

Development for Proposed Computerized Questionnaire Program to Evaluate TQM Implementation in Jordanian Construction Projects

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Abstract— The construction sector is one of the most important business fields in Jordan, and this sector is suffering from severe problems regarding its management and quality standards; however, total quality management (TQM) process is considered as a modern system in the field of quality.

The main purpose for this research is to computerize the traditional process for the questionnaire system. The questionnaire system should reduce time, effort, and cost through the elimination of papers' based work and the routine procedures. A computerized questionnaire program was developed to evaluate TQM implementation in construction projects (according to TQM factors application) by examining the appliance of four ISO 9001-2008 requirements during different project phases. In general, the used tool in building this program is Microsoft Visual basic (2010 edition). However, if the evaluation level for the intended project was weak; therefore, this program has the ability to propose the necessary recommendations to improve TQM status.

Out of this research, it is concluded that the proposed computerized computer program is simple to be implemented in Jordanian construction projects, and its results were accepted in evaluating the TQM.

Index Terms—Total Quality Management, Proposed Computerized Questionnaire Program, Microsoft Visual basic 2010 edition.

I. INTRODUCTION

TQM appears to be a very important concept which is difficult to summarize in a short definition. It is a process that should be led by a senior management person in order to obtain an involvement for all employees in the continuous improvement of the performance of all activities [1].

Despite of the international adoption of the TQM concept, it has not been developed within the Arab region, and that was due to the lack of basic knowledge of TQM, and also as a result of the low level for the organizations' readiness for change [2].

In general, during this research, the TQM status was evaluated (using the Development Proposed Computerized Questionnaire program) to determine the two main TQM factors in construction project (i.e., customer satisfaction and

Continuous improvement) by examining the appliance of four ISO 9001-2008 requirement and during different project phases.

Accordingly, the main aim for this research was focused on enhancing the old questionnaire process through conversion to computerized system by enabling the researcher to extract the statistical results of the target sample in the study, automatically. Furthermore, it was assumed that the system could accelerate the process of questionnaire by build a computerize system (Questionnaire system). However, the program application must validate user entries in order to ensure that no errors are encountered. Therefore, if a certain error had been occurred, then it must be displayed in a well-structured way in order to force the users to easily understand it.

II. LITERATURE REVIEW

TQM is regarded as one of the most important techniques in improving the quality, in which several organizations and companies were used to conduct it to reach the success. The wide implementation for TQM all over the world (for different sectors and industries) leads to positive results appeared in these sectors and industries due to its implementation [3]. In general, the function of TQM is to provide a high quality product to the customers, in turn to increase the productivity and also the customer satisfaction; furthermore, to decrease the cost with lower price and a higher quality product. TQM is the approach of managing different industries to improve the quality of product [4]. In addition, TQM could show Establish strategic goals, mission and vision based on the concept of TQM, and then bind all parties together (including subcontractors) to reach the above goals. However, the organizations need to follow continuous improvement while maintaining a long-term perspective. The improvement will have to be made both in the processes and the organizational system in order to make the TQM program successful [1].

Furthermore, (TQM) Total quality management is defined as both a management of quality philosophy and group of guiding principles that promote culture in organizations and all members participation in organization aiming in order to

achieve the long term success process through continuous improvement and customer satisfaction of products, and the benefits for all society members [5], [6], [7] .

III. CONSTRUCTION PROJECTS

Too many construction projects started everywhere, and every day all around the world. However, these projects could be divided into four major groups as shown below [8] :

- Residential building projects.
- Institutional building projects.
- Special industrial projects.
- Infrastructure and heavy projects.

IV. CONSTRUCTION PROJECT PARTIES

For all types of construction projects, it is well known that a set of parties sharing in managing and conducting the proposed project within its design budget and time (each based on his particular responsibilities.); however, this set consists of the owner, contractor, and engineer (i.e., Project Parties) [9].

V. CONSTRUCTION PROJECT PHASES

In general, the process of execution for any construction project should pass through the following six phases as shown below [10] :

- Study Phase.
- Design Phase.
- Contract Documents Phase.
- Contractor Selection Phase.
- Implementation Phase.
- Close Out Phase.

