 percent of variation, in the variable Table 2 shown.

Table 2 Eigen value, percentage and total variance explained

Component	Initial Eigen values		
	Total	Percentage of Variance	Cumulative Percentage
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

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 screen plot as a guide to decide on the number of factors to be extracted, the Kaiser`s criterion (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 3

Table 3 Eigen values and % of total variance explained of TQM elements:

Total Variance Explained (Note: components from 15 - 53 are not shown)						
Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	Percent of Variance	Cumulative Percentage	Total	Percent of Variance	Cumulative Percentage
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.						

We can see that the first few factor explain relatively large amount of variance (especially factor 1 where the factor 1 equal 65.924%. 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 4 shows the correlation between components are high Inter-relation between component, this indicate that variable in one component are also highly correlated with variables in other component

Table 4 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 (correlation coefficient are high). The research concludes that all the factors related to each other. Therefore the 53 items all were highly correlated with their respective constructs

Summary of the factors analysis:

The paper present the result of the study on the critical success factors for TQM implementation in the Libyan construction industry. A total of 6 factors with 53

variables were considered in the questionnaires, the factors analysis was carried out on collected the data, which identified five critical success factors with 50 variables of total quality management. The reliability and the validity analysis on the result were being conducted.

Conclusions:

Based on findings from the questionnaire, the literature review and interview results several conclusions can be made:

- From the questionnaires 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
- 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 weaknesses 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, which top management are not keen to adopt due to lack of educational skills. For this reasons the implementing of the quality management in Libyan construction industry is difficult and it is likely to take long time to understanding the exactly meaning of quality management systems and their implementation.
- Some managers mentioned company and government policy which does not allow employee delegation. In this case the employees could not take a decision without management approval; from leaders or supervisors.
- This study has assessed the level of TQM implementation in a sample of Libyan companies. The organizations were found to have a low level of

implementation of the critical success factors, this was due to: lack of knowledge of quality management systems, methods and tools and lack of top management commitment which caused: a lack of vision, poor strategic competence and employee involvement and a lack of measurement

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Appendix: questionnaires:

1. Management Commitment and Leadership.

Management Commitment and Leadership
Q1) My company is committed to implementing the Quality Management System (QMS
Q2) My Company obtains the necessary feedback to verify the effectiveness of any new quality the improvements
Q3) Top management assumes active responsibility for evaluation and improvement of quality management system.
Q4)The company use incentives to encourage all employees to improve the performance continuously
Q5) My company used Quality plan to improve quality continuously
Q6)The company has a quality circle
Q7) Quality policy in the company' is clear and understood by employees
Q8) Management Policy is committed the quality to meet customer requirements and continuous improvement.
Q9) Management develops the company's goals of quality and consistent with the policy of quality.
Q10) My Company recruits qualified people to implement quality management system.
Q11) Management always tries to involve all employees in any changes which affect them
Q12) Management reviews the quality issues during regular meeting
Q13) My company adopts a formal strategy for improving quality

2. Communication system.

Communication

Q1) There is clear and consistent communication of mission statement and objectives which define quality values, expectations and focus

Q2) There is an effective system in the company to contact customers.

Q3) There is an effective system of communication with suppliers/subcontractors.

Q4) My company has effective communication systems, between top management and employees.

Q5) Employees are kept well informed about any changes in the organization policy and reasons behind such change

Q6) Enough effort is made by the organization to understand the opinion and thinking of all employees.

Q7) There is an effective system in the customer to contact company.

3. Training and education.

Training and education

Q1) My company has training programmes to help employees identify quality improvement issues.

Q2) The company has training programmes for employees to improve interactive skills (e.g., communication skills, effective meeting skills, and empowerment and leadership skills).

Q3) All employees are regularly updated on the quality management system

Q4) My company trains all employees how to use statistical tools in quality control

Q5) All employees and workers are sent for quality training

Q6) Shortage of funding hampers quality training

4. Teamwork.

Teamwork
Q1) Employees are very good at working in a team
Q2) There is active contact between team members of construction project.
Q3)The teamwork enjoy working together
Q4)The team leader is democratic and collaborative
Q5)There is a programme to develop teamwork a cross departments
Q6)There is very little enthusiasm for working in the company
Q7)Employees do not believe in team work
Q8)All departments a cross the company work as a team
Q9)The nature of the business does not allow performing work through groups
Q10) team takes the goals and objectives literally, and assumes a shared understanding

5. Employee's empowerment.

Employees empowerment
Q1) My company give employees the opportunity know how to use quality tools and techniques
Q2) My company encourage employees to improve their skills
Q3) My supervisor give me authority to do the work
Q4) My company has a recognition /reward programme for all employees
Q5) My company believes that employees satisfaction is important to achieve high quality
Q6) My company sends employees to quality
Q7) Iam invited to make suggestion for improving quality
Q8) My supervisor discusses with me before making decision
Overall mean `

6. Work environment culture.

Work environment culture
Q1) My company has a quality culture
Q2) Employees treat the other like their family
Q3) The company is a very safe place to work
Q4) The company is a very dynamic place
Q5) Employees feel confident that the company will always treat them fairly.

Q6) There is healthy relationship between employees at all levels


Q7) The company has a customer focused culture.


Q8) Most employees are happy at work.

Q9) Employees are encouraged to bring forward quality improvement idea. `


Appendix 2 :

Sample of the questions (asked through interview)


 *My company is committed to implementing the Quality Management System (QMS*

 *The company use incentives to encourage all employees to improve the performance continuously*


 *My company adopts a formal strategy for improving quality*

 *Top management assumes active responsibility for evaluation and improvement of quality management system*

 *My company adopts a formal strategy for improving quality*

 *There is an effective system in the company to contact customers.*

 *There is an effective system of communication with suppliers/subcontractors.*

 *My company has effective communication systems, between top management and employees.*

 *All employees and workers are sent for quality training*

- ✚ *My company trains all employees how to use statistical tools in quality control*
- ✚ *All employees are regularly updated on the quality management system*
- ✚ *My company has training programme to help employees identify quality improvement issues.*
- ✚ *The company has training program for employees to improve interactive skills (e.g., communication skills, effective meeting skills, and empowerment and leadership skills).*
- ✚ *There is good interaction contact between team members of construction project.*
- ✚ *There is a programme to develop teamwork a cross departments*
- ✚ *All departments a cross the company work as a team*
- ✚ *There is a programme to develop teamwork a cross departments*
- ✚ *My company give employees the opportunity to know how to use quality tools and techniques*
- ✚ *My company encourages employees to improve their skills*
- ✚ *My supervisor give me authority to do the work*
- ✚ *My company has a recognition /reward programme for all employees*
- ✚ *My company sends employees to quality courses*
- ✚ *My company has a quality culture.*

✚ *there is healthy relationship between employee at all levels*

✚ *The company is very safe place to work*

✚ *Employees feel confident that the company will always treat them fairly.*