VI. TOTAL QUALITY MANAGEMENT (TQM)

Numerous definitions were stated by authors for TQM. However, the Asian Institute of Technology (AIT), define TQM as "a philosophy that strengthens and support the culture to foster continuous organizational improvement through integrated, systematic, consistent and reliable effort involving everything and everyone, focusing primarily on total satisfaction of internal and external customers, where employees work together in teams with process ownership, guided by a committed top management, which takes a practical participation" [11] . The British Quality Association defines TQM as "an all-agreement business management philosophy focusing on completely fulfilling customer requirements with a maximum of effectiveness and efficiency" [12] . In addition, British Standard (BS) described the TQM as the management philosophy that aimed to achieve organization objectives. Furthermore, the (AIT), defined the TQM as the philosophy aiming to satisfy the customers.

Out of the above definitions, a simple definition for the TQM is to reach and obtain the external and internal customer requirements.

BASICS OF TQM PRINCIPLES IN CONSTRUCTION PROJECTS

The concept of TQM is regarded as modern concept in construction projects. Previously, it was only applied to industrial projects. However, the construction companies in the United States applied (TQM) after they noticed the great success of industrial companies when using the application for the concept of TQM which is based on the achieving the basic principles (i.e., the Customer Satisfaction and Continuous Improvement) [13] .

Customer satisfaction

The basic function in the construction industry is to perform the customers' project, and then providing him with facilities and services to meet his requirements. In general, any construction company should carry out and complete its work at a competitive cost in order to guarantee being continuous in their field; therefore, TQM is a management philosophy that based on identifying (exactly) the customer needs and requirements, and then plan to create suitable environment and working conditions to be suitable to achieve the customers' needs and requirements at the lowest possible cost (using quality control) and at any phase of the construction process. Accordingly, after closing out and readiness for using the construction project, the satisfaction for the customer needs will be reached to its quality level.

a) Continuous improvement

In order to continue in the improvement; the following should be achieved:

- Continuous improvement for current methods and procedures and to keep existed improvements during the product processing control.
- Focusing on obtaining technological developments (in construction and engineering process) during innovation and creation.

In general, the construction project consists of a group of activities; therefore, it is needed to develop, innovate and create in each activity to achieve quality and fulfill customers' satisfaction.



Fig. (1): Deming Cycle

Furthermore, during each activity implementation, it is needed to reduce the gap between the customers' requirements and current status, and that could be conducted throughout the implementation of problem analysis process using the Deming Cycle "Plan-Do-Check-Act". In general, the Deming Cycle contains four processes, it occurs every time and constantly repeated and could be applied everywhere in construction projects, Fig.(1).

VII. ISO 9001-2008

It is the last version that sets out the criteria for a quality management system, and considers (only) the standards in the family that would be certified. It can be used by large or small organization, regardless of its field of activity. Moreover, the ISO 9001:2008 is implemented by more than one million companies and organizations in over 170 countries [14].

In order to achieve the TQM (important) factors in construction projects, (i.e., the customer satisfaction and continuous improvement); four ISO 9001-2008 requirements should be considered for this purpose [15]:

- Management responsibility.
- Resource management.
- Product realization.
- Measurement, analysis, and improvement.

In general, each requirement related to the ISO 9001-2008 will include a number of elements.

VIII. SAMPLE SIZE

The selection of the research sample was based on selecting the population size from specialized engineers (i.e., Civil, Architectural, Electrical, and Mechanical) and with minimum experience of 10 years. However, according to the information as provided by the Jordanian Engineering Association, the distribution of the intended sample (up to March 2013) is indicated in Table (1):

Table (1): Engineers Distribution According to Specialization

Specialization	No. of Engineers
Civil Engineers	20,670
Architecture Engineers	12,150
Mechanical Engineers	7,436
Electrical Engineers	5,645
Total	45,902

IX. PROGRAM AIM

According to the above explanations, the aim of implementing the above program is to:

- Make the questionnaire survey process being automated.
- Reduce time, effort, and cost by submitting and receiving questionnaire survey through e-mail rather than personal appointments.
- Provide essential recommendations (in case of the TQM implementation status was considered "Weak").
- Give the manager the opportunity to save the results for the current status in order to compare it at any time after doing the required recommendation.

X. PROGRAM IMPLEMENTATION PROCEDURE

The running process for the proposed program to evaluate TQM implementation (as engineering practices in construction projects) includes several stages and requires some clarifications, as follow:

- Choosing the favorite language.
- Feeding the main program interface with general information (the administrator has the ability to edit, save, print, and reach to all interior data in the software, in order to ensure the secured procedure.
- Selecting of construction project phase (the respondent can choose any phase to answer).
- After choosing the phase, the program will review the related questions concerning the main factors to indicate the respondent answers, where the answers will be as: Strongly Agree, Agree, Neutral, Disagree, Strongly disagree; therefore, the respondent have to answer all questions, then after pressing the next bottom alarm, message will appear if the respondent leave or forget any answer, so the respondent have to answer all questions to move for the next step.
- The program will remark the answered phase with different colors, then continue in choosing other phases to finalize all six phases.
- The program will calculate the mean sub factors answers for the respondents in the sample size, to determine the main factors in order to identify the project phase mean. In addition, the program will neglect the respondent from sample size if the participating. After that, the program will show results containing the evaluation of TQM status for each phase, then for the overall project phases and performance.
- If the evaluation level of TQM implementation classified as weak the program will suggest a set of recommendations to improve TQM in the needed phase and use it as a comparison in the future.

For further clarifications regarding the above statements, the following Fig. (2) – (7) represent the program interfaces.

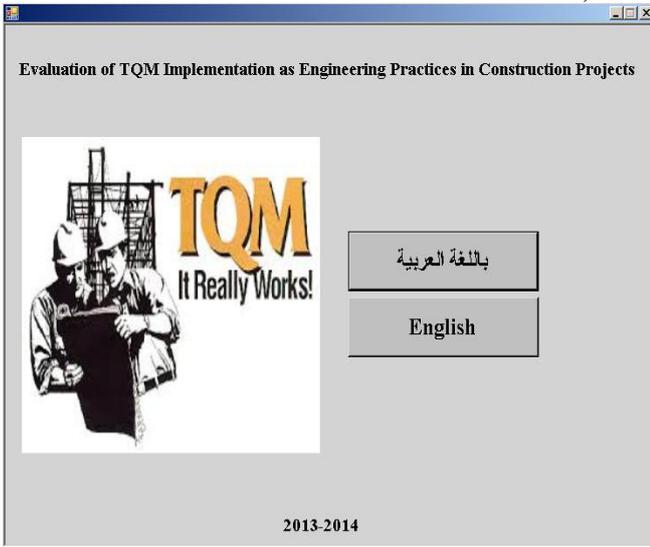


Fig.(2) language choice

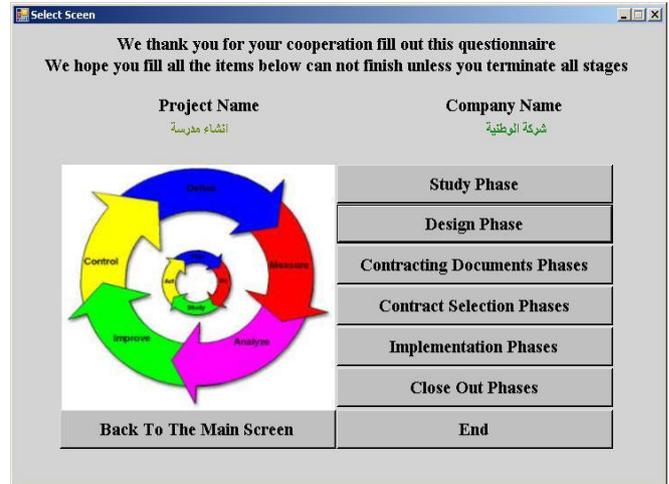


Fig.(5) Project Phase

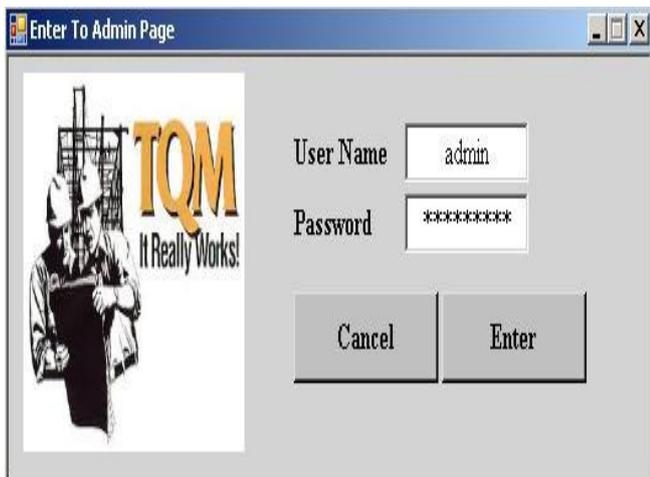


Fig.(3) Admin Identification

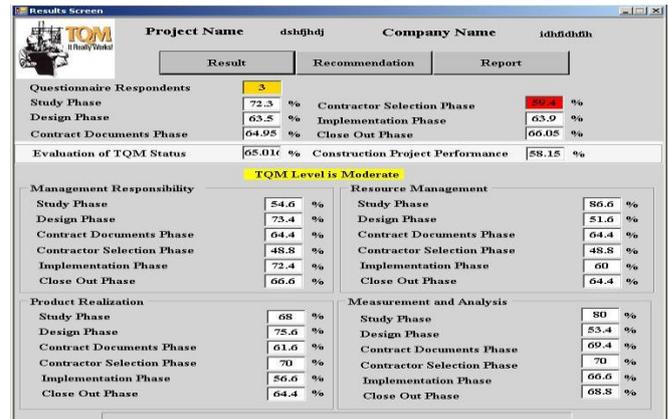


Fig.(6) Final Results

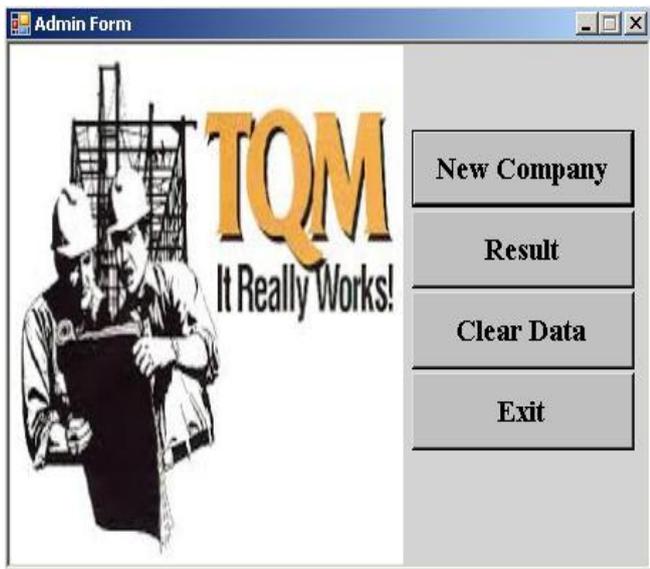


Fig.(4) Admin Options

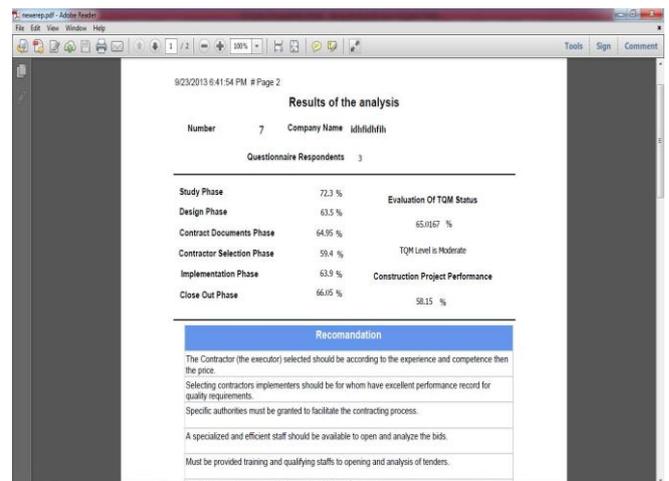


Fig.(7) Recommendations & Report

XI. EVALUATION FOR THE TQM PROGRAM

To evaluate the applicability and efficiency of the TQM implementation proposed computer program (PCQP), an evaluation questionnaire have been used as an approach to

evaluate the applicability and validation of the (PCQP). The evaluation questionnaire consists of a set of questions to be answered by a selected group of the participants (20 engineers from the research sample and those experts in construction sector); however, the questionnaire data have been collected then analyzed in a form of Mean, Percentage, and Classification, as indicated in Table (2):

Table (2): The Mean, Percentage, and Classification for PCQP Respondents

N.	Statement	<i>m</i>	%
1	The proposed computer program could be applied in construction projects.	4.4	88
2	The proposed computer program is successful in evaluating TQM implementation in construction projects.	4.3	86
3	The proposed computer program is easy to be used and familiar.	4.9	97
4	The proposed computer program has a great flexibility and we can modify it to be applied during project phases.	4.2	83
5	The proposed computer program is accepted from the theoretical and practical sides.	4.3	85
6	The recommendation suggested by the proposed computer program is a base to improve TQM status.	4.6	91
7	Your evaluation to the proposed computer program in achieving its aims.	4.6	92
	Overall	4.4	88.8

XII. CONCLUSIONS

After analyzing the evaluation of the questionnaire data, it is concluded that the average mean is 4.44 with a percentage of 88.8% (which is of high classification in supporting the PCQP, where:

- Its applicability was high (i.e., positive response = 88%), and successful in evaluating of the TQM (i.e., positive response = 86%).
- Using of PCQP and its familiarity showed very high classification (i.e., positive response = 97%).
- Its flexibility showed high classification (positive response = 83).
- According to the above statements, PCQP was accepted, and the proposed program recommendation could be considered as a base to improve TQM status, and then to achieve its aims for the construction projects in Jordan.

REFERENCES

[1] Al-Tayeb, Mustafa, "Critical Success Factors of TQM Implementation on Construction Projects in Gaza Strip", Master thesis, The Islamic University – Gaza, (2008).

[2] Haffar, Mohamed, "The Influence of Organizational Culture on Total Quality Management Implementation in Syrian Public Manufacturing Organizations, Brunel University", (2010).

[3] Bhat, K.S. and J. Rajashekhar, "An empirical study of barriers to TQM implementation in Indian industries", The TQM Magazine, 21(3): 261-272, (2009).

[4] Das, A., V. Kumar and U. Kumar, "The role of leadership competencies for implementing TQM (An empirical study in Thai manufacturing industry)", International Journal of Quality & Reliability Management, 28(2): 195-219, (2011).

[5] Juran, J. and Godfrey, A., "Juran's Quality Handbook", 5th edition. New York: McGraw-Hill, (1999).

[6] Rampersad, H., "Total Quality Management, an Executive Guide to Continuous Improvement". New York: Springer, (2001).

[7] Besterfield, D., Besterfield-Michna, C., Nesterfield, G. and Besterfield-Scre, M., "Total Quality Management", 3rd Edition. New Jersey: Prentice Hall, (2003).

[8] Renee Miller, "The Four Types of Constructions", (2013) . from web site; http://www.ehow.com/info_8096333_four-types-constructions.html#ixzz2ZJh9HIXf

[9] General Contractors of America (AGCA), the American Subcontractors Association (ASA) and the Associated Specialty Contractors (ASC), "Guidelines for a Successful Construction Project, USA", (2003).

[10] Watts, Bert, Nester and John, "The Six Phases of Capital Project / project Management, (2014). from web site; [http://www.hamiltoncountyohio.gov\(2014\)/facilities/project.asp](http://www.hamiltoncountyohio.gov(2014)/facilities/project.asp)

[11] Nukulchai, W. K., "Towards Total Quality Management in Higher Education", the Experience of Asian Institute of Technology/ Asian Institute of Technology, (2003).

[12] Wessel, and Burcher, P., "Six Sigma for Small and Medium-Sized Enterprises" The TQM Magazine, Volume 16 No.4, pp.264 – 272, (2004).

[13] Oberlender, Garold D., "Project Management for Engineering and Construction", Oklahoma State University, (2000).

[14] ISO Technical Committee, "(TC) ISO/TC 176", sub-committee, (2008) . from web site: http://www.iso.org/iso/iso_9000

[15] International Standard ISO 9001, (2008) "Quality Management Systems Requirements, Fourth Edition, from web site: <http://www.gobookee.net/international-standard-iso-9001-fourth-edition/